

ROLE OF LIVESTOCK IN SUSTAINABLE AGRICULTURE

IAHA Pre-Conference on
Organic Animal Husbandry
November 7-8, 2017

linked to the 19th Organic World Congress,
New Delhi, India, November 9 - 11, 2017



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INTRODUCTION

Otto Schmid, IAHA Chair

It is a great honour to open this pre-conference here in India. The event is organized by the IFOAM Animal Husbandry Alliance (IAHA) in collaboration with the Organic Farming Association of India (OFAI), the National Centre of Organic Farming (NCOF), the Indian Veterinary Research Institute (IVRI under ICAR), the Indian livestock development & ethno-veterinary group ANTHRA, the Swiss Research Institute of Organic Agriculture (FiBL) and IFOAM - Organics International.

The main theme of the conference is the important role of livestock in sustainable agriculture. A special focus is given to animal health issues. The goal is to identify main research and development needs for organic animal husbandry across the world. The preliminary results from thematic workshops will be discussed in a workshop at the IFOAM Organic World Congress being held in Delhi between the 9th & 11th of November 2017. The final conclusions on research and development needs will be communicated to the IFOAM General Assembly.

IAHA is an informal network of individuals and organizations interested in strengthening the development of organic animal husbandry around the world. IAHA was founded during the 2nd IFOAM Husbandry Conference, September 2012, in Hamburg. IAHA is supported by the IFOAM World Board and Secretariat in Bonn. In the past IAHA has sent out thematic newsletters (on Europe, Latin America, Asia and North America), which are on the IAHA website: The main activity of IAHA is to organize all three years a pre-conference linked to the IFOAM Organic World Congresses.

At the Organic World Congress 2014 in Istanbul, IAHA organized a pre-conference and a workshop session at the main conference. The focus was on drafting an international Action Plan for the strengthening of Organic Animal Husbandry from 2014-2017, which was supported by the IFOAM General Assembly.

For OWC 2017 we decided to organize a two day pre-conference with an additional practical workshop on folk veterinary medicine and Ayurveda for animal health on a farm. This very rich and diverse programme was only possible thanks to a strong engagement of the local organizers. Therefore I want to thank the members of the IAHA Organising Committee for their great support, in particular the local organizers: Nitya Ghotge from ANTHRA (India) and Mahesh Chander from the Indian Veterinary Research Institute (India). They were assisted by Marion Johnsen (New Zealand), Chris Atkinson (UK) Angela Escosteguy (Brazil), as well as from Barbara Früh and myself from FiBL (Switzerland).

We very much acknowledge the support by members of the Advisory Committee, in particular those, who have helped to review the papers (see list in Proceeding).

We thank the National Center for Organic Farming (NCOF) in Ghaziabad with Dr. Kishan Chandra, director NCOF and Mr. T. K. Ghosh, regional director NCOF, Ghaziabad for hosting the Conference. We also thank Dr Suresh Honnappagol, Animal Husbandry Commissioner for the support and Dr. R.K. Singh from ICAR. And we thank as well all the key note speakers.

Furthermore we want to thank the IFOAM head office (Simon Kufferath, Alicja Klaus, Thomas Cierpka and Markus Arbenz) and FiBL in Switzerland (Director: Prof. Dr. Urs Niggli) for support as well as several sponsors from India, which are listed in the proceedings.

Otto Schmid
Chair of IAHA Steering Group



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डॉ. आर.के. सिंह
Dr. R.K. Singh

निदेशक
Director

Message

I am happy that the ICAR- Indian Veterinary Research Institute is partnering with important agencies like IFOAM-IAHA, FIBL, ANTHRA, OFAI, NCOF & IFOAM-Organic International to organize the conference on "Role of Livestock in Sustainable Agriculture, during 6-8 Nov, 2017 as a pre-conference to the 19th Organic World Congress (9th -12th Nov 2017). The ICAR- Indian Veterinary Research Institute - having a history of over 127 years - has always been working for the betterment of animal health and productivity. The animal production is important from the standpoint view of sustainability and climate change. The importance of livestock in organic agriculture is immense but comparatively less attention has been paid so far on organic animal husbandry and its implications on organic agriculture. It gives me high surge of pleasure that the organizers thought of this theme and chose to organize it at National Centre of Organic Farming (NCOF). I am confident that this conference will highlight the importance of animals in organic agriculture towards promoting sustainable agriculture around the world.

I congratulate the organizers and wish grand success to the conference.

(R K Singh)



सत्यमेव जयते

Dr. Suresh S. Honnappagol
Animal Husbandry Commissioner



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GOVERNMENT OF INDIA
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Department of Animal Husbandry, Dairying & Fisheries
Krishi Bhawan, New Delhi-110 001

Dated: 26th October, 2017

MESSAGE

I am pleased to know about the joint venture of ICAR-IVRI, IFOAM-IAHA, FIBL, ANTHRA, OFAI, NCOF & IFOAM in organizing a preconference on "**Role of Livestock in Sustainable Agriculture**", during 6th - 8th Nov, 2017 before the 19th Organic World Congress of 9th -12th Nov 2017 at the National Center of Organic Farming (NCOF), Ghaziabad (UP).

I am impressed about the theme chosen by the organizers as livestock rearing is very deeply embedded in the socio-cultural milieu and traditions of Indian farmers since centuries.

The importance of Livestock in Organic agriculture is immense and I am confident that this conference will highlight the importance of the same. I do hope that deliberations and recommendations emerging out of this conference will further streamline the developments in organic agriculture sector around the world and in India.

I congratulate the organizers and wish a grand success to the conference deliberations.

(Suresh S. Honnappagol)

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Message



I am extremely glad that IFOAM Annual Husbandry Alliance (IAHA) and FIBL in collaboration with National Centre of Organic Farming, Ghaziabad, Govt. of India are organizing Pre-Conference on "Role of Livestock in Sustainable Agriculture during 06th -08th November, 2017 in NCOF, Ghaziabad as part of 19th World Congress being organized in India, particularly in a time, when the world is moving towards organic agriculture, in which Organic Animal Husbandry play crucial role in achieving sustainable soil health.

Integration of Animal Husbandry in organic farming is highly essential not only for organic food production like organic milk, organic eggs, organic meats etc. but also for recycling of crop residue and organic waste into nutrient and improving soil fertility for sustainable agriculture.

NCOF has brought Animal Husbandry including processed organic food into PGS Organic Certification under on line PGS- India Programme where emphasis has been given on Animal welfare which is going to be mandatory under in domestic market under FSSAI Act in India.

I hope that this conference will surely identify constraints for Animal welfare and integration of Live Stock into organic farming and come out with suitable recommendations which will be useful for preparing road maps for sustainable agriculture across the world. NCOF is proud to host this conference.

I wish this conference a grand success.

(Dr. Krishan Chandra)
Director



Global Agenda for Sustainable Livestock



Livestock is important to achieving the SDGs?

“Sustainable development is only possible in a world without hunger and poverty. Agriculture and livestock are important to feed the world. Millions of poor people depend on livestock for their livelihood. These livelihoods need to be secured with sustainable livestock systems.

FRITZ SCHNEIDER

Chair, Global Agenda for Sustainable Livestock

The Global Agenda for Sustainable Livestock

Background

Poverty and hunger eradication are among the greatest global challenges facing the world today and an indispensable requirement for sustainable development. Driven by population and economic growth, particularly in developing countries, the demand for livestock products is expected to increase by about 70 percent in the coming 30 years. The livestock sector contributes to address these challenges by promoting a sustained economic growth, inclusive social development and an efficient use of natural resources. The Global Agenda was born in 2011 when stakeholders from all relevant parts of the livestock sector have formed a partnership to perform a global and joint effort. The Global Agenda recognizes that for livestock to be sustainable, the sector needs to respond to the growing demand for livestock products and enhance its contribution to food and nutritional security; provide secure livelihoods and economic opportunities for hundreds of millions of pastoralists and smallholder farmers; use natural resources efficiently, address climate change and mitigate other environmental impacts; and enhance human, animal, and environmental health and welfare.

The Global Agenda for Sustainable Livestock is a multi-stakeholder partnership committed to sustainable development of the livestock sector. The Nature of the Global Agenda can be outlined as follows:

- Multi-stakeholder partnership
- Open and voluntary
- Inclusive and consensual
- Change-oriented
- Continuous improvement
- Evidence and knowledge based
- Mutual respect

The Global Agenda:

1. Provides a global platform, regionally and locally rooted, to comprehensively address the sector's multiple challenges towards sustainable development
2. Engages in policy dialogue, sharing of experiences, and agrees on action. It recognizes the multiple social, economic, and environmental dimensions
3. Builds capacities to monitor and assess changes, and provides tools for policy making at country level
4. Creates added-value by strengthening inclusion and representativeness of all regions' stakeholders and acts as an effective support to enhance synergies and regional comparative advantage
5. Takes the main orientation from the UN Agenda 2030 for Sustainable Development and aligns all its activities to advance the contribution of livestock to the attainment of the SDGs

Facilitates dialogue, generates evidence and supports the adoption of good practices and policies.

Main achievements (2011 - 2017)

1. Establishment of a Multi-Stakeholders Partnership with the active engagement of Governments, Civil Society Organizations, Private Sector, Donors, Academia, NGOs, as well as Inter-governmental and Multi-lateral Organizations, to facilitate stakeholder dialogue and concerted action in support of a sustainable livestock sector.
2. A structure to support and guide the Global Agenda has been developed: this includes a Guiding Group, Action Networks and a Technical Support Team
3. Development of the multi-stakeholder partnership with 105 members who signed the consensus document.
4. Successful alignment of the Global Agenda to the SDGs
5. A series (7) of Multi-stakeholder platform (MSP) meetings have been held, which have built consensus, shared knowledge and developed a shared vision: Brasilia and Phuket 2011 – Nairobi 2012 – Ottawa 2013 – Cali 2014 – Panama 2016 – Ethiopia 2017
6. The development and inclusion of new Action Networks

The Global Agenda has established the following Action Networks:

- Closing the Efficiency Gap
- Restoring Value to Grasslands
- Waste to Worth
- Global Network on Silvo-Pastoral Systems
- Dairy Asia Partnership for Health and Prosperity
- Livestock Environmental Assessment and Performance Partnership
- Livestock Antimicrobial Partnership
- Livestock for Social Development
- Animal Welfare Action Network
- Investments for Sustainable Livestock Production (not approved yet)

The Global Agenda Consensus Document

The Global Agenda bases its rationale and its mission, vision and objectives on the Consensus Document. Signing the document is a condition to be part of The Global Agenda.

By signing the consensus, members:

1. Recognize the UN Agenda 2030 for Sustainable Development and the SDGs, and livestock development as having a key role to play for their attainment
2. Recognize that the implementation of a Global Agenda for Sustainable Livestock depends on the active engagement of Governments, as well as civil society, the private sector, donors, academia and research institutions, NGOs, and Inter-governmental and Multi-lateral Organizations.

The Global Agenda and Organic Livestock

Organic livestock production contributes substantially to tackle the challenges towards sustainable livestock development. Important challenges needing urgent solutions are:

- **Animal health.** Production of animal based products with minimal medication
- **Animal welfare.** Organic livestock systems can show best practices for animal welfare aspects. Animal welfare needs to become more important and binding, also for trade relations. Pioneer function.
- **Resource efficiency.** The experience of organic farming is crucial in the further development of the livestock systems towards higher resource efficiency.
- **Diversity of domestic animal genetic resources.** To conserve and further develop domestic animal genetic resources is part of organic livestock production .
- **Sustainability assessment.** Measuring sustainability of conventional and organic production systems. Contribution to the further development of assessment tools with the experience and knowhow of organic livestock production.

The Global Agenda as inclusive multi-stakeholder partnership welcomes a strong involvement of the organic livestock sector community.


The Global Agenda Action Plan 2016 – 2018

The Global Agenda's activities are guided by a three year Action Plan with the following main objectives

1. Consolidation of an inclusive platform to serve as a means of policy dialogue and knowledge exchange for agreement on joint action in support the SDGs
2. Provision of tools and analytical evidence to facilitate the adoption of strategies, frameworks and policies towards sustainable livestock development
3. Ensure local practice and policy change through continuous improvement and innovation

The 8th Multi Stakeholder Partnership Meeting (MSP) 2018 in Mongolia

The 8th MSP will be organised in Mongolia in June 2018. The major theme will be the challenges and contribution of pastoralist system to food security and nutrition and how to make these systems sustainable.



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KEY NOTE ADDRESS

Sustainability, the role of animal welfare and silvopastoral systems


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Key words: sustainability, animal welfare, silvopastoral, livestock, cows

Abstract

In world agriculture, there will be increasing demand from consumers for the avoidance of adverse effects on human welfare, animal welfare and the environment. A system or procedure is sustainable if it is acceptable now and if its expected future effects are acceptable, in particular in relation to resource availability, consequences of functioning and morality of action. A production system might be unsustainable because of: inefficient usage of world food resources; adverse effects on human health and human welfare in general; poor welfare of animals; harmful environmental effects such as low biodiversity or insufficient conservation; unacceptable genetic modification; not being "fair trade" in that producers in poor countries are not properly rewarded; or damage to rural communities. Consumers might judge, because of any of these inadequacies, that the quality of the product is poor. Animal welfare has been developing rapidly as a scientific discipline. The welfare of an individual is its state as regards its attempts to cope with its environment. The welfare of cows in India is often very poor and policies should be changed to prevent this. Three-level plant production, including pasture and nitrogen-fixing shrubs and trees with edible leaves are an example of a silvopastoral system. The production of leaves and other material that can be eaten by the animals is much greater than can be achieved by pasture-only systems. Tree leaves are of great value during dry periods when pasture is not productive. Results in tropical and sub-tropical areas show that in semi-intensive three-level silvopastoral systems, production of cattle and other animals can be better, soil structure and water-holding capacity much improved, biodiversity and predators of disease-causing animals much increased and animal disease reduced. The increase in food, water, habitat choice, shade, and quality of social interactions, and the reduction in disease, result in substantial improvements in animal welfare. Industry, including organic producers, should be proactive and rapidly change policies relating to animal welfare and other aspects of sustainability.





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KEY NOTE ADDRESS

Integrating animals and crops into organic farming systems in South Africa and Kenya

Raymond Auerbach¹, Marike Swanepoel¹, N'wa-Jama Mashele¹


Key words: organic farming; pastoralism; transhumance; compost; sustainable farming systems

Abstract

Long term comparative farming systems research trials on the George Campus of Nelson Mandela University initially showed a yield gap, with conventional (chemical) production systems outyielding organic systems by 20% in the first year and by 40% in the second year. This was partly due to poor levels of available soil phosphate, and partly to pest and disease pressure. In the third year of research, these problems were remedied, and the yield gap was closed in spite of drought. A major reason for this was the effect of available phosphate on plant root growth, though better moisture retention in organic soils due to compost was also a factor. In Kenya, agro-pastoral systems allowed some of the 25 million agro-pastoralists who are dependent on transhumance to improve their terms of trade, and to add value to their livestock after following the rains in the Horn of Africa. The Keekonyokie Conservation Meat Enterprise offered a direct and sympathetic marketing channel to 200 000 pastoralist families through a co-operative, a butchering facility and market outlets in Nairobi. Methane was extracted from manure and paunch material which was used to power the slaughterhouse and for local household energy which replaced the cutting of trees for firewood. Liquid manure slurry was turned into compost for crop production.

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KEY NOTE ADDRESS

Sustainability, the role of animal welfare and silvopastoral systems

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Key words: sustainability, animal welfare, silvopastoral, livestock, cows

Abstract

In world agriculture, there will be increasing demand from consumers for the avoidance of adverse effects on human welfare, animal welfare and the environment. A system or procedure is sustainable if it is acceptable now and if its expected future effects are acceptable, in particular in relation to resource availability, consequences of functioning and morality of action. A production system might be unsustainable because of: inefficient usage of world food resources; adverse effects on human health and human welfare in general; poor welfare of animals; harmful environmental effects such as low biodiversity or insufficient conservation; unacceptable genetic modification; not being "fair trade" in that producers in poor countries are not properly rewarded; or damage to rural communities. Consumers might judge, because of any of these inadequacies, that the quality of the product is poor. Animal welfare has been developing rapidly as a scientific discipline. The welfare of an individual is its state as regards its attempts to cope with its environment. The welfare of cows in India is often very poor and policies should be changed to prevent this. Three-level plant production, including pasture and nitrogen-fixing shrubs and trees with edible leaves are an example of a silvopastoral system. The production of leaves and other material that can be eaten by the animals is much greater than can be achieved by pasture-only systems. Tree leaves are of great value during dry periods when pasture is not productive. Results in tropical and sub-tropical areas show that in semi-intensive three-level silvopastoral systems, production of cattle and other animals can be better, soil structure and water-holding capacity much improved, biodiversity and predators of disease-causing animals much increased and animal disease reduced. The increase in food, water, habitat choice, shade, and quality of social interactions, and the reduction in disease, result in substantial improvements in animal welfare. Industry, including organic producers, should be proactive and rapidly change policies relating to animal welfare and other aspects of sustainability.



1. Sustainability

Many members of the public are now concerned about whether or not a food production system is sustainable. A definition of sustainability is: a system or procedure is sustainable if it is acceptable now and if its expected future effects are acceptable, in particular in relation to resource availability, consequences of functioning and morality of action (Broom 2014). There has been a change from a push to a pull society in that, whereas producers used to determine methods of production, consumers now choose to buy products that they regard as ethical so they have much more control over methods of production. The ethics of food production is now included in consumers' evaluations of product quality (Broom 2010). If production methods are not acceptable, retail companies, production companies and countries that do not produce good quality, sustainable products are likely to be boycotted and hence forced to change (Bennett et al 2002, Broom 2014). If the consequences of genetic selection, feeding or housing result in the product being avoided by consumers, the production method is not efficient. The development of new, sustainable systems is urgently needed.

2. Factors that affect sustainability

World resources should be used efficiently. At present there is much waste of food.

Herbivores, such as ruminants and carp, that eat leaves or other food that humans cannot eat, are much more important than pigs, poultry or salmon which compete with humans for food or eat other animals (Broom et al 2013). Land and soil should be carefully conserved and improved.

Foods which are good for the health of the consumers are more acceptable to them.

In all aspects of farming, antimicrobial use will have to decrease because of the development of antimicrobial resistance.

Poor welfare of animals is probably the third most important reason for livestock production to be unsustainable. There are concerns about all animals but especially about sentient animals: all vertebrates, cephalopods and decapod crustaceans.

Many agricultural methods result in low biodiversity in farmed areas because of widespread herbicide and pesticide use. A combination of land-sparing, where areas are fully conserved, and land-sharing, where the biodiversity of the farmland itself is maximised, is needed. Livestock production can result in pollution locally and in greenhouse gas production which should be reduced but may have to be balanced against efficiency of use of world resources (Broom et al 2013).

Many people in the world are unwilling to accept the use of genetically modified plants and few people accept the use of genetically modified or cloned animals. All cloning of farm animals results in poor welfare while genetically modified animals may have welfare problems so there should be checks using a wide range of welfare indicators before they are used for any purpose (Broom 2008, 2014).

In recent years, consumers in many countries have been appalled to find that producers of food in poor countries are often not properly rewarded for their work and large profits go to distribution companies. Hence products like coffee, cocoa and fruit are among those that are independently checked and have a Fair Trade label.

When small-scale rural farmers are out-competed by large-scale production, local communities may disappear. The general public often find this unacceptable so schemes are introduced by governments to safeguard such communities. In the European Union, subsidies to preserve rural communities have minimised migration from the countryside and prevented large cities from becoming ever larger.

3. Animal welfare

The animals that are legally protected are generally those that are sentient (Broom 2014, 2016). The term welfare is used for individual animals of all kinds, including humans, but not for plants or inanimate objects. Welfare is the state of the individual as regards its attempts to cope with its environment (Broom 1986) so can be measured scientifically. For most species, consideration of needs is the first step in considering the welfare of an animal.

Topics that lead to changes in purchasing by consumers include close confinement of animals in conditions that do not meet their needs and painful procedures such as slaughter without stunning and hot-iron branding. Poor welfare may be a result of genetic selection procedures, for example fast-growing broiler chickens, dairy cows with high milk yields and dogs with compressed faces. Hence some widely-used animal housing systems management procedures and breeding methods are unsustainable (Broom 2017).

Organic standards are generally good in relation to sustainability but if welfare were not included in the standards, the system might not be sustainable. Some early organic standards prohibited chemicals for disease treatment so animal welfare was sometimes very poor. In India, cows are revered by many people. However, they are often not cared for so their welfare may be poor in that they may starve, eat plastic or have untreated disease. If old animals that have stopped producing milk can't be sold, owners have no money to replace the cows and can't produce milk at all. The answer would seem to me to be for older animals to be killed by people whose religion permits it. The money obtained from this would allow Hindu farmers to continue to produce milk. At present neglect means extreme cruelty to many cows. There is also illegal trade in which animals are sent out of the country, often in very bad conditions. I believe that neither of these practices is acceptable, either to Hindus or to other people in India.

4. Sustainable livestock systems for the future

An example of an animal whose management could be changed to be sustainable is the dairy cow. Dairy cattle can utilise pasture plants, a resource unavailable to humans as food. However, many are fed concentrates that humans could utilise and have poor welfare due to lameness, mastitis or reproductive disorders. Some high-producing cows are fed 40% concentrates with up to 96% of their dietary protein usable by humans. This system results in a net loss of nutrients for humans but if the cows were given a diet with 70% or more forage plants and 30% or less concentrates, the system would involve a net food benefit for humans. Cows selected for lower milk production, fed less concentrates and fed more forage plants have few welfare problems.

Three level plant production, including pasture, shrubs with edible leaves and trees that may also have edible leaves, is an example of a silvopastoral system. Semi-intensive silvopastoral cattle production systems are more productive than fertilised pasture systems, use less water, manage the soil taking account of worms and water retention, encourage predators of harmful animals, minimise greenhouse gas emissions improve job-satisfaction for stock-people, reduce injury and stress in animals and maximise good welfare (Murgueitio et al 2008, Broom et al 2013). Semi-intensive silvopastoral systems for beef production use one fifth of the land and between one quarter and one sixth of the conserved water that fertilised pasture or feedlot systems use.

Table 4. Summary of benefits of silvopastoral systems for animal welfare.

(Broom 2016)

Nutritional improvement because of shrub and tree intake

Thermal comfort resulting from more shade

Less risk of dehydration because more water in plants and soil

Less fear because of concealment

Health better because more predators of ticks and flies

Body condition better because of nutrients, shade and less disease

Food intake and social behaviour improved

Better human-animal interactions

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KEY NOTE ADDRESS

Integrating animals and crops into organic farming systems in South Africa and Kenya

Raymond Auerbach¹, Marike Swanepoel¹, N'wa-Jama Mashele¹

Key words: organic farming; pastoralism; transhumance; compost; sustainable farming systems

Abstract

Long term comparative farming systems research trials on the George Campus of Nelson Mandela University initially showed a yield gap, with conventional (chemical) production systems outyielding organic systems by 20% in the first year and by 40% in the second year. This was partly due to poor levels of available soil phosphate, and partly to pest and disease pressure. In the third year of research, these problems were remedied, and the yield gap was closed in spite of drought. A major reason for this was the effect of available phosphate on plant root growth, though better moisture retention in organic soils due to compost was also a factor. In Kenya, agro-pastoral systems allowed some of the 25 million agro-pastoralists who are dependent on transhumance to improve their terms of trade, and to add value to their livestock after following the rains in the Horn of Africa. The Keekonyokie Conservation Meat Enterprise offered a direct and sympathetic marketing channel to 200 000 pastoralist families through a co-operative, a butchering facility and market outlets in Nairobi. Methane was extracted from manure and paunch material which was used to power the slaughterhouse and for local household energy which replaced the cutting of trees for firewood. Liquid manure slurry was turned into compost for crop production.

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The long-term comparative organic farming systems research trials are funded by the National Research Foundation through the African Organic Farming Systems Research Project and the Centre of Excellence in Food Security, with assistance of S Haddad Agricultural Services and the African Earth Observatory Network, of which Raymond Auerbach is a Fellow. The Keekonyokie Conservation Meat Enterprise at Kajiado in Kenya has had support from the Food and Agriculture Organization of the United Nations through the FAO-SARD Livestock Farmer Field Schools.

Introduction

Organic farming has the potential to address climate change and small-farmer insecurity, while improving human health and countering obesity, diabetes, gluten intolerance and many other non-communicable diseases associated with industrial agriculture. To do this, the broken nutrient cycles associated with urban waste, greenhouse gas emissions, ocean acidification, agro-chemical use and sewage pollution need to be restored to health. This can be done through linking energy storage by the green plant to the capacity of herbivores to convert cellulose to protein and manure, the ability of aerobic bacteria and fungi to decompose manure and plant materials, and the usefulness of that compost in sequestering soil carbon and providing the nutrients needed for human nourishment. This paper will show how long-term research trials in South Africa have allowed compost and crop rotation to be used to produce organic crops cost-effectively, and how integrating resource use in agro-pastoral communities in Kenya has used livestock waste products to add value to Maasai meat products while producing methane for energy and compost for food production.

The importance of animal manures in organic farms has already been shown in the long-term DOK trials in Switzerland, where compost-based BioDynamic systems regularly out-performed manure-based organic systems over 34 years of trials, having higher levels of sequestered soil carbon (Fließbach *et al.*, 2007); they show that farmyard manure return to soils has a positive impact on soil carbon, but that the application of compost has further benefits associated with the aerobic decomposition, where less methane develops than with manure, and soils are less acidic. Compost not only provides nutrients and carbon in a stable form, but the colloidal humus contributes to raising the cation exchange (CEC) and water holding capacities of the soil.

Material and methods

The long-term trials on the George Campus of Nelson Mandela University are laid out as complete randomised block experiments with main factor being farming system (organic and conventional), split for crop rotation and replicated four times. These are described fully in Auerbach (forthcoming). The rotation crops are cabbage, sweet potato and cowpea, and the conventional crops are fertilised according to soil analysis, with pests and diseases conventionally prevented. The organic trials receive only five t/ha of compost every third season (on the cabbage crop), containing less than a quarter of the NPK nutrients applied to the conventional cabbage. The sweet potato and cowpea receive no fertiliser and no compost at all. The organic plots are treated with biological pest and disease control remedies (Neem oil, *Trichoderma spp.*, *Bacillus thuringiensis*, and Bio-insek – a blend of organically acceptable bacteria). The crops are rainfed, and weeds are controlled by hand in all plots. The Keekonyokie Conservation Meat Enterprise at Kajiado in Kenya is described in Kibue & Auerbach (2013), but is not a formal research project.

Results

Soil fertility

The soils on the trial site are poor in available phosphate (about 6 mg/kg), much of which is tied up by aluminium oxides; all plots received one t/ha of dolomitic lime per year for the first three years. Available soil phosphate in the conventional treatments rose to 21 mg/kg after two years, while the organic soils only rose to 12 mg/kg. In the third year, rock phosphate was added to the organic plots, and available soil phosphate rose to 25 mg/kg.

Soil carbon decreased from 4.1% pre-ploughing to 2.5%. In the organic treatments, this has risen to 3.1% over three years, while the control and the conventional chemical treatments have remained unchanged.

Comparable soil water in the topsoil two weeks after rain was 2.1% under mulch, 1.4% under non-mulched organic treatments and 1.3% under non-mulched conventional treatments in the second year (mulch vs non-mulch was significant at the 5% level; organic non-mulched vs conventional non-mulched was not significantly different). Water retention was already higher in the organic plots in the second year (the data have not yet been statistically analysed), and this trend has continued in the third and fourth year (Eckert & Auerbach, forthcoming).

Crop yields

Details of cabbage yields over the first three years are given below (Table 1):

Although the third year was a drought year, and the conventional chemical treatment mean

Table 1: Mean results for cabbage harvests (kg/plot); non-significant

Seasonal rainfall for three years of the research: (George Mean Annual Rainfall - 866 mm):		2015 754mm	2016 975mm	2017 605mm
Management system	Planting practice	Mass (kg) Cabbages in nett plot		
	Monocrop/rotation	2015	2016	2017
	Mono-crop cabbage	48,9	65,5	61,0
	Rotated	50,5	74,6	66,3
Chemical mean		49,7	70,0	63,7
	Mono-crop cabbage	40,4	41,2	66,0
	Rotated	40,5	58,3	75,2
Organic mean		40,5	49,7	70,6
Control mean	Control monocrop cabbage	17,0	5,8	13,1

declined to reflect this, the organic treatment mean continued to rise, marginally outperforming the chemical. Rotational treatments (both conventional chemical and organic) were better than monocropped cabbage from the second year, although this was not statistically significant. Yields on the control crops were very low. Conventional chemical cabbage looked larger when harvested, but the scale showed otherwise, as could be felt as soon as the cabbages were cut. A number of cabbages were given to visiting farmers, who cooked them at home and invariably preferred the taste of the organic cabbages, but no objective quality tests have yet been carried out on the produce. Sweet potatoes and cowpeas also had similar yields under conventional and organic farming systems. The organic sweet potatoes sold for a higher price (R18/kg vs R15/kg for conventional). As they were orange fleshed sweet potatoes, they were very well received, as the flavour was excellent (both organic and conventional); however, keeping quality was significantly poorer than white fleshed sweet potatoes.

Discussion

The long-term trials will need to run for ten years before the sustainability of the two systems can be evaluated. Already, the yield gap between organic and conventional farming systems has been closed, and some benefits in terms of soil fertility and water use efficiency of organic farming have been noted. Organic systems appear to produce similar yields with lower levels of nutrients.

In the meantime, a project at Kajiado in Kenya (the Keekonyokie Conservation Meat Enterprise see Kibue & Auerbach, 2013), showed how the formation of a co-operative helped Maasai pastoral cattle owners in seven important ways:


- 1 The co-operative allowed mothers to stay in the villages with children, who could then attend school.
- 2 When the fathers returned after the season, they obtained better prices for their cattle from the Keekonyokie Co-operative.
- 3 The cattle were slaughtered in the local slaughterhouse, and packed meat was sent to Nairobi, adding value to the produce.
- 4 Manure and paunch material were used to generate methane, which powered the slaughterhouse.
- 5 Liquid slurry was then composted, transforming a waste material into a useful fertiliser.
- 6 Compost was used to produce vegetables for co-operative members, improving local nutrition.
- 7 Farmer Field School were set up, to promote inter-generational knowledge transfer from the herders to their children, and also involving the grandparents, and tapping into their long-term knowledge and experience.

Conclusion

Organic farming systems can contribute to environmental services (water use efficiency, soil fertility and food sovereignty), while co-operative marketing can make integrated use of natural resources, and develop social capital creatively, contributing to stabilising rural livelihoods. Long-term research needs to examine the sustainability of these practices in the long term before vigorous conclusions are made. The value of ecosystem services and quality of the food produced should be investigated.

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Integrated and organic dairy farming for sustainable livelihood of JLG farmers in Karur District

Akila, N¹ and Bharathy, N²

Key words: you, should, give, max, six, keywords

Abstract

A project on Integrated Dairy Farming for sustainable livelihood of small and marginal farmers under NABARD, FTTF was implemented in Karur district during 2015-16. Under the project 60 Joint Liability Groups (JLG) were formed with 300 members in Karur, Krishnaraypuram, Kadavur, K.Paramathi & Thanthoni blocks of the district. After a field survey, the farmers were identified, sensitized on JLG formation and credit linked with commercial banks for purchase of 600 milk animals with DEDS subsidy. Then, all these farmers were imparted training on integrated and organic dairy farming. Under the project, model dairy farms with dairy animals, mixed fodder banks, vegetable gardens, own concentrate feed and vermi-compost units were established in 11 villages to taught hygienic and organic milk production. Marketing tie up with Tamil Nadu Milk Producers Co-operative Society (Aavin) was made. To assess the success of this project, a field study was done with 23 groups of 115 members in Thanthoni block. The results and the success of the same are narrated in the article.

Acknowledgments

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Introduction

Livestock rearing in rural villages of India is an age-old practice and the farmers possess cattle, sheep and goats and poultry with agriculture. The by-products of each other act as compliment to one another. Crop and dairy mixed farming is dominant form of milk production activities in India. It is an important livelihood options for the vulnerable sections namely landless, small and marginal farmer who forms major stakeholder in the smallholder dairy (Rao and Birthal 2002; Thirunavukarasu *et al.* 2014). The small marginal rural milk producers, scattered all over the country, accounting for about 155.5 million tons during 2015-16 compared to 17 million tons in 1950-51 (NDDDB 2015-16). Dairy farming is one of the major enterprises for livelihood of rural farmers in Karur district and more particularly, for rural women, who are mainly involved in dairy. Not only the milk and milk products provide profit to the farmers, also, recycling farm waste paves way for production of bio- inputs and uses in field fetch more prices for organic agricultural produces.

Production of organic feed grains helps to keep the animals healthy and production of organic livestock products. Hence to upscale the "Integrated Dairy Farming" along with connected activities like Fodder cultivation, bio-gas, panchagavya production, vermi-compost making, vegetable cultivation using drip, port tray cultivation of vegetable seedlings and organic milk production through a research project on Integrated Dairy Farming for sustainable livelihood of small and marginal farmers under NABARD, FTTF was implemented in Karur district during 2015-16.

Material and methods

Karur District of Tamil Nadu is located at 10°57'N 78°05'E / 10.95°N 78.08°E. It has an average elevation of 122 m (400ft). Regarding livestock sector, cattle, sheep and goats are the main livestock of the district agriculture and animal husbandry especially dairy sector is the major occupation in rural areas. As per the 2014-15 livestock census Karur district has 1,50,063 cattle, 37,487 buffaloes, 2,60,130 sheep, 1,78,551 goats and 24,22,346 poultry. (Livestock population 2014-15).

For the present study, totally 300 dairy farmers in 60 Joint Liability Groups were selected purposively for this scheme from Karur, Thanthoni and Krishnarayapuram blocks. Thus, the target group was comprised of a total of 60 dairy farmer JLGs from 20 villages of three blocks in Karur district. The selected JLG members were imparted proper training and technical skills on profitable dairy farming practices, ethon veterinary treatment practices, hygienic and organic milk production, fodder development, bio-gas, waste utilization and vegetable cultivation along with exposure visit to institutional farms. Model dairy farms with dairy animals specific to native breeds, mixed fodder banks, vegetable gardes, own concentrate feed and vermi-compost units were established in 11 villages. These farms were used to taught hygienic and organic milk production. Skill training on own feed preparation and ethno veterinary treatment for different ailments was taught to the farmers. Hygienic way of milk production without any micro organisms and antibiotic residual in milk was educated by correct method of milking, feeding and healt management. The methods of clean shed, animals, milkman and utensils Recycling farm waste into vermi-compost and the same as applied to their own fields was motivated. Marketing tie up with Tamil Nadu Milk Producers Co-operative Society (Aavin) was made. After the implementation of the project an impact analysis was conducted thorough field study by selecting 23 groups of 115 farmers from Thanthoni block. The practices followed by the farmers and integrating different units of dairy farms to produce organic milk was assessed with 115 farmers and the results were presented. The milk analysis was done through CMT, coliform count and laboratory tests of boiling and clotting analysis.

Results

Demographic details of the respondents

It was found that 71.5 % of the respondents belonged to the age category between 37 – 59 years. Majority of the respondents had primary education (42.8%) and had up to secondary education (29%). Around 74 per cent of the respondent's occupation was agriculture and animal rearing and 16 % of the respondents had some other employment in industries or factories with agriculture and animal husbandry. It is obvious that 75.5 % of the respondents had the income level between Rs. 92000-198000/- per annum and majority of the respondents were the marginal farmers (85.5 %) ie. land size up to 1ha. The average bovine population with the respondents was 3 ± 1.15 .

Adoption of technologies and integration

The adoption level of different technologies taught to the farmers was assessed and presented in Table 1.

Table 1: Adoption of technologies by the beneficiaries

S.Nº	Technology	Before training		After training	
		No	%	No	%
1	Ethno veterinary treatment	-	-	66	57
2	Own Concentrate feed preparaton and feeding balanced ration	9	8	25	21
3	Green fodder production and feeding	24	21	115	100
4	Hygienic and cean milk production	-	-	88	76
5	Vermi compost preparation	-	-	10	9
6	Applying vermi compost to vegetable garden	-	-	18	16

It is observed that out of 115 beneficiaries, 76% followed hygienic and clean milk production practices of milking from clean and healthy animals, clean sheds, washing udder before and after milking, clean milkmen and clean utensils; 57% of beneficiaries follow ethno veterinary treatment for mastitis learnt during the training and 21% of farmers started to prepare own concentrate feed mixture for their animals and the conception rate reported was good. Almost cent percent of the farmers cultivated mixed green fodder, which reduced the quantity of concentrate feed up to 1kg per day/beneficiary.

Ethno veterinary treatment for different ailments like mastitis, enteritis, fever, anestrums was regularly followed by the beneficiaries and assisted them to reduce the treatment cost up to Rs.2000/cow/incidence. Especially the treatment for mastitis and enteritis gave immediate remedy and reduces the treatment cost as well as antibiotic residual effect. Hence the adoption level was significant among the trainees is in line with the results of use of ethno veterinary medicine for treating livestock in Ethiopia was high stated by Yirga *et al.* (2012). Among the farmers 9 % were adopted all practices taught to produce organic milk. It is also learnt that due to the 3 vermi compost models established to train 115 beneficiaries, now 10 farmers are preparing vermi compost and one of the farmer yielded one ton compost and distributed the same to other farmers @ Rs5/ kg. Apart from these, the yield of vegetables got increased by applying vermi compost, besides


fetching better price of Rs.5-6/kg to farmers because of absence of use of fertilizers and also reduces the cost of cultivation. Similar findings were observed by Sorathiya *et al.* (2014). Though the farmers maintained the animals by adopting the technologies learnt, constraints were faced in expanding the same to all farmers. Farm waste recycling and production of organic fodder and feed grains was not accepted by many farmers due to additional workload and lack of knowledge.

Discussion

It was found from the study that an additional 1190 liters of milk/day from 230 animals, reduction in use of antibiotics, feeding green fodder cultivated in their own land, feeding own concentrate mixture, production of organic milk and vermi compost production resulted in healthy animals, premium price for milk and enhanced income level for the selected beneficiaries. But to convert the conventional dairy farming into organic and integrated dairy enterprise in a large scale, extension activities in dairy farming should be designed in such a way to teach the profitable interventions and update the technical knowledge and skill in organic and scientific dairy management, clean milk production and farm waste utilization will be helpful to develop a commercial and profitable dairy enterprise. Additional subsidies to organic dairy farms and premium price for organic dairy products should also be introduced to attract the farmers to enter into organic dairy production. Awareness should be created among the consumers towards the organic dairy products and availability of those products in their door steps will enhance the status of organic dairy farming.

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Enhancing sustainability in India's states: The case of animal husbandry in Sikkim to go organic

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Key words: Sikkim, organic state, sustainability, livestock

Abstract

There is significant interest in promoting organic agriculture in rainfed drylands and mountainous areas in developing countries like India. Considering the natural benefits in switching to organic farming in these areas, the government finds it justifiable to declare such regions as organic zones or fully organic states. The state of Sikkim in the north-eastern part of India is one such state that has been declared as fully organic. Political decisions and policies need to be prepared for the implementation of such decisions to prove the move justified. Moreover, the sustainability of the decisions requires effort across different dimensions of the practice. The stakeholders are expected to make required changes, especially by making them more science based. This paper describes the preparations of the Department of Animal Husbandry, especially efforts put in by scientists and officials in drawing a roadmap for organic animal husbandry development in Sikkim.

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Introduction

On 18th January, 2016, the Prime Minister of India announced Sikkim² as India's first fully organic agriculture state.

It was a huge announcement having wide ranging implications for the agricultural sector of the state. Sikkim has been gearing itself for switching to organic agriculture since 2010 when the Sikkim Organic Mission³ (SOM) was officially launched on 15th August 2010. Its role, to organize activities more systematically under a formal structure. Earlier in 2003, the historic declaration was made in the Sikkim State Legislative Assembly, wherein a resolution was passed for policy interventions geared towards realizing the vision of transforming Sikkim into a 'Total Organic State'. This intent of the state to convert to organic status led to series of activities and initiatives by various departments of government to initiate pro-organic activities in the state. The state departments of agriculture and rural development were particularly active in bringing about necessary changes in the system. The state department of animal husbandry also took the initiative to follow up the activities relevant to organic animal husbandry. This paper describes the initiatives undertaken towards developing a roadmap of organic animal husbandry development in Sikkim state.

Material and methods

In order to streamline organic animal husbandry developmental activities in the state, the Department of AH, LF & VS organized the first Organic animal husbandry workshop for the Veterinary Officers of the state on 27 & 28th September 2014, which initiated some thinking on the lines of Organic Animal Husbandry. To further encourage organic animal husbandry development activities in the state, a daylong workshop was convened on 31st October, 2015 by the SOM.

This workshop was conducted under the expert guidance of the author, wherein, 42 veterinarians took part in the deliberations.

The development officials of the state, including veterinarians from the state animal husbandry and dairy development and rural development departments, have attended various training programmes, exposure visits outside the state, workshops, orientation programmes, certification procedures, etc. over last 3-4 years while marching towards becoming truly an organic state in India.

Results

The key objective of this workshop was to develop a Road Map for organic animal husbandry development in the state of Sikkim. The workshop and series of discussions with the stakeholders in the livestock sector of Sikkim state resulted in a document, *Organic animal husbandry development in Sikkim: The roadmap* (Chander & Sharma, 2015). The document showed the way forward for organic animal husbandry developmental activities in the state. Further to this, three senior level veterinary officers of Livestock and Dairy Development Departments attended a Model Training Course on organic animal husbandry at ICAR-Indian Veterinary Research Institute, Izatnagar during 16-23 November 2015 coordinated by the author. Later on, two scientists from ICAR- National Organic Farming Research Institute based in Sikkim underwent a short course on organic animal husbandry coordinated by the author at ICAR- Indian Veterinary Research Institute to enhance their capacities in this emerging area. The SOM, the Department of AH, LF & VS and the newly

1 <https://en.wikipedia.org/wiki/Sikkim>

2 <http://www.sikkimorganicmission.gov.in/>

established National Organic Farming Research Institute are working towards making organic animal husbandry, in conjunction with crops, a sustainable practice in Sikkim. It is hoped to encourage an increasing number of visitors to the state to learn and promote organic farming. In India's North Eastern region in particular, Sikkim is being seen as a role model state to be followed by other states in the region in matters of organic agriculture.

Discussion and conclusion

This document is a humble effort towards the development of organic animal husbandry in the state of Sikkim. Sikkim has taken an ambitious, path breaking, bold and pioneering decision to be the first fully organic state in India, in all respects. This is an appreciable but challenging decision, since many nuts and bolts have to be fixed to give a practical shape to it so that it is acceptable under organic production systems. As the farming practices, including animal husbandry, practiced in Sikkim are very close to practices recommended under organic production systems, the State is naturally blessed for organic farming. Yet, we need creative interventions in the areas of animal breeding, feeding, housing, management, disease control, value addition, product marketing etc. to make it a truly organic state. It is a challenging task considering the feed and fodder scarcity, nagging diseases especially coccidiosis in poultry and uncontrolled movement of livestock along borders of the state. This document has recommended several needed interventions for guiding the stakeholders at different levels towards orienting and developing organic animal husbandry in Sikkim as a sustainable practice.

Sikkim and other states considering developing organic animal husbandry should consider following interventions:

- Developing/reviewing STATE POLICY FOR ORGANIC AGRICULTURE - elaborating vision, mission, objectives, roles, responsibilities, strength, weakness, opportunities and challenges (SWOC) in context of organic animal husbandry
- Arranging cheaper certification mechanism-State OA certification agency
- Developing a system of livestock grower groups including PGS for livestock production
- Exploring possibilities for the export of organic products from the state
- Developing a Bio-tourism infrastructure
- Setting up a Traceability system to develop a livestock value chain
- Capacity building of veterinarians, other staff and farmers
- Breeding policy suitable for organic systems
- Feed and fodder assurance to livestock


The European Union has developed action plans (Schmid, Padel, Lampkin and Meredith, 2015) for organic agriculture including animal husbandry, which could be good to guide organic animal husbandry developmental activities in India, with location specific changes.

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Knowledge, Attitude and Perception of organic Basmati growers of Suchetgarh Basmati Rice Cluster of R. S. Pura Sector of J&K State (India) towards organic livestock farming

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Key words: Organic livestock farming, Suchetgarh Basmati Rice Cluster, knowledge, attitude, perception

Abstract

The region of Ranbir Singh Pura (R.S. Pura) is reknowned for producing the best basmati rice in the world. Considering the importance of organic farming and its export potential at premium prices, the Department of Agriculture of Jammu Division initiated the production of organic basmati from a cluster of three villages; Suchetgarh, Korotana Khurd and Bidipur Jattan with its headquarters at Suchetgarh. The cluster is called the Suchetgarh Basmati Rice Cluster (SBRC) and the project known as the SBRC Project. The cluster comprises 769 organic basmati-producing families cultivating rice in approximately 880 ha. Fifty families per village were selected randomly to study their knowledge, attitude and perception of towards organic livestock farming. The study revealed that the majority of the basmati growers (65%) had a low level of knowledge of organic livestock farming, and 29% had a medium level of knowledge. About 60% of the organic basmati growers had a favourable attitude towards organic livestock farming compared to 38% of respondents who had a neutral attitude. In case of perception of the importance and requirements of organic livestock farming today, the majority of respondents (61%) possessed a medium level of perception, 24% had a low level, and 15% had a high level of perception. The study concluded that, if the organic basmati growers are motivated and had adequate training related to organic livestock farming, they can become a hub for organic products of both agriculture and animal origin.



Introduction

India is blessed with numerous agro-climatic zones which aid the cultivation of the most crops and other agricultural products. According to available 2013 statistics, India ranks 15th in terms of the world's organic agricultural land area and, in 2015, organic producers were reported. India continues to have the highest number of producers (585,200), followed by Ethiopia, and Mexico (FIBL & IFOAM Year Book 2015). The total area under organic certification is 5.7m ha (2015-16). This includes cultivable area (26%, 1.49m ha) and forest and wild areas for collection of minor forest products (74%, 4.2m ha). In 2015-16, India produced around 1.4 million tonnes (Mt) of certified organic products including all varieties of food products: sugarcane, oil seeds, cereals and millets, cotton, pulses, medicinal plants, tea, fruits, spices, dried fruits, vegetables, coffee etc. The total volume exported during 2015-16 was 263,687 Mt. The value of organic food exported was around \$US 298m. Organic products are exported to the European Union, USA, Canada, Switzerland, Korea, Australia, New Zealand, South East Asia, Middle East, South Africa etc. Oil seeds lead the products exported (50%) followed by processed food products (25%), cereals and millets (17%), tea (2%), pulses (2%), spices (1%), dry fruits (1%), and others.

The State of Jammu and Kashmir (J&K State) is a budding state as far as organic agricultural production is concerned. Livestock also plays a very prominent role for development of the economy of J&K State. Around 70% of the population of the State reside in rural areas and are either directly or indirectly dependent upon this sector for their livelihood and employment.

In 2012, the Department of Agriculture, Jammu Division, introduced a project to produce organic basmati rice in Suchetgarh, and organic Saffron in Kistwar. The first crop of organic basmati was planted in 2016. The project was named as Suchetgarh Basmati Rice Cluster (SBRC), and undertaken by three villages (Suchetgarh, Korotana Khurd and Bidipur Jattan). Further, Non-Governmental Organizations (NGOs) now come from all over India to J&K State with a view to undertaking organic production in other regions of the state such as Bhandarwah, Poonch, Rajouri, Samba and Kathua. However, organic production requires knowledge and is management-intensive. Producers must therefore be well-versed in organic production standards, principles and practices, which requires a high degree of knowledge and skill. In organic production, it is not simply the final product that matters but the whole production process, which must be inspected and approved by the accredited certification bodies. Organic livestock farming is still evolving, and further research is needed to ensure it is sustainable.

Materials and methods

Selection of organic farmers

The farmers were selected randomly from all three villages within the SBRC of R.S. Pura region of J&K State. Figure 1 shows the location of the J&K State in India (a) and the region of R. S. Pura where the project is based.



(a)



(b)

Figure 1 showing (a) the location of J& K State in India, with a marker indicating the location of the Suchetgarh Basmati Rice Cluster and (b) the R. S. Pura region of J&K State, India.

Out of the 769 organic farming families, 50 families per village were selected randomly for the study. The data were collected from the respondents with the help of a pre-tested, semi-structured interview schedule, and then analysed using standard statistical tools.

Results

Out of the total number of farmers, most (55%) were middle-aged (35-50 years), 35% were old (>50 years), and only 11% were young (<35 years). Around 56% of farmers had middle and secondary level of education whereas 22% were illiterate. As far as family size was concerned, the majority (58%) belonged to medium-sized families, 28% to small families and 14% to large families. Regarding social participation, around 60% organic farmers were member of either one or more formal/informal organisations and 11% were office bearers of formal organisations such as *Gram Panchayats* as either *Sarpanch* or *Panch*.

The total land holding of the 150 organic farmers was 170 ha, with 19% of total land under organic cultivation. Most of the cultivated land was irrigated by tube wells and water from the Ranbir Canal, which is fed by Chenab River. The study revealed that the majority of the basmati growers (65%) had a low level of knowledge of organic livestock farming, followed by 29% of respondents with medium level of knowledge. About 60% of organic basmati growers had a favourable attitude towards organic livestock farming and 38% had a neutral attitude. In terms of perception about the importance and needs of organic livestock farming today, a majority (61%) of respondents possessed a medium level of perception followed by 24% with a low level and 15% with a high level of perception.

Discussion

The profile of organic farmers in the present study highlighted their salient socio-personal characteristics which was assumed to influence their knowledge, attitude and perception towards organic livestock farming. The study revealed that the majority of the organic farmers were middle-aged, had either middle or secondary education passes, came from medium-sized families, and a majority participated socially in formal or informal organisations. A few were elected office bearers of *Gram Panchayats* and had good extension contacts and liaised with officials of the Department of Agriculture, Department of Animal Husbandry and other departments of state government. The study revealed that, although the organic farmers had low level of knowledge and awareness about organic livestock farming, a good majority had a favourable attitude towards it. A sizeable number of respondents showed a neutral attitude which can be converted to a favourable attitude by training and motivation. Regarding perception, again, a good majority of the respondents had a medium level of positive perception towards organic livestock farming which can be changed to high level of perception by awareness and capacity-building. Further, the farmers in the area were using traditional knowledge for healing livestock ailments without the use of antibiotics and other steroidal products. Also, the crop residues produced from the organic land were utilised as organic fodder, either in the form of dry or green fodder, for the production of organic milk and milk products.

Conclusions

The farmers in the study appear to have gained some confidence in organic basmati rice production activities due to the training and marketing support provided by the Department of Agriculture Production, Jammu. Further, the premium prices for organic Basmati have motivated them to try organic livestock production as well, mainly looking at the prospects of high premiums on such products in the domestic and international markets. A new programme called the *Paramparagat*

Krishi Vikas Yojana (PKVY) was launched by the Ministry of Agriculture and Cooperation and is a component of the Soil Health Management (SHM) project of the National Mission of Sustainable Agriculture (NMSA). Under PKVY, organic farming is promoted through the adoption of clusters of organic villages and PGS certification. The scheme was launched during 2015-16 to promote organic farming in the State of Jammu and Kashmir. The amount of US \$134,879.37 was available under PKVY, including US \$ 17,834 from the State. The expenditure for organic farming in the State was of the order of US \$ 74,131.34.the State. The organic farmers face a number of challenges such as lack of inputs like seeds, subsidized bore wells for irrigation, suitable markets and better prices for their produce, a cumbersome process of organic certification, lack of training, information and awareness about organic livestock farming, and fewer domestic buyers of organic products at higher prices etc. These problems discourage farmers from organic livestock farming but this can be overcome by raising awareness amongst the producers, as well as consumers, about the importance and need for organic livestock products in the sustainable development of humankind and also by effective extension advise for the organic growers. The study concluded that if the organic basmati growers are motivated and have adequate training related to organic livestock farming, they can become a hub for organic products of both agricultural and animal origin.

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Comparision of Organic Dairy Standards with the Practices followed by the Farmers

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Key words: Organic dairy, farmers practices, comparison of organic

Abstract

Organic Dairy Farming is a way to increase the export of dairy products and also strengthen rural farmers. India is the number one milk producer in the world and has to improve its standards and quality systems to compete in the global market. In order to provide quality products and a focused and well directed development programme of organic agriculture, the Ministry of Commerce and Industry, Government of India, launched a National Program of Organic Production (NPOP) in 2000, which was formally notified in October 2001 under the Foreign Trade & Development Act (FTDR Act). However, this has to be accelerated and standardised from the very beginning by clear policy support and strategic direction from the Government of India (GoI). India has the potential to grow in organic dairying because more than 70 per cent of the practices followed by the farmers are in line with organic production standards except for some of the requirements which need to be fulfilled such as: supplying organically-certified feed to animals, maintaining records, maintaining animals in organic holdings since, providing bedding materials, vitamins, trace elements and supplements from natural origin.

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Introduction

Organic dairy farming requires the raising of animals on organic feed, that is, pastures cultivated without the use of fertilizers or pesticides, along with the restricted usage of medicines, antibiotics and hormones. Though organic farming is in-built under the Indian system of farming, the certification norms prescribed by different recognized agencies are mandatory. Farmers rear their livestock in a traditional manner which has a close resemblance to organic dairy farming standards. There was no conscious effort on the part of farmers to rear livestock as per organic standards, in fact, most Indian farmers were not even aware of the organic concept *per se*.

Farmers of marginal, small, and semi-medium operational holdings own 87.70 % of the livestock, and the low external inputs-based Indian dairy sector has better prospects to transform to organic production because the majority of Indian farmers follow organic farming not by choice but rather by default. There is wide scope for India to prosper in the global organic market as the country already exports products like skimmed milk powder (44.07%), milk fats and butter (35%), whole milk powder (8.14%), cheese and fermented products (2.93%), processed cheese (2.81%) and whey and other products (2.04%) to countries like UAE, Bangladesh, Nepal, Philippines, Egypt, Yemen and Saudi Arabia etc (Joshi, 2013). The market for organic foods is growing at a Compound Annual Growth Rate (CAGR) of 20 to 22 % with 2,000 organic outlets operated by farmers and non-Governmental organisations (NGO's) (Organic Trade Association, 2012). The Agriculture and Processed Products Exports Development Authority (APEDA), Indian Council of Agriculture Research (ICAR), State Agricultural Universities (SAUs), State Departments of Agriculture, State Department of Animal Husbandry coupled with the NGO's, are now working towards promoting organic production.

Materials and Methods

The present research study was conducted in Telangana State, Medak District, and was purposely selected for the study because it has the Deccan Development Society (DDS), an internationally-known NGO, which promotes organic farming. Thus, the dairy farmers of this district became aware of organic dairy farming. Three mandals (sub-districts) were randomly selected for the study, from which four villages were selected randomly and, from each village, 10 farmers selected randomly, giving a total of 120 farmers.

An interview schedule was developed in accordance with the National Standards for Organic Production (NPOP), developed by the GoI, which consisted of 26 practices, and the farmers were interviewed about the practices they followed. The research observations were recorded and then compared to organic production standards. To quantify the dairy farming practices followed by the respondents compared to organic dairy farming standards, the overall response regarding each practice was put on a two-point scale: organic dairy farming practices followed or not followed were recorded as 'practiced' and 'not practiced' respectively and score of 2 and 1 were allotted respectively. The comparison was measured in terms of frequencies and percentages.

Results

I) Behavioural needs of the animal: From Table 1, it is clear that the majority of farmers (80%) provided 'sufficient fresh air, daylight and resting area', 49.17% protected 'against adverse weather conditions', 38.33% fulfilled the 'biological and ethological needs', 24.17% made provision of 'free movement', only (10.00%) of farmers provided 'bedding materials'. The farmers rear the animals in semi-intensive system is the reason for the above trend. (Subrahmanyeswari and Chander 2008a, Borell and Sorensen 2004, Pathak and Chander 2002).

II) Feeding: It was confirmed that the majority of respondents (88.33%) provided 'ample access to fresh water', 81.67%), sourced more than >50% of the feed from 'on-farm or within the region', 48.33% had 'access for grazing', 41.67% 'provided balanced diet to the animals', (22.50%) provided 'daily access to roughage', only 15.83 % gave 'vitamins, trace elements and supplements from natural origin', 95.83% did not use 'synthetic products', and none of them gave '100% organically certifiable feed'. The reason for the above trend was that farmers always preferred to feed animals traditionally with the available feed inputs on their farm rather than buy commercial feed (Vetouli et al. 2012, Subrahmanyeswari and Chander 2008c, Pathak and Chander 2002).

III) Breeding: 75.83 reported that 'breeds are adapted to local conditions', 62.50% 'reproduced through natural breeding or AI', 23.33% reported 'breeding stock may be brought in from conventional farms', 90% 'reproduction shall not include high technological methods', and as none of the farms were organic holdings, 8.33% of the farmers brought the calves at four weeks from conventional farms. The reason for the above trend is that most of the farmers reared indigenous breeds which were readily adapted to local conditions and their inclination was towards natural service. (Subrahmanyeswari and Chander 2013, Subrahmanyeswari and Chander 2008c, Pathak and Chander 2002).

IV) Health care: 72.50% provided 'prompt treatment to sick and injured animals', 60.00% followed a 'vaccination schedule', 96.67% did not used 'hormone treatment', and 38.33% used natural medicine. The above trend might be due to the farmers' utmost care towards animal health care, prevention of diseases through availing, government-provided vaccinations and treating the animals by indigenous traditional knowledge which has been followed for a very long time. (Subrahmanyeswari and Chander 2008c, Pathak and Chander 2002, Sutherland et al, 2013).

V) Others: 88.33% of respondents stated that 'draft animals must be well cared'; on 6.67% of large farms 'mutilations are carried out' (Pathak and Chander 2002). Of those carrying out dairy farming at large scale, only 1.67 % 'maintained records'. This may be due to illiteracy (Lokhande et al 2012, Pathak and Chander 2002).

Table 1: Comparison between organic dairy farming standards and farmers' practices

S.No	Practice	Organic dairy farming standards	P F (%)	NP F (%)
I) Behavioural needs of the animal:				
1.	Movement of animals	There should be provision of sufficient free movement	29 (24.17)	91 (75.83)
2.	Resting area	Enough lying and/or resting area should be provided according to the needs of the animal	96 (80.00)	24 (20.00)
3.	Bedding material	Required bedding materials shall be provided	12 (10.00)	108 (90.00)
4.	Air and daylight	Sufficient fresh air and natural daylight according to the needs of the animals should be provided	97 (80.83)	23 (19.17)
5.	Weather conditions	Animals should be protected against adverse weather conditions	59 (49.17)	61 (50.83)
6.	Natural behavior	Adequate facilities shall be provided for expressing behavior in accordance with the biological and ethological needs of the species	46 (38.33)	74 (61.67)
II) Feeding:				
7.	Drinking water	Ample access to fresh water according to the needs of the animals	106 (88.33)	14 (11.67)

S.No	Practice	Organic dairy farming standards	P F (%)	NP F (%)
8.	Grazing	All animals shall have access to open air and/or grazing appropriate to the type of animal and season, taking into account their age and condition	58 (48.33)	62 (51.67)
9.	Feeding strategy	Animals should be fed adequately with balanced diet in a form allowing them to execute their natural feeding behaviour and digestive needs	50 (41.67)	70 (58.33)
10.	Feed	All animals should receive 100% organically certifiable feed. If certain feeds are not available, then 10-15% conventional feed are allowed.	0 (0)	120 (100)
11.	Source of feed	More than 50% of feed shall come from on-farm or be produced within the region	98 (81.67)	22 (18.33)
12.	Vitamins	Vitamins, trace elements and supplements shall be used from natural origin	19 (15.83)	101 (84.17)
13.	Cultivation of fodder	No specific standards but all animals shall have daily access to roughage	27 (22.50)	93 (77.50)
14.	Synthetic products etc.	Use of Synthetic growth promoters or stimulants, Synthetic appetizers, Preservatives, Artificial coloring agents, Urea, farm animal by-products to ruminants, animal manure or Droppings, dung, solvent extracted feed, Pure amino acids Genetically engineered organisms are not allowed.	115 (95.83)	5 (4.17)
III) Breeding:				
15.	Origin of animals	All the organic animals should be born and raised on the organic holding. When organic livestock is not available animals could be brought from conventional farm at certain age: 4weeks old calves fed with colostrum & mainly whole milk.	10 (8.33)	110 (91.67)
16.	Source of breeding stock	Breeding stock may be brought in from conventional farms at an annual rate not exceeding 10% of the adult animals of the same species in the farm.	28 (23.33)	92 (76.67)
17.	Breeds	Breeds should be chosen which are adapted to local conditions.	91 (75.83)	29 (24.17)
18.	Reproduction method	Reproduction should be natural or AI	75 (62.50)	45 (37.50)
19.	Use of high technological methods in Reproduction	Breeding shall not include high technological methods like embryo transfer, hormonal heat treatment, use of genetically engineered species/breeds	108 (90.00)	12 (10.00)
IV) Health care:				
20.	Treatment for sick and injured animals	Sick and injured animals shall be given prompt and adequate treatment	87 (72.50)	33 (27.50)
21.	Type of treatment	Natural medicines and methods, including homeopathy ayurvedic medicine and acupuncture, shall be emphasized	46 (38.33)	74 (61.67)
22.	Vaccination	Vaccine shall be used only when diseases are known or expected to be a problem in the region of the farm and where these diseases cannot be controlled by other management techniques.	72 (60.00)	48 (40.00)

S.No	Practice	Organic dairy farming standards	P F (%)	NP F (%)
23.	Hormone	No hormone should be used, except for treatment of individual animal	116 (96.67)	4 (3.33)
V) Others:				
24.	Mutilation	Mutilations are not allowed. The certification programme shall allow the exceptions like Castrations, Dehorning	112 (93.33)	8 (6.67)
25.	Record keeping	All records of the farm in detail including the receipts should be kept	2 (1.67)	118 (98.33)
26.	Draft animal	Draft animals must be well cared, must be used in a humane manner that cause least possible stress and suffering. There should be maximum and minimum age, no overwork or overloading.	106 (88.33)	14 (11.67)

F = Frequency. Total number of respondent, n=120. S.No = Practice N° P = Practised. NP= Not Practised.

Discussion

Integrated Farming: A majority of the farmers practiced an integrated farming system with 78.30% having small and marginal land, and 70.83 % of holdings having 1-6 animals. As small land- and livestock-holdings predominate in India, the priority for livestock rearing is the proper utilisation of farm by-products and nutrient recycling, and meeting the nutritional requirement of the family rather than marketing.

Awareness: Farmers should be made aware that the practices they are following organic in nature for more than 70% and its demand in the market; with little efforts on their part that is providing bedding material, maintaining records, giving organic certified feed and vitamins, trace elements and supplements from natural origin they can be certified as organic dairy farmers.

Certification: The farmers who are registered in DDS are certified as organic under group certification and are not certified individually. Farmers follow the traditional farming practices. Due to their illiteracy and lack of knowledge they are not aware of the market demand for organic products or that their practices are organic. Thus, they are not getting remunerative prices for the products, and this is discouraging them from going into organic dairy production. The Government has to take efforts to make the certification process simpler and easier to encourage the farmers to be certified individually. Although the dairy sector has a long way to go to reach organic dairy standards, with the support of Government and a stepwise approach it is not impossible. India, is the largest producer of milk in the world, with 127.3 million tonnes of milk products (2011-12 Animal Husbandry Dept), and can venture into global organic market. With its rich livestock diversity, high tolerance to disease and stress, it can offer more opportunities for converting farmers to organic dairy farming especially as more than 70% of the practices followed are as per organic standards except - for some of the basic requirements like feeding organically certifiable feed to animals, maintaining records, maintaining animals in organic holding since birth, providing bedding materials, providing animals vitamins, trace elements and supplements from natural origin.

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Farm Health Online: delivering practical knowledge for sustainable livestock production

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Key words: sustainable, livestock, health, welfare, knowledge, website

Abstract

Organic farming places great importance on high standards of animal health and welfare and organic principles provide an aspirational framework. However, without the necessary knowledge, tools and support, there is a risk of poor health and reduced welfare. Farmers increasingly use the internet for knowledge yet available information is scattered and frequently of unknown origin, credibility and organic relevance. This paper describes the development and content of a website, Farm Health Online www.farmhealthonline.com, which supports organic farming with appropriate material from many scientific research and advisory sources, making it accessible for farmers, veterinarians and advisors. It is divided into three main sections; Disease Management, Health and Welfare and Veterinary Questions. It successfully transforms evidence-based scientific research into sustainable on-farm practical advice for livestock farmers, whilst helping ensure high levels of animal health and welfare and safeguarding the environment.

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Introduction

Organic farming places paramount importance on high standards of animal health and welfare and organic principles provide an aspirational framework (Vaarst et al., 2004). However, without access to the necessary knowledge, tools and support, there is a risk of poor health and reduced welfare.

Organic farming has multiple environmental, social and economic objectives that can lead to conflicts compromising health status and well-being. There is need for advisory material drawn from sound scientific evidence that enables farmers to nurture and care for animals as sentient beings with the capability to defend themselves against diseases inherent within the farmed environment, whilst also allowing them to provide an economic income and to contribute to other ecological and social functions.

So where do organic farmers get their knowledge from? Farmers increasingly use the internet for guidance yet available information is frequently of unknown origin, incomplete, often conflicting, and lacks credibility and organic relevance. New innovations, ideas and solutions are often published in inaccessible peer-reviewed journals with research conclusions of little relevance to the practitioner. This paper describes the development and content of a website called www.farmhealthonline.com supporting sustainable livestock farming by bringing together appropriate information from a wide range of scientific literature and advisory sources, making it accessible for farmers, veterinarians and advisors.

The website www.organicvet.co.uk (Roderick and Hovi, 2000) was used a starting point for Farm Health Online. This was originally aimed primarily at organic farmers and advisors during a period when there was rapid conversion to organic farming in Europe and there was very little practical advice available on farming livestock without reliance on veterinary medicines. The majority of veterinary advice was frequently based on a poor understanding of organic farming practices. More recently, there has been a change in circumstances that has led to some organic practices becoming more attractive and relevant to a much larger population of non-organic farmers as a result of:

- A greater emphasis on animal welfare, driven in part by consumer demand and legislation;
- The widespread development of anti-microbial resistance and the need to develop production systems with reduced dependency on veterinary medicines;
- The evolution of more 'environmentally-friendly' production systems that contribute to reduced greenhouse gas emissions, have lower levels of diffuse water pollution and/or contribute to enhanced biodiversity; and
- A requirement for greater economic efficiency associated with the increased cost of some purchased inputs, especially of feeds and fertilisers.

Materials and methods

The content of the website was created by reviewing and editing the original Organic Vet website and adding new material drawn from recent peer-reviewed literature, books, reports and conference proceedings. The criteria for inclusion of material was largely related to the relevance of the published information to a set of sustainable livestock principles developed from core organic principles and concepts related to livestock. All of the knowledge and advisory materials were reviewed by expert veterinarians prior to publication.









Results

A set of sustainable livestock practices and principles were adapted from those published in organic farming legislation and literature. These were embedded within the website and made continuously available presented as a drop-down feature entitled "Read Our Sustainable Livestock Principles" (Figures 1 and 2). These provided a sustainable farming context for the website.

Figure 1: The Farm Health Online website Sustainable Livestock Principles

- Livestock should be land-based and integrated with farm cropping enterprises
- Animals should be provided with conditions that enable them to exhibit natural behaviours
- Reduce dependency on veterinary medicines without jeopardising the well-being of animals

Figure 2: The Farm Health Online website Sustainable Livestock Practices

	Animals should have outdoor access, shade, shelter, lighting and sufficient space for them to undertake free movement and to exhibit natural behaviours.
	Use breeds and strains well-suited and adapted to the prevailing conditions.
	Implement herd and flock planning based on sound ecological practices and epidemiological knowledge.
	Good practice biosecurity should always be undertaken.
	Maintaining animals in closed herds and flocks and at stocking rates that enables free movement, reduces risks of disease spread and minimises environmental damage.
	Forage and grazing should be the main source of nutrients for ruminants, and should be continuously available to non-ruminants.
	The use of mutilations as standard production practices should be avoided.
	Improved understanding and responsible usage of veterinary medicines.

More than 120 indexed cattle, sheep, goat, poultry and pig Disease Management pages were written detailing aetiology, epidemiology and sustainable control options summarised into good practice guidance. Diagrams of processes and systems such as modes of transmission, biochemical pathways and simple physiology were developed to help illustrate specific conditions to farmers. Separate species-specific Health and Welfare pages were composed to promote positive health and welfare. These were linked to particular disease pages where necessary, and included sections on housing, feeding, breeding, natural behaviour and animal welfare assessment.

Generic Veterinary Questions pages were written to explain emerging issues such as anti-microbial resistance, biosecurity and zoonoses. Explanations of animal health planning and biosecurity practices relevant to all species were also included, with links to species and disease specific pages. All the information was fully referenced, hyper-linked to source and supplemented with explanatory diagrams, videos and images.

Discussion

Whilst organic farming regulation provides the basis for the sustainable development of organic production, it does not provide guidance on implementation. Farm Health Online transforms evidence-based scientific research into sustainable on-farm practical advice. It is a new portal containing validated knowledge supported by visual aids on how best to implement pro-active herd health planning in situations where farmers are also trying to achieve other private and public good objectives, as well as meeting organic legislative requirements. Sustainable control options are only possible when there is a clear understanding of the risk factors. The website endeavours to highlight and explain disease risk factors, and particularly those associated with the sustainable farming conditions, suggesting approaches to minimising these risks within the framework of the core principles. Diseases frequently do not occur in isolation and due to a challenged immune system, or other stress-related factors, many diseases are interlinked. The website highlights these associations e.g. the multi-system disease symptoms caused by Caprine Arthritis Encephalitis Virus in goats and the linkages between feather pecking and nutritional deficiency in poultry.

A set of clear philosophical and practical guidelines ensures that the website material is appropriate and relevant to all organic farmers as well as the increasing population of uncertified livestock farmers aiming to meet high standards of animal welfare and environmental management, such as those producing entirely pasture-based ruminant systems and free-range pig and poultry.

Farm Health Online promotes outdoor systems based on well-adapted breeds fed and housed to meet physiological and behavioural needs. The website promotes preventive disease management, responsible veterinary medicine use and sound health planning with veterinary consultation. There are broader issues that affect all livestock farmers, the solutions to which can often be found within the organic sector. Of particular relevance are pages highlighting practices associated with reducing dependence on antibiotics, given global concerns over anti-microbial resistance. Likewise, pages highlighting biosecurity practices contribute to international drives to reduce risks of zoonoses.

The importance of disseminating agricultural research outputs to farmers is well recognised. However, farming is a complex with a large number of considerations. This is particularly the case with so-called sustainable systems, with multiple public and private good objectives. There are also potential conflicts involved in meeting these objectives. The Farm Health Online approach combines ethological thinking, epidemiological knowledge and ecological aims contributing to the development of enhanced communication of science to organic farmers and advisors.

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Management and results of small-scale organic laying hens in Southern Brazil. Case report.

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Key words: laying hens, welfare, rotation, parasites, medicinal plants

Abstract

Due to increasing consumption and the payment of a differentiated price, organic eggs have been a good option to improve the income of small farmers. However, since the organic production system is new and lacking in research and technical guidance, there is still no consolidated methodology to guide farmers. In order to contribute to this, we report on the management of 100 laying hens over 18 months on an organic farm in Brazil. Parasites were controlled by the rotation of the animals to interfere in the cycle of the parasites and by the use of bioactive and medicinal plants. In this period the mortality was 2% and between 40 and 66 weeks the mean posture was 84.21% and the mean weight of the eggs was 66.19 g. The good results are an indicative of the success of the adopted management. The farmers also declared that they are satisfied. Accordingly, such methodology should be further studied and detailed to obtain more consistent results and thus serve as a guiding basis for organic laying hen breeders.

Introduction

The production and demand for organic eggs has been growing impressively in Brazil, however the productive sector still does not have a consolidated methodology of production according to organic production regulations. Several studies report attempts to find substitutes of restricted chemical inputs for permitted inputs such as medicinal plants with varying results (Guidotti 2011; Escosteguy 2014). Considering that the organic system is preventive, the whole context must be re-evaluated and adjusted and not simply regarded as a substitution of inputs (Escosteguy 2007).



Case presentation

We report on the management of 100 laying hens of the Isa Brown line from June 2015 to December 2016 on a traditional small family farm in Viamão / RS. The farm has been organically certified for seven years. We describe the hygiene management adopted and the results achieved where the animal, the environment and prevention were taken into account when establishing a management system.

1. Feeding

The animals receive a balanced feed based on certified corn and soybeans, supplemented with forage peanut pasture (*Arachispintoi*) and fermented corn. Fermented grains reinforce or reestablish the probiosis of the intestinal tract, consequently, improving the formation of a healthy and balanced microbiota. This may protect the hens against the development of pathogenic microorganisms as *Salmonella* spp (Silva, 2000, Figueiredo, 2016).

2. Animal welfare

After the age of 45 days the pullets have free access to grassland during the day. The total area used is one hectare divided in five pickets. The henhouse with an internal area of 30 m² has five direct exits for each picket. The hens have a comfortable environment as in addition to adequate space, the pickets have several trees, providing shade and shelter from strong winds as well as a sensation of protection. The pastures, based on peanut pasture, are well-managed and kept in good condition with the rotation of the animals.

3. Sanitary management

The animals rotate in the pickets observing the principle of decontamination of the pastures through a minimum rest of 40 days. This interferes in the life cycle of both internal and external parasites.

4. Use of bioactive and medicinal plants

The farmers also use herbs to help in the control internal and external parasites.

To control the red mite (*Dermanyssus gallinae*) they spray an alcoholic solution of 5% citronella (*Cymbopogon* spp.) by volume in the nests, once a week. It acts as a repellent.

To reinforce the control of internal parasites they use the following (for the 100 hens) once a week

- 5 ml of a cereal alcohol solution of 5% thyme (*Thymus vulgaris*) by volume mixed in the fermented food;
- 5 ml of a cereal alcohol solution of 5% oregano (*Origanum vulgare*) by volume mixed in the fermented food;
- Leaves and stem of one banana tree (*Musa* spp) offered directly for free consumption.

Results

The proposed management resulted in good animal health, good productivity and economic return. In the reported period the mortality of the laying hens was 2% and between 40 and 66 weeks old the mean posture was 84.21% and the mean weight of the eggs was 66.19 g. The owners declare that they are satisfied with the results because although the organic ration is expensive, productivity is high and economic return is satisfactory.

Discussion and conclusions

The good results are indicative of the success of the adopted management. We consider that it is fundamental to consider the entire production system and to take prophylactic measures correcting any errors mainly related to environmental infestation by parasites and animal welfare. The use of medicinal plants in animals should also be further studied and encouraged, considering the good results and low cost.

Such methodology should be further studied and detailed to obtain more consistent results and thus serve as a guiding basis for organic breeders.

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Tick and helminths control in organic dairy cattle. Case report in southern Brazil.

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Key words: tick, helminths, welfare, homeopathy, rotation, parasites

Abstract

Controlling internal and external parasites in animals without the use of synthesized chemicals has been a challenge for organic livestock, especially in countries with a warm climate and grazing animals. We report the management adopted by a 27-hectare farm in transition to an organic system, with Jersey cattle, located in Tapes / RS / Brazil, from October 2015 to September 2016. The new routine included (1) rotating pickets to interfere with the parasite cycle and optimize the use of pastures, (2) improving the calves' welfare, and (3) using a homeopathic product (Sulfur CH 30) in the salt offered ad libitum to animals. The pasture was damaged because the fall and winter were rainy, thus causing the animals' weight loss. Even so, there was a reduction of ticks (assessment performed visually) and helminths, which were investigated through the parasitological examination of faeces. The farmer also found economic benefits in substituting conventional veterinary products for homeopathic medicine because of a decrease in expenditure on inputs. These results serve as an indication of the success of the adopted management. Accordingly, such methodology should be further studied and detailed to obtain more consistent results and thus serve as a guiding basis for organic livestock breeders.

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Introduction

Infections of internal and external parasites in cattle throughout Brazil are favoured by the predominance of tropical and subtropical climates, use of more sensitive (European) breeds of cattle and high concentrations of animals in the pastures. In organic systems, the use of synthetic chemicals is severely restricted. Thus, organic breeders are looking for other alternatives to parasite control. Several studies show that the conversion to an organic system should encompass changes in the intensity of infection by parasites and attention to animal welfare. Thus, the use of prophylactic practices is imperative, since mere substitution of inputs alone is not enough (Neves, 2009, Almeida, 2013). The present work reports on several measures adopted in the management of the animals that on a Jersey cattle farm, aiming at parasitic control in the conversion phase to the organic system. The new routine included changes in pasture management, use of homeopathic products and improvement in animal welfare.

Case presentation

We report on changes instituted between October 2015 to September 2016.

The property is a 'traditional' 27 hectare farm. Since the 1990s Jersey cattle have been raised on natural pastures, rotating in large pickets in an extensive system. From 2005 biofertilizer has been sprayed on the pastures, eliminating the use of NPK. Ticks and helminths were always a problem and control was achieved through five acaricide baths/year and four everminations /year. Due to high costs, parasite resistance and the constant re-infestation of animals by ticks, in 2012, the farmer began bathing the animals with herbal medicines, interspersed with chemical dips. As of October 2015, the farmer ceased using synthetic chemicals to control ticks and helminths and started to use homeopathic products. In addition, pasture management was improved by incorporating rest periods and calf health was enhanced.

General information

Sixty three mixed age, pure Jersey cattle are managed on 17 hectares of improved native grassland. A rainy winter damaged the pastures and therefore the nutritional status of the animals was compromised. The calves and heifers were last treated with a chemical anthelmintic in October 2015 and acaricides were not applied during the reported period. Below is a description of the activities as they were and the adopted changes.

1. Management of pasture

Overall grazing intensity averages at 4 animals/hectare. The size of the pickets and the concentrations of animals varies according to the climate, the season and the category of livestock. In the reported period, the size of the pickets was reduced a little to make better use of the pastures allowing a minimum rest of 30 days between grazings. This strategy interferes in the cycle of parasites by decreasing the number of larvae and eggs present in the environment. (Almeida, 2013). The principle of decontamination of the pastures was observed under the new regime.

2. Improvements in the welfare of calves

Previously calves were tied in their first week and then housed in individual stalls until 3 months of age with no social interaction. As of April, changes were made. The calves were able to access to grass in small groups during the day and were housed again at night or during periods of heavy rain. Social interaction and exposure to pasture increases welfare, reduces stress and strengthens the immune system improving health (Magalhães, 2007).

3. Use of homeopathy

Lactating cows (20) received the homeopathic drug Sulphur CH 30, mixed in the salt and supplied ad libitum, from October to January and from April to September. There was an overall improvement in the state of the animals and there was a 9.9% increase in milk production even without changing the food provided. The other animals (43) received Sulfur CH 30, from April until the end of the trial (September/2016). Sulphur increases animals' defenses and also favours animal development (Dias, 2015). Salt troughs were accessible but protected from the rain and sun so as not to interfere with the medicine.

Results

With the adoption of the new routine, there was a significant reduction of ticks and helminths. In addition, there was also a reduction of over 90% in drug costs.

Control of the tick population was evaluated by visual observation. Fifteen days after the beginning of salt intake with Sulfur CH 30 there was a visible decrease in the number of ticks in the animals and the few remnants were wilted and altered. The incidence / quantity of ticks remained low throughout the period.

The incidence of helminths was evaluated by the parasitological examination of faeces of the animals, carried out at the Laboratory of Helminthology of the Faculty of Veterinary Medicine / UFRGS, in October. Results of the parasitological examination of faeces according to diagnostic techniques used are shown in Table 1.

Table 1- Results of parasitological exams of bovine faeces according to diagnostic different techniques used.

Animal category	Technique		
	Willis-Mollay (eggs)	Gordon& Whitlock(OPG)	Dennis-Stones&Swanson
01 Lactating cow	0	0	0
02 Lactating cow	0	Str 100	0
03 Heifer 2 years old	0	0	0
04 Heifer 2 years old	0	0	0
05 Calve ≤ 7 months	Str 26	Str 400	0
06 Calve ≤ 7 months	0	0	0
07 Cow > 3 years old	0	0	0
08 Cow > 3 years old	0	0	0
09 Heifer 1 year old	0	0	0
10 Heifer 1 year old	0	0	0

Str=Strongyloidea

Comparison of the financial cost of the treatments adopted in the farm

Table 2 shows the annual cost values of treatments with synthetic chemicals that were previously used in the farm and the value of homeopathic drug treatment.

Table 2. Comparison of the financial cost of the treatments. Dec 2016 values.

	Active Principle	Value	Total values
Synthetic Chemicals: Acaricides	Amitraz	44 US\$	144 US\$
	Deltametrin		
	Cipermetrin		
Anthelmintics	Levamisole hydrochloride	100 US\$	
	Doramectin		
	Disophenol		
Homeopathic product for control of ticks and helminths.	Sulphur dynamized	13 US\$	13 US\$

Homeopathic treatment is much cheaper and has the advantage of not having to move and disturb the animals, which reduces the level of stress. The manpower that would be involved in the application of the products is no longer required.

Discussion/Conclusion

As shown in the results, the new management adopted had a positive effect as both the tick and helminth populations were low, within acceptable and desirable levels, without damaging the animals. We suggest that this occurred because the trialled management considered both the animal and its environment. The measures adopted (1) reduced environmental contamination by parasites, (2) improved animal welfare whilst strengthening the immune system, (3) stimulated the animal's ability to defend itself against parasites with homeopathic medicine.

Simply replacing restricted inputs with permitted inputs will not have the same favourable results if we do not correct the environmental problems that may lead to a high parasite populations and/or compromise animal welfare, thus suppressing their natural defences.

The great difference in the financial cost of the inputs is also an aspect that must be taken into account. Homeopathic treatment costs less and neither pollutes the environment nor the food.

Suggestions to tackle the future challenges of organic animal husbandry

We suggest that the studies, researches and recommendations in the area of organic livestock strongly consider the need to evaluate the entire production system and to take prophylactic measures, correcting any errors mainly related to environmental infestation by parasites and animal welfare. The use of homeopathy in animals should also be further studied and encouraged, considering the good results, low cost, easy use and, moreover, the fact that it does not pollute the environment or the food.

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Use of Ethno-veterinary practices (EVP) to reduce antibiotic drug residues in bovine milk: A field study

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Key words: Ethno-veterinary practices, antibiotic-drug residues, documentation, rapid assessment, veterinary care

Abstract

High disease incidence in cross-bred dairy cows in India and the associated excessive and indiscriminate use of antimicrobials and other veterinary drugs leads to residues in animal products like milk. It also creates a rising number of antimicrobial resistant microbes. The Trans-Disciplinary University (TDU) of Bangalore and the Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) documented 441 local ethno-veterinary practices (EVP) from 14 locations in 10 states of India and rapidly assessed them for their safety and efficacy. Out of the 441 ethno-veterinary formulations 353 are assessed to be safe and efficacious. A total of 248 medicinal plants were used in these formulations. Over 200 veterinarians were trained for using EVP to manage 15 different clinical conditions in livestock. TDU and TANUVAS have also trained 3700 farmers, 38 extension officers and 325 Village resource persons for preventing and treating certain clinical conditions in dairy animals using EVP. The Field study using the fresh EVP formulations for mastitis, FMD, enteritis/diarrhoea, udder pox, indigestion and external parasites in various states in India (Kerala, Karnataka, Tamil Nadu and Gujarat) indicated 91.5%, 99.7%, 100%, 93%, 100% and 100% clinical success respectively. An intervention impact analysis showed 18 to 49% reduction in antibiotic residues in the milk which indicates EVP is effective in reducing antibiotic use in milking cows

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Introduction

The indiscriminate use of antibiotics in human medicine, agriculture and animal health, have resulted in the emergence of antimicrobial drug resistant (AMR) microorganisms (Nisha, 2008). Most of the antibiotics used in humans, crops and livestock end up in the environment. It is estimated that by 2050 AMR will cause 10 million deaths per year (O'Neill 2014). There is no effective and strategic implementation of government regulation in India to control antibiotic use in humans and domestic animals, in agriculture and other activities like horticulture and fisheries. Against a background of emerging endemic zoonotic diseases and higher occurrence of non-communicable diseases (NCDs) the immediate attention of the all the stake holders to replace fragmented approaches by holistic strategies is warranted.

Local healers and some farmers have experience in traditional veterinary health care, better known as ethno-veterinary practices (EVP). They use the locally available medicinal plants for prevention and treatment of animal health conditions. The objectives of this study were 1) to collect ethno-veterinary practices for prevention and cure of animal health conditions using herbal formulations from healers and knowledgeable farmers, 2) to rapidly assess the safety and efficacy of these practices and 3) promotion of these practices among veterinarians and other stakeholders to reduce the use of antibiotics and other chemical drugs and thereby prevent their residue in the milk

Methods

Twenty four community based organizations from ten states of India were selected for implementing the programme. Participatory Rural Appraisal (PRA) and Matrix ranking were used for prioritization of animal health conditions. Participatory documentation and rapid assessment to find the safety and efficacy of documented formulations was conducted using Rapid Assessment of Local Healing Tradition (RALHT) methodology (Nair 2006, Raneesh et al 2008 and Nair & Raneesh 2011). The ethno-veterinary practices were documented repeatedly through transect walks, interview and group discussions in local languages. The medicinal plants were identified by botanists from the local institutions and wherever necessary authenticated by the taxonomy team of TDU. Formulations for 15 select disease conditions have gone through clinical observation studies. Two hundred and forty bulk milk samples were collected from the farmers of different milk cooperatives before and after intervention and tested for the presence of antibiotic residue (Nagwa et al.2009, Kaya S and Filazi A 2010)

Result

Out of the 441 Ethno-veterinary practices documented from 24 locations for 52 prioritized conditions, 353 practices were found efficacious and safe. 248 species of plants belonging to 80 families were used in the above formulations. TDU and TANUVAS have trained 200 veterinarians, 3700 farmers, 38 extension officers and 325 Village resource persons to use EVP to manage 15 different clinical diseases in livestock. Parameters like pH, Somatic Cell Count (SCC) and Electrical Conductivity (EC) of clinical mastitis became normal within 6 days of treatment with the EVP formulation

The percentage of clinical healing using the fresh EVP formulations for various health conditions is shown in Table 1. An intervention impact analysis showed 18 to 49% reduction in antibiotic residues in the milk. This indicates EVP-based natural products are an effective alternative to synthetic chemicals in dairy farming

Table 1: Field intervention study showing clinical conditions, number of cases monitored and % of complete recovery

No	Conditions	Number treated with EVM alone	% of complete cure
1	Mastitis	1561	91.7
2	FMD	835	99.7
3	Enteritis	119	100
4	Udder pox	90	93
5	Indigestion	118	100
6	External parasite	48	100
7	Teat obstruction	64	90
8	Udder oedema	62	96.8
9	Pyrexia	21	100
10	Post-partum complication	30	99

Discussion

The study indicates that a substantial number of people depend on plants and have belief in EVP for their day to day livestock health care. EVP is both clinically efficacious and cost effective. A rapid assessment methodology was used for assessment of safety and efficacy of these documented ethno-veterinary practices. At every level such as principles, logical framework, philosophy and worldview there are major differences between traditional knowledge systems in India and Western science. The difference lies primarily in the fact that, in indigenous knowledge systems the evaluation is 'systemic', whereas in Western medicine it is 'atomic' or cellular. The principles of classification in western medicine, Ayurveda and folk knowledge belong to radically different orders and at present, there are poorly established correlations between the medical systems. Even though the logic of folk knowledge lacks the theoretical rigour of Ayurveda or western medicine there is an inherent relationship between classical textual knowledge (Ayurveda/Mrugayurveda) and folk knowledge, and therefore they are better tools for assessment of the folk health traditions for their safety and efficacy (Raneesh et al 2008, Nair & Unnikrishnan 2010).

Mastitis, FMD, enteritis, impaction of rumen, bloat, calf scour, indigestion, helminthiasis, ephemeral fever, fever, udder pox, wounds, maggots in wounds, repeat breeding and post-partum complications substantially affects the farmer's income. Ethno-veterinary practices of India have great potential to address current animal health challenges as EVP comprises decentralized local resource-based applications that are safe, efficacious and cost effective. It can also lead to the reduction in the use of antibiotics and other chemical drugs, and associated residue in the animal products. The urgent revival of these traditional veterinary practices is a high priority in the light of the benefits they provide.

Conclusion

The study shows that there is large amount of cost effective traditional knowledge and resources for animal health available in the community and communities use these practices regularly.

However, these practices need to be assessed for safety and efficacy before mainstreaming and promoting these EVP as an effective alternative to antibiotics and other synthetic chemicals in livestock diseases. The present study has shown EVP are effective solution for preventing and treating certain clinical conditions in dairy animals.

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Improving animal health and welfare under organic principles - what can recent research say?

Mette Vaarst¹

Key words: animal health; animal welfare; organic principles; disease prevention

Abstract

Organic animals continuously face a wide range of challenges, depending on species and location. Recent research emphasise site-specific developments and solutions, to meet these needs, under the many different conditions on the planet. One major challenge at the structural level is the current low breed diversity, which sincerely threatens future development of diverse and context-relevant organic farming in many places, and the current 'single-purpose specialisation of animals', which is not in accordance with organic principles. Improvement of organic animal farming furthermore requires an increased emphasis on closed nutrient cycles providing high quality local feed including protein feed, and linking animals to land, ensuring outdoor access. The importance of the human care-giver is crucial, and this points to a focus on good education and networks of farmers and other professionals to handle complex situations. Finally, a current strong emphasis from the 'one-health-sector' on reduction of use and over-use of medicines because of increasing resistance, may further push for the development of more 'medicine free organic animal farming', hence further encourage the promotion of animal health and robust animals.

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Introduction

Organic animal farming focuses on integrating animals into a farming system in balance with other elements in the farming system, and in relation to the surrounding landscapes, social systems and food systems. It also focuses on supporting lived lives to stay healthy and to live a life worth living based on each individual's premises, based on some underlying principles, which guide the way of farming under many different contexts. Organic animal farming emphasizes animal health and welfare, understood in a certain way, which makes organic animal farming unique (Vaarst and Alrøe 2012). Organic animal farming furthermore focuses on producing healthy, nutritious and safe animal products. In summary, organic animal production is so much more than just producing animal products with a certain label, seen in isolation from the surroundings.

Health is an underlying principle for the whole farm, from soil to plants, animals, humans and the wider ecosystem. Health is so much more than just 'freedom of diseases', it can be understood as a dynamic concept of 'resilience': the living animal's ability to withstand and absorb shocks and respond sensibly to changes in its surroundings (Döring et al. 2015). This leaves the humans with a responsibility to take care of the animal by creating an environment, which can support the animal, ensure, as much as possible under farmed conditions, that it can meet its natural needs, provide at the same time – immediate and appropriate intervention when needed. Animal welfare is closely linked to the combination of these goals, which are fundamental to the organic principles. Giving animals life opportunities to meet their natural needs, including in terms of nutrition and behaviour, and taking care of and responsibility for their wellbeing whenever their welfare is at risk of becoming compromised.

Material and methods

This paper is based on articles from current and recent research projects, including review articles and information from project websites. It refers to a few selected cases, selected to cover different animal species and different geographical and ecosystem conditions, although mostly European, and mostly about dairy farming. Further information and full references can be obtained from the author on request, due to space limitations.

Review results

Challenges and opportunities specific to organic animal farming in Europe

Animal husbandry in Europe has generally become increasingly industrialised, not only in terms of large scale farming, but also in terms of the human organisation around the farm, the work processes and the dependencies on external inputs, amongst others, fossil fuels. Big efforts are currently underway to bring down the use of antimicrobials in the face of the severe threats of AMR, and in this respect, organic animal farming is generally in the forefront of developments. The structures of non-organic farming and food systems challenge organic animal farming. In many cases, organic animal farming has become a niche production, which is profitable for farmers and processors, sets inspiring examples and gets great consumer and citizen awareness. Generally, however, organic farming is under great pressure to compete in market conditions with the large non-organic food industry. Furthermore, the organic farming sector navigates in challenging landscapes, e.g. with extremely low breed diversity for all animal species, and in many countries with limited support from research, advisory services and businesses. These structures can affect organic animal farming and the health and welfare of animals negatively, because they create very competitive situations. Schmid et al. (2013) concluded at a European level that for all animal species, the combination of site-appropriate breeding, ethologically sound husbandry, efficient

hygiene measures and disease preventive feeding strategies are of major importance for the future development of organic animal husbandry. As described in more detail below, the human choices of strategies, daily management routines and ability to intervene when relevant is of crucial importance, and there are increasing challenges with respect to time and making qualified observations in organic herds.

Challenges and opportunities for organic animal farming in East Africa

In large areas of the world, the possibility of exporting organic fruit and other plant products has pushed the conversion of many farms to certified organic production. Many of these farms have animals, and in many cases, the animals are 'outside interest' as a part of the entire farming system. This has been documented in more projects, one of them being ProGrOV (www.progrov.org; 2011-current; see also poster presentation about organic animals and dairy farming in East Africa). This gives a whole range of challenges, some of them about making the farming systems function as a system, e.g. with large parts of the farms being allocated for cash crop production, and therefore not giving the animals space for outdoor access. The lack of local markets for organic animal products do not provide incentives to better integrate animals into the farm or meet organic principles. Besides this, the presence of endemic and severe infectious diseases, e.g. tick borne diseases, is a constant challenge.

Organic animal agriculture needs active effort for larger breed diversity and more multi-purpose breeds

Recent Dutch studies indicated that the breed diversity in dairy herds increased on conversion to organic agriculture, because of a stronger focus on robustness. Organic pig farming is also characterised by the use of breeds, which are more suited for outdoor living, sunshine and longer lactations. Smallholders – many of which are also organic – generally maintain diversity through having different breeds of chickens, as opposed to the larger industrial organic or non-organic broiler and egg-producing farms and units. In organic farming there is a general emphasis on robustness, diversity and involvement of 'context-appropriate breeds'. Although organics does not make a substantial contribution to the safe guarding of endangered breeds. One of the major challenges facing agriculture is the control over genetic material from large breeding companies. To change this, organic farming organisations and farmers need to focus on the development of breed diversity and e.g. develop infrastructures for male animals, breeding goals for multi-purpose breeds and robust animals living under organic conditions. Organics needs to develop breeding plans outside the larger companies

Often difficult to demonstrate the good effects of animal health promoting efforts – but that should not keep organic animal farming from developing improved practices

The research project SOLID (2011-2016) included farmer experience with different health promoting strategies in a series of participatory small research projects (<http://farmadvice.solidairy.eu/animal-health/>). The project explored, amongst other themes, the use of herbs in pastures and diverse swards, which to a large extent were low-input and/or 'natural pastures'. It illustrated interesting multipurpose benefits e.g. animals nourish landscapes and at the same time benefit from a diversity of plants with all their different trace minerals and other contents. It also illustrated the difficulties in demonstrating 'health promotion and animal welfare benefits' using natural scientific methods. It seemed clear to some farmers that animals selected herbs and ate the foliage very rapidly, but apart from that, it could not be proven that the herbs promoted animal health. Nevertheless, improving animal health and welfare living up to the organic principles needs a strong emphasis on providing conditions for animals which support their robustness, health and wellbeing.

Focusing on reducing the use of medicine and 'longevity' as an indicator of good health and welfare

With the increasing challenges of antimicrobial resistance (AMR), increased emphasis has been on the necessity to reduce the use and overuse of medicines in animal farming. This has many societal benefits since up to 90% of the medicines given to a living organism, will go out to the environment in the soil and water and influence the environment. However, in large parts of the world, the opportunity to use medicines has been emphasised as important in 'emergency cases' to ensure that a sick animal does not suffer. In USA, antimicrobials cannot be used for treatment of organic animals, which has led to much emphasis on the animal health promotion, and alternative ways of handling disease, although some authors found very little difference between the daily routines in organic versus conventional dairy herds (Stiglbauer et al., 2013; Sorge et al., 2016). In addition, no systematic major differences were found in milk quality between organic and conventional farms in USA dairy herds (Mullen et al, 2013; Cicconi-Hogan et al., 2013). Rather big differences were found within different production systems ('organic' being regarded as one production system), and grazing in itself had a more profound effect on milk quality than 'being organic', which has also been found in previous European studies.

The human choices: strategies, management and daily care

When keeping animals under less restrictive conditions, as happens in grazing systems with larger groups of animals, the humans taking care of the animals and being part of the so-called 'ethical alliance' between humans and animals, must have great ability to observe and interact in relevant ways with the animals and the herd. The design and organisation of a farm is paramount to enable this, and the skills and education of each human care-giver is fundamental for the success of actually meeting organic principles. Current European pig research points to the potential importance of longer lactations and therefore also longer time together with piglets. This requires a re-think of farm structures, routines and the yearly rhythm on a farm. Very recent research, such as the EU-project IMPRO (www.impro-dairy.eu), supports research results from the last decades emphasising that the organic standards and legislation is not enough to ensure good animal health and welfare: of course not! Human care-givers are the ones to fill out every farm framework, and through their choices and actions make sure that animal health and welfare is good. Farmer interaction, exchange of knowledge, continuous development and education as well as good advisory services contribute to this. Previous studies involving several European countries showed a great lack of awareness and ability from 'conventional' animal advisors, e.g. veterinarians, in terms of understanding and giving advice for farm development under organic principles. Recent studies from France (Duval et al., 2016 & 2017) showed that there was still a huge effort needed to enable veterinarians to advise organic farmers how to develop their farms and herds and meet organic principles.


Improving animal health and welfare in accordance with other burning global issues

The balance between the individual animal and the entire farming system is important in organic herds. This means, as emphasised above, that it is important to develop appropriate breeds which are able to live from locally produced feed without problems, and to create farming systems which enable animals to meet their natural needs and enable humans to take care of them and intervene when relevant. This will lead to coherent systems where the cycle will work, as opposed to the detachment seen in animal producing industries. There can be a complete separation between where feed is produced, animals live and where their products are sold. Through limiting the numbers of animals to what the land can carry in harmony with producing food for humans and giving animals good lives, the organic animal system helps ecosystem health and minimises external inputs such as fossil fuels and medicines. 'Efficiency' in relation to, for example, climate change is debated widely, and some scholars emphasise the importance of 'precision management' and 'top-tuning' animals to high production to be efficient. The organic animal farming solution could be strong linkages between animals and land, e.g. to keep ruminants and other grazing animals in

areas where grassland can be suitable parts of the landscapes, to minimise fossil fuels use and to emphasise the importance of systems approaches of diversified landscapes and farms.

Discussion and conclusion

Organic animals still face many site-specific challenges, often related to searching for balance between animals being well-integrated into farming systems, and at the same time acknowledged as living sentient beings, each with their needs. Animals have species-specific natural needs – behavioural as well as nutritional and hygienic – and they need relevant intervention when their health and welfare is threatened. Recent research emphasises diversity and site-specific developments and solutions, to meet these needs under the many different conditions on the planet, and ‘one size fits all’ is not applicable in organic systems. This points to the importance of focusing on good education and networks of farmers and other professionals to be able to handle complex situation in diverse systems. Humans working with animals should be able to observe the animals, interpret their behaviour and patterns, and react accordingly. A stronger emphasis on ‘medicine free organic animal farming’ worldwide is under current discussion, and this trend can potentially push a development further towards animal health promotion emphasis. On the structural level, the current low breed diversity is a major threat to the future development of diverse and context-relevant organic farming in many places, and the current ‘single-purpose specialisation of animals’ is not in accordance with organic principles.



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Preliminary evaluation of the supplementation with 2 levels of Pennyroyal (*Mentha pulegium*) in the diet of broilers

Fabián Cruz Uribe¹, Damián García Barrero², Cristina Genoy Jóven²

Key words: mortality, growth promoter, supplementation broilers

Abstract

The objective was to evaluate the effect on weight gain and mortality of two levels of Pennyroyal (*Mentha pulegium*) in the diet of broilers. The experimental work was performed by evaluating 3 groups of 35 male broilers from 1 day old for a period of 45 days. Each group had a diet balanced with a treatment as follows: D1: Control group; D2: Supplemented with ground Pennyroyal at a ratio of 0.25g kg⁻¹ of the dry diet; D3: Supplemented with ground Pennyroyal at 0.5g kg⁻¹ of the dry diet. Pennyroyal supplementation was effective in reducing mortality in broilers. The final weights at 45 days demonstrate a difference of 370 grams per animal between diets 1 and 3, and 143 grams per animal between diets 1 and 2. The preliminary study determines that the Pennyroyal by its results in weight gain, conversion and mortality could be a good alternative as growth promoter in broilers.

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Introduction

For years, different compounds have been used as growth promoters in the diet of broilers. However, the indiscriminate use of chemical preservatives has led to problems which make it necessary to adopt strategies that are accessible, simple in application, and nontoxic to animals (Shukla *et al.* 2008). It has been reported that some phytochemical compounds of plants improved the growth performance because their ability to enhance digestibility, to balance the gut microbial ecosystem and to stimulate the secretion of endogenous digestive enzymes (Williams and Losa 2001; Cross *et al.* 2007). Plants such as *Mentha pulegium* are rich in terpenes and phenolic compounds (carvacol, pulegone, piperitone, neoisomenthol and others) with important antioxidant and antimicrobial properties (Oumzil *et al.* 2002; Mahboubi and Haghı, 2008; Erhan *et al.* 2012). This work was carried out to evaluate the use of *Mentha pulegium* as non synthetic (natural) growth promoter in diets of broilers.

Material and methods

A palatability test was performed before the experiment, including in the diet, levels of ground Pennyroyal of 1, 2, 5 and 10 g kg⁻¹. The animals did not accept to consume the feed with diets of 5 and 10 g kg⁻¹, and lowered their consumption with the level of 2 g kg⁻¹. Then, the experiment was designed with lower levels of Pennyroyal.

The experimental work was performed by evaluating 3 groups of each 35 male broilers line Ross 308 from 1 day old during 45 days. The balanced diet for starter (1 -10 days) had 22% protein and 3010 Kcal kg⁻¹ EM, for grower (11 – 24 days) had 21% protein and 3150 Kcal kg⁻¹ EM and for finisher had 20% protein and 3200 Kcal kg⁻¹ EM.

Each group had a balanced diet with 3 treatments like this:

Treatment 1 (D1): Control group without supplemented Pennyroyal

Treatment 2 (D2): Supplemented with ground Pennyroyal at a ratio of 0.25 g kg⁻¹ of the dry diet.

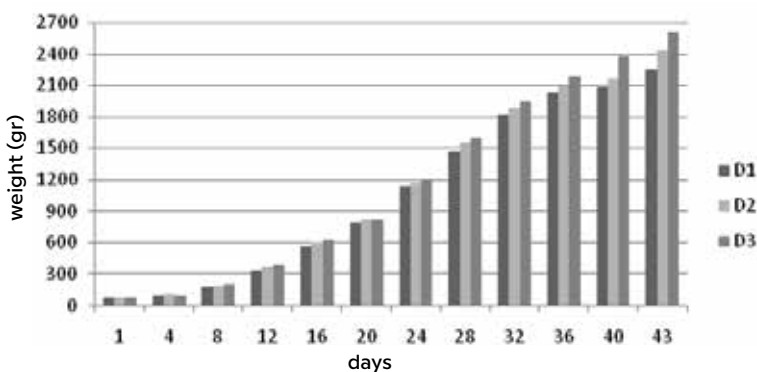
Treatment 3 (D3): Supplemented with ground Pennyroyal at 0.5 g kg⁻¹ of the dry diet.

Pennyroyal was harvested, cleaned and dried at environmental temperature. The pulverized leaves were included in the diet according the treatment. The variables evaluated were weight (grs day⁻¹), mortality (%) and conversion. Data were assessed using ANOVA in a completely randomized design and tested for SNK test.

Results

Weight and daily gain: The final weight of treatment 1 was 2245 grs, treatment 2 was 2428 grs and treatment 3 was 2615 grs (Figure 1). The Shapiro - Wilk test (to determine normality) allowed ANOVA to be performed. Significant difference (P=0.000) was found between the diets.

Figure 1. Weight evolution per diet



This study allowed identifying an average daily gain (ADG) of 50.569 gr day⁻¹ for the animals of the treatment 1, from 54.790 gr day⁻¹ for those of the treatment 2 and 59.139 gr day⁻¹ for those of the treatment 3.

Table 1: Conversion and mortality with different levels of Pennyroyal in diets of broilers

	D1	D2	D3
Conversion	1.76 ^a	1.62 ^b	1.51 ^b
Mortality (%)	20.0 ^a	4.0 ^b	0.0 ^b

Different letters significant at P=0.000 (SNK Test)

Mortality and conversion: Regarding the accumulated mortality in the period, it was found that that D1 presented a significant difference compared to the other two treatments (P= 0.000). Treatment 1 presented a conversion of 1.76 however, D2 and D3 presented better conversions. Treatment 3 that had the highest dose of pennyroyal (*Mentha pulegium*) showed a better conversion and lowest mortality compared to D1 and D2 (Table 1).

Discussion

Different studies ratify that the use of *Mentha pulegium* in the broiler diets generates positive effects. Nobahkt *et al* (2011) reported positive effects on parameters such as weight gain from the use of pennyroyal in broiler diets. This situation coincides with the findings found in the present study where the treatments had significant difference (P=0.000) between them, and treatment 3 had the highest final weight.

However, Geran *et al* (2010) found that dietary supplementation of this plant for broilers did not significantly affect variables such as consumption and weight gain. Ghalamkari *et al* (2012) reported that the use between 5 and 10 g kg⁻¹ of pennyroyal in the diet had no significant effects on the growth performance of broilers, although the final weight obtained for the broilers treatment with 5 g kg⁻¹ was the highest. Erhan *et al* (2012) in a study that supplemented *Mentha pulegium* L. (control, with 0.25% and 0.50% supplementation) also found no significant difference between the diets. Rosero *et al* (2012) in a comparison between Ross and Cobb broilers in Cauca (Colombia) found that the daily weight gain for Ross animals was 51,440 gr day⁻¹. This information coincides with what was found for the animals of the D1, but was lower than the weight gains of diets that included Pennyroyal (D2 and D3).

The antimicrobial activity of Pennyroyal can inhibit intestinal pathogenic microorganisms especially Gram positive (Abdenour *et al.* 2012; Hajlaoui *et al.* 2009; Mahboubi and Haghi, 2008). Erhan *et al* (2012) referred to the importance of *Mentha pulegium* L. as an antimicrobial source with intestinal effect for E. coli control. Iscan *et al* (2002) and Oumzil *et al* (2002) described the chemical components of *Mentha pulegium* L with strong antimicrobial activity, such as pulegon, mentone, menthol, piperitone, piperitone oxide and thymol.


Erhan *et al* (2012) in their study reported that administration of Pennyroyal sp in feed in broilers increased lactic acid bacteria in the jejunum and also reduced the E. coli count in jejunum compared to the basal diet which could generate a better process of digestion and absorption of nutrients, Conversion rate and weight gain

Conclusion

The supplementation with ground Pennyroyal in doses of 0.25 g kg⁻¹ and 0.5 g kg⁻¹ of the diet in dry matter base is a promising alternative for small producers in the production of broilers when presenting lower mortality and better feed conversion with effects on weight gain. This trial showed some tendencies regarding weight gain. In particular with regard to mortality, there seems some interest to make more trials, also with other breeds lines.

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Meat Quality Attributes Of West African Dwarf Rams Administered With Aqueous *Aspilia Africana* Extract

NseAbasi NsikakAbasi Etim

Key words: *Aspilia africana*, aqueous, meat, quality, mutton, protein

Abstract

This study was conducted to determine the sensory and chemical attributes of West African Dwarf (WAD) rams administered with aqueous *Aspilia africana* extract. Twenty-four rams aged 6-9 months with average weight of 4.65kg were used for the study. The experiment was in a completely randomized design of four treatment groups with six rams per treatment. Each treatment was replicated three times with two rams per replicate. Rams in treatment one (T1) (control) received 10ml of distilled water, while those in T2, T3 and T4 received 1000mg/kg Body Weight (BW), 2000mg/kg BW and 3000mg/kg BW of aqueous *Aspilia africana* extract, respectively. Rams in all the treatment groups were fed 2kg of forage and 500g of the same concentrate diet daily. The extract was administered for 64 days after which four rams per treatment group were slaughtered for meat quality evaluation. Results for proximate composition (%) of meat from the loin revealed that the values obtained increased with increase in the dosages of the extract. Highest significant mean values were recorded for T4; 29.91, 37.55, 10.34 and 4.56 while the lowest mean values of 25.58, 32.58, 9.06 and 4.37 were recorded for T1 (control group) for dry matter, crude protein, fat, and ash, respectively. Panellists rated the meat to be similar in colour, while values for flavour, texture, juiciness, tenderness and overall acceptability significantly increased with increase in dosages of the extract, and lowest values were obtained for T1. Meat pH varied significantly; T4 had the highest mean value (5.79) while T1 the lowest (5.41). The high and significant increase in sensory and chemical attributes of meat from rams administered with aqueous *Aspilia africana* extract is an indication that *Aspilia africana* could improve meat qualities and its overall acceptability.



Introduction

The rapid growth of organic farming has been among the most remarkable changes in global agriculture in recent decades. Initially, attention was focused on organic crop production, but that has now been changed and there is greater need to understand animal health and welfare better (Vaarst *et al* 2004). Organic animals should receive their nutritional needs from organic forage such as *Aspilia africana* and other feeds of good quality. This is because the health and well-being of animals are strongly linked to feeding (IFOAM Norms 2012). This, in turn, affects the meat quality of animals, which is a function of both sensory and chemical properties (Bello and Tsado 2014).

Due to the high demand for meat as a source of protein, it became imperative to increase meat production from short-cycle animals like sheep and to source easily available forages, especially those with the potential for increasing meat quality. Therefore, this study was conducted to determine the sensory and chemical attributes of West African Dwarf rams administered aqueous *Aspilia africana* extract.

Material and methods

The research was conducted in the Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture, Akwa Ibom State University, Obio Akpa Campus, Akwa Ibom State Nigeria.

Preparation and Administration of Extract: Fresh leaves of *Aspilia africana* were collected then chopped into tiny pieces with a chopping stick and sharp knife, and ground using a hand blender to produce *A. africana* leaf meal. 1000g of the leaf meal was measured into five conical flasks and extracted with 600ml distilled water for 48 hours at room temperature. The mixture was filtered into 250ml conical flasks with Whatman paper N^o1. The solution was filtered while the filtrate was concentrated to a semi-solid form using a rotary evaporator at 40°C to produce gel-like aqueous *A. africana* extract. This was weighed and each of the solutions prepared as 100mg/ml, 200mg/ml and 300mg/ml respectively.

Experimental Animals and Management: Twenty four pubertal West African Dwarf rams of average weight of 4.65kg, aged 6–9 months were used for the study. The sheep were quarantined for two weeks before the commencement of the experiment. The animals were housed one ram per pen. The sheep were properly identified using plastic neck-tags. The health of the animals was properly monitored and adequate treatment was given to unhealthy animals. Routine inspection and regular cleaning were carried out.

Experimental Diet: The rams were fed 2kg of forage daily. The forage included: *Panicum maximum*, *Pennisetum purpureum* and *Cynodon nlemfuensis*. Each animal also received 500g of concentrate daily. Water was available freely throughout the study.

Experimental Design: The experiment was in a completely randomized design. The treatment consisted of administration of aqueous *A. africana* extract at 0mg/kg body weight (control, T1), 1000mg/kg weight (T2), 2000mg/kg body weight (T3), 3000mg/kg (T4). Six rams were randomly assigned to each treatment and balanced for weights. Each treatment was replicated three times with two rams per replicate. The experimental model was as follows:

$$Y_{ij} = \mu + T_i + E_{ij}$$

Where:

Y_{ij} = Individual observation

μ = Overall mean

T_i = Treatment effect

e_{ij} = Random errors, which is assumed to be independently, identically and normally distributed with zero mean and constant variance (iind) (P=0.05).

Administration of Aqueous Extract to Experimental Animals: *Aspilia africana* was administered once a day orally for 64 days using 10ml syringes. The control group (T1) received 10ml of distilled water while treatments 2, 3 and 4 received 10ml of each of the following 100mg/kg, 200mg/kg and 300mg/kg body weight of aqueous extract of *Aspilia africana*, respectively.

Slaughtering of the Rams for Sensory Evaluation and Proximate Analysis: At the end of the 64 days of experiment, four rams in each treatment group were fasted overnight and slaughtered humanely. Samples of loin meat collected from each treatment. They were cut into chops of an average of 50g and pegged with 1, 2, 3, 4 tooth picks to correspond with the treatment (T1, T2, T3, T4) for identification. They were cooked in water at 100°C for 30 minutes in a pot using a gas cooker as described by Fasae et al. (2010). Ten unbiased panellists were used in the assessment procedure using questionnaires. They were instructed to chew a sample from each treatment and score it for colour, flavour, texture, juiciness and tenderness. After scoring each sample, and to reduce flavour carryover, sachet water was served to panellists to rinse their mouths after scoring each sample. The panellists scored each sample on a nine-point hedonic scale: 9-like extremely, 8-like very much, 7-like moderately, 6-like slightly, 5-neither like nor dislike, 4-dislike slightly, 3-dislike moderately, 2-dislike very much, 1-dislike extremely (AMSA 1978; Bello and Tsado 2014). Overall acceptability was scored on a three-point scale: 1-least acceptable, 2-more acceptable, 3-most acceptable (Iwe 2002) The chemical constituents of the meat samples were determined according to A. O. A. C (1990) methods. Meat pH was determined using Digital pH meter (Testo 205) (Bello and Tsado 2014).

Data Analysis: The data were subjected to Analysis of Variance (ANOVA) (Steel and Torrie 1986). Significant means were separated using Fisher's Least Significant Difference (LSD).

Results

Sensory Evaluation of Meat from Loin of WAD Rams Administered with Aqueous *Aspilia africana* Extract: Table 1 shows the result for sensory evaluation of meat from loin of experimental West African Dwarf rams administered with aqueous *A. africana* extract.

Table 1: Sensory Evaluation of Meat (SEM) from loin samples of West African Dwarf rams administered with Aqueous *A. africana* Extract

Parameters	T ₁	T ₂	T ₃	T ₄	SEM
Colour	7.50	7.50	7.50	7.50	0.00
Flavour	5.30 ^d	6.10 ^c	6.90 ^b	7.55 ^a	0.30
Texture	6.05 ^b	6.25 ^b	7.10 ^a	7.40 ^a	0.31
Juiciness	6.00 ^d	6.55 ^c	7.15 ^b	7.55 ^a	0.16
Tenderness	6.10 ^d	6.50 ^c	7.15 ^b	7.48 ^a	0.24
Overall acceptability	1.00 ^d	1.50 ^c	2.00 ^b	3.00 ^a	0.50

a, b, c, d, means in same row with different superscripts are significantly different (P<0.05)

Meat colour was not significantly different (P>0.05) among the various treatment groups. During sensory assessment, significant differences (P<0.05) were observed for eating quality traits. The Panellists rated meat from the treated group higher in flavour, texture, juiciness, tenderness and overall acceptability. The increase in the sensory properties of the treated rams with respect to the control group was observed to be dose dependent which also explains the significant differences (P<0.05) observed between the treated groups (T₂, T₃ and T₄). T₄ recorded the highest significant mean values in all the sensory traits measured compared to other treatment groups.

The increased values observed in the treated groups corroborates the findings by Fasae *et al.* (2014) who reported that with increasing fatness of the carcasses, the tenderness and flavour of the cooked cuts of sheep meat increased significantly, which is evident by the result for fat composition of meat from the treated rams shown in Table 1. A report by Risvik (1994) indicated that juicy meat is generally preferred by consumers. Moreover, the higher overall acceptability observed in T₂, T₃ and T₄ may be attributed to the better meat quality traits possessed by rams in these groups which may be as a result of *A. africana* administered to them.

Chemical Composition (%) of Meat from WAD Rams Administered with Aqueous Aspilia africana Extract: The results for chemical composition (%) of loin meat of WAD rams administered with aqueous *A. africana* extract at different doses are outlined in Table 2. They revealed a significant difference ($P < 0.05$) in the dry matter content of the meat samples among the various treatment groups. The lowest mean value was recorded for the control group (T₁) while a dose-dependent and significant increase was observed in the treated groups.

Table 2: Chemical Composition (%) and Meat Quality Attributes of WAD Rams Administered Aqueous *A. africana* Extract.

Parameters	T ₁	T ₂	T ₃	T ₄	SEM
Dry matter	22.58 ^d	26.41 ^c	27.09 ^b	29.91 ^a	0.22
Crude protein	32.58 ^d	33.46 ^c	34.95 ^b	37.55 ^a	0.40
Fat	9.06 ^b	10.10 ^{ab}	10.23 ^a	10.34 ^a	1.11
Ash	4.37 ^b	4.43 ^b	4.53 ^a	4.56 ^a	0.06
Cooking loss	50.00	50.00	50.00	50.00	0.00
Meat pH	5.41 ^b	5.53 ^b	5.69 ^a	5.79 ^a	0.12

a, b, c, d, means in same row with different superscripts are significantly different ($P < 0.05$).

A similar trend was observed for crude protein. The result for fat and ash content of the meat samples from the entire treatment groups revealed significantly low values in T₁ and significant highest value in T₄. The higher values of the treated groups may be due to the rich chemical constituents of the experimental extract.

No significant difference ($P > 0.05$) was observed in the cooking loss. In contrast, the meat pH values revealed a significant difference ($P < 0.05$) among the treatment groups. All values were within normal range reported by Bello Tsado (2014) indicating that the meat sample of all the treatment groups were of good quality

Conclusions

The high and significant increase in sensory and chemical attributes of meat from rams administered with aqueous *Aspilia africana* extract is an indication that the forage can improve meat qualities and its overall acceptability.

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The effects of essential oils dietary supplementation on feeding behaviour of sheep under organic animal husbandry

Muazzez Cömert Acar (Polat)¹ and Mohamed Ibrahim El Sabry²

Key words: organic farming, sheep, oregano, garlic, essential oils, feeding behaviour

Abstract

The objective of this study was to evaluate the effect of using oregano and garlic essential oils as a dietary supplement on the feeding behaviour of two different sheep breeds, Anatolian Merino sheep (Anatolian Merino) and Polatlı sheep (Polatlı) under organic animal husbandry. Twenty male sheep (ten from each breed) were randomly assigned into two groups: oregano or garlic. The experiment was divided into pre-experiment and main experimental periods. The same organic concentrate was offered to all animals over the experimental period, while the organic concentrate was supplemented with either oregano or garlic essential oils (5000 ppm/kg) during the main experimental stage. Individual feeding behaviours (number of meals and meal duration) were recorded using a digital camera during the entire experimental period. The number of meals (%) and meal duration (min) increased in the oregano group during the main experiment compared to the pre-experimental period ($P < 0.01$). In the main experiment, the sheep in the oregano group were unwilling to eat and had a higher number of meals (number/day) in comparison to the sheep in the garlic group ($P < 0.01$). Moreover, the Polatlı group fed oregano oil had a higher number of meals compared to the Anatolian Merino ($P < 0.01$). During the main experiment sheep fed oregano consumed the offered concentrate feed, but in longer time compared to sheep in the garlic group ($P < 0.01$). In the main experiment, Anatolian Merinos fed on oregano oil showed a shorter meal duration during the morning feeding compared to the afternoon feeding ($P < 0.01$). It is concluded that the feeding behaviours of sheep could be affected by essential oil as a dietary supplement, especially oregano oil. Also, Polatlı sheep had a higher sensitivity to the changes in the diet compared to Anatolian Merinos.

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Introduction

Oregano (*Origanum vulgare L.*) and garlic (*Allium sativum L.*) oils have been reported as effective feed supplements in animal diets. The medical and beneficial properties of essential oils are very important for organic livestock, because of the limited usage of chemically synthesised allopathic veterinary medicinal products. Literature about the feeding behaviour of small ruminants with respect to oregano and garlic is lacking (Keskin et al., 2005). Recently, the interest in the feeding behaviour of ruminants has increased (Görgülü et al., 2011). Further research about the toxicity to animals, palatability and effects on organoleptic quality of animal products is required to ensure that the essential oils can be safely used to enhance animal productivity and reduce the negative impacts of animal production on the environment (Benchaar and Greathead, 2011). The objective of the study was to investigate the effect of oregano and garlic essential oils as a dietary supplement on feeding behaviours (total number of meals and meal duration) of two local Turkish sheep breeds under organic animal husbandry.

Material and methods

The experiment was conducted between the 25th of November and 6th of December 2012 at Ege University, Ödemiş Vocational School Experiment Farm at Izmir (38°13'03" North, 27°57'50" East) under organic animal husbandry. The experiment was divided into two periods: pre-experiment (5 days) and main experiment (7 days). The same organic diet was offered to all animals during the entire experimental period, oregano or garlic essential oil supplements (5000 ppm/kg) were given during the main experimental stage. The organic concentrate was formulated to meet the minimum Nutrient Requirements of Sheep (NRC, 1985) and daily dry matter intake was calculated as approximately 4% of body weight. The organic concentrate was offered to the sheep as a maximum 40% of dry matter intake divided into two meals/day (morning feeding at 8:00, afternoon feeding at 16:00). The organic concentrate diet contained 151.3 g/kg crude protein and 12.08 MJ/kg Metabolisable energy (ME). Sheep had a free access to Lucerne hay, which contained 137.3 g/kg crude protein and 7.55 MJ/kg ME, and water. Individual feeding behaviour (total meal duration and number of meals) were recorded using an Avenir mark AU-548 model camera (camera 1/3" SONY Super HAD CCD) with 4/6mm lens for 24 hour periods during the experiment. The cameras were mounted 3m from floor level in a fixed position in each pen. The recorded tapes were later played in a video recorder TV set, and analysed in detail. The examined behavioural elements were: total meal duration: cumulative duration of acts of eating at the trough, number of meals: individual eating acts. Nine-month-old yearling male Anatolian merino sheep (bred from German mutton Merino, 80% and native White Karaman, 20% and registered as a local breed in 2004) and Polatlı Sheep (bred from Ile de France, 75% and native White Karaman, 25% registered as a local breed in 2010) (Ertuğrulet al., 2011) were used. Twenty sheep (ten from each breed) were housed in 2 identical pens (5 from Anatolian Merino, 5 from Polatlı were kept in the same pen) with the same direction and orientation. The sheep were numbered, using henna, so that they could be individually identified. The statistical package SPSS (15.0)® was used to analyse the results. The number of meals (%) was calculated by dividing the count of each number of meals in each time period by the number of total observations in that time period. A Friedman-Anova analysis followed by the Student-Newman-Keuls Test was used to verify any significantly different effects of essential oils and/or breeds.

Results and discussion

Feed characteristics appear to influence feeding intensity within a given meal. Variations in eating rates impact overall and actual meal duration. Görgülü et al. (2011) stated that time spent eating and the patterns of meals have important effects on total daily intake of animals. In the oregano group,

for both the Anatolian Merino and Polatlı breeds, the total number of meals (%) increased during the main experiment compared to the pre-experimental period ($p < 0.01$). On the other hand, there were no differences observed in the sheep in the garlic group. Garlic oil did not cause a noticeable effect on the meal duration, while oregano increased the meal duration ($p < 0.01$) during the main experimental period (Figure 1). In the current study, oregano affected feeding behaviour, which is in agreement with findings of Simitziset *al.* (2005). Although, the Polatlı fed on oregano group had the smallest total number of meals during the pre-experiment period, it had the highest number of meals compared to other groups during the main experimental period ($p < 0.01$) (Figure 1).

The results in Figure 1 show that the breeds had different sensitivities to feed supplements, which was reflected in their feeding behaviour. Polatlı and Anatolian Merino fed on garlic oil supplements showed similar feeding behaviour (Figure 2). The garlic oil group had a lower number of meals (12 and 14 /day respectively) and a shorter meal duration (27.37 and 28.42 min respectively) compared to the sheep which received oregano ($p < 0.01$). Although Polatlı and Anatolian Merino fed oregano showed similar total meal duration (40.69 and 36.15 min respectively), Polatlı (34 meals/day) had higher number of meals compared to Anatolian Merino (27 meals/day) ($p < 0.01$). Görgülüet *al.* (2011) and Wangsnest *al.* (1976) record the average number of meals per sheep per day as 8.94 and 8.48 respectively, but this parameter is in the high range in ruminants (Wangsnest *et al.*, 1976). But, results similar to those recorded in this trial were reported for meal duration in sheep by Görgülüet *al.* (2011).

These findings show that sheep have higher preference for the feed sprayed with garlic essential oil in agreement with Horton *et al.* (1991). Tager and Krause (2011) reported that different essential oils can alter feeding behaviour by increasing the number of meals, which will cause a shortening of the length of the meal. From another perspective, this may be beneficial in preventing acidosis, as it may help control the sharp decrease in rumen pH after feeding. So, it may give an advantage for oregano oil when it is being suggested as diet supplement.

The breed differences demonstrated in this trial suggest that sheep should be handled in different ways, according to their breed when using new feed additives under organic conditions.

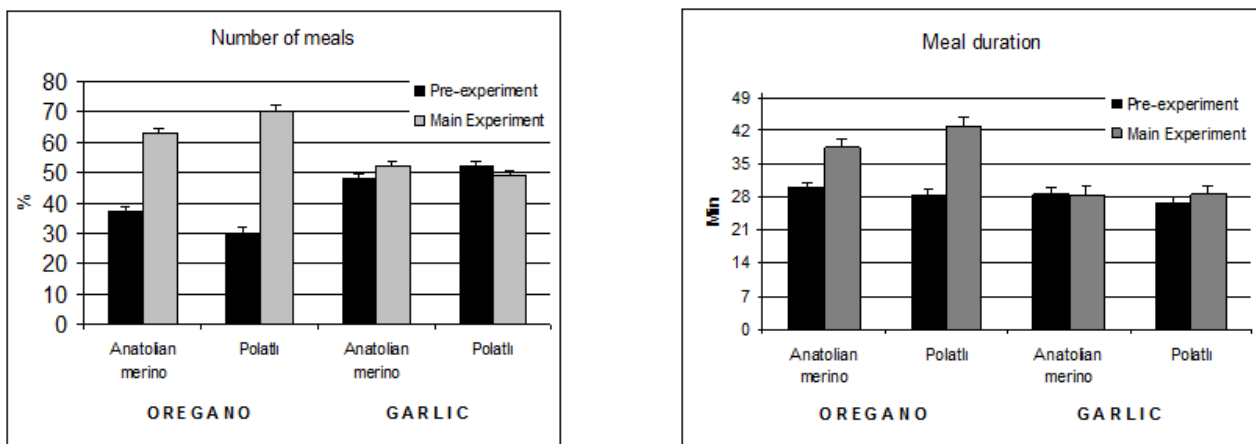


Figure 1. The effect of essential oil supplementation on the number of meals (%) and meal duration (min/day) during the pre-experiment and main experiment periods (least squares means, $p < 0.01$)

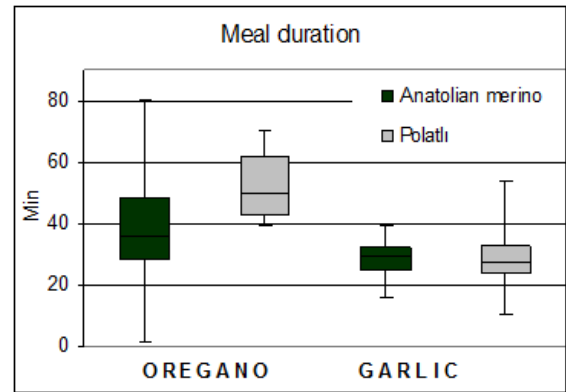
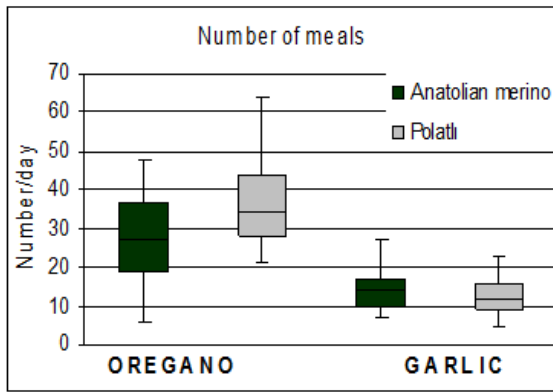


Figure 2. Effect of essential oil supplementation on the number of meals and total meal duration by medians (interquartile range) for the Anatolian Merino and Polatlı sheep breeds during the main experimental period (Box-plots).

The essential oils and breed did not affect the total number of meals (%) at the morning and afternoon feeding times (Figure 3). Anatolian Merino fed on oregano oil showed a shorter meal duration during morning feeding compared to the afternoon feeding ($p < 0.01$) (Figure 3). This suggests that each breed may have its own feeding behaviour. Görgülüet *al.* (2011) stated that feeding behaviour may vary among breeds, and also depends upon the productive and physiological status of the animal. Simitziset *al.* (2005) reported that different sheep had different sensitivities to changes in diets.

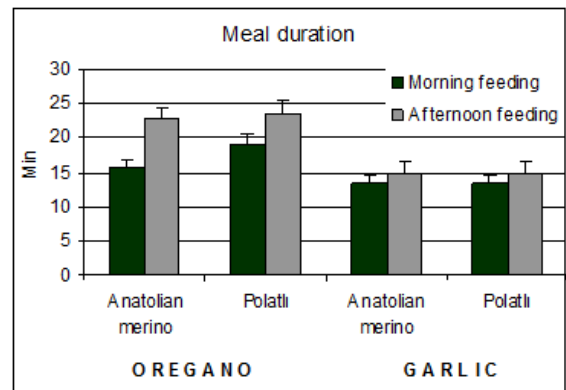
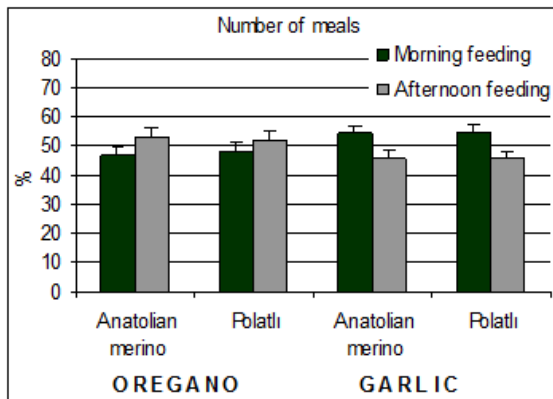


Figure 3. The number of meals and meal duration of during morning and afternoon feeding times of Anatolian Merino and Polatlı sheep fed on supplemented essential oils (least squares means, $p < 0.01$)

The results of this study showed that feeding behaviours had been affected by essential oil the dietary supplementation, especially oregano oil. Polatlı sheep showed higher sensitivity to the changes in the diet compared to Anatolian Merino under organic husbandry conditions.

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Comparison of Carcass Characteristics, Meat Quality, and Blood Parameters of Slow- and Fast-Grown Female Broiler Chickens Raised in Organic or Conventional Production System (Meat Quality)*

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Key words: female broiler, meat quality, organic feeds

Abstract

The objective of the study was to compare the meat quality of slow- and fast- grown female broiler chickens fed in organic and conventional production systems. The two genotypes tested were medium slow-growing chickens (SG, Hubbard Red JA) and commercial fast-growing chickens (FG, Ross 308). Both genotypes (each represented by 400 chickens) were divided into two sub-groups fed either organic (O) or conventional (C) systems. Chickens of each genotype and system were raised in a semi-environmentally-controlled poultry house until 21 days of age and were assigned to five pens of 40 chickens each. Then, O system chickens were transferred into an open-sided poultry house with an outdoor run. At 81 days of age, 10 female chickens from each genotype and production system (n = 40) were randomly chosen to provide material for meat quality analysis. O system values were higher for dry matter, crude ash, crude protein, and pH¹⁵ values in breast meat and for crude ash, crude protein, and pH¹⁵ values in drumstick meat (p<0.05). In addition, total saturated fatty acids, total mono-unsaturated fatty acids, and total omega 3 were significantly higher in the O system than in the C system. Thus, the O system showed a positive advantage compared to the C system regarding female chicken meat quality, primarily within the ash, protein, and total omega 3 fatty acid profiles.

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¹ The pH values at 15 min post-slaughter

Introduction

To meet consumer demand for better tasting meat, enhanced animal welfare, and environmentally-friendly production, new modes of production systems have been established in Europe and the United States (Castromán *et al.*, 2013). To aid producers in making informed decisions about their production systems, a better understanding of the meat quality resulting from widely divergent genotypes raised in different production systems and provided different diets is required (Fanatico *et al.*, 2007). Environment and genotype interactions are very important for the characteristics of meat quality. However, controversy has arisen with respect to qualitative meat characteristics as to whether organic or conventional production results in a better outcome because of the numerous factors involved (Castellini *et al.*, 2002a). The objective of the study was to compare meat quality (chemical and fatty acid compositions) of medium slow-growing and fast-growing female chickens fed using organic and conventional production systems.

Materials and methods

The trial was conducted at the Poultry Research and Training Center of Ege University in Turkey. The organic starter and grower diets consisted of 95% organic feedstuffs. The organic finisher diet comprised 98.5% organic feedstuffs. All organic diets were supplemented with organic maize, soybean meal and wheat. Fish meal and sunflower seed oil were sourced from conventional products for the organic diets. The slaughter age was 81 days for both genotypes. The skin and external fat were removed from the breast (pectoralis major) and drumstick meats and then the nutrient composition (dry matter, crude ash, crude protein, and ether extract) was determined based on AOAC-approved methods (AOAC, 1995). The pH values at 15 min post-slaughter (pH¹⁵) were measured with a digital pH meter (Hanna Instruments HI 8314, Padova, Italy). The fatty acid composition of the diets (Table 1) and drumstick meats were determined from lipids extracted from samples of about 5g in a homogenizer with 20 ml 2:1 chloroform/methanol (Folch *et al.*, 1957). Total fatty acid composition was determined by gas-liquid chromatography (Agilent Technologies 6890 N Network GC System, Anaheim, CA, USA).

Table 1. Ingredients and nutrient composition of organic and conventional diets

Ingredients, g/kg	Organic Diet			Conventional Diet		
	Starter 1 to 28 d	Grower 29 to 56 d	Finisher 57 to 81 d	Starter 1 to 21 d	Grower 22 to 42 d	Finisher 43 to 81 d
Analyzed nutrient composition						
ME, kcal/kg	2898	3000	2930	2957	3011	3058
Crude protein, %	21.80	21.12	17.45	23.51	20.88	19.20
Fatty acids, g/100 g lipid						
Σ SFA	12.66	17.84	14.87	15.15	13.59	15.76
Σ MUFA	22.25	26.02	27.80	27.60	27.84	27.46
Σ PUFA	59.82	48.62	53.52	52.45	55.58	52.35
Σ Omega 6 (n-6)	55.61	45.20	51.64	50.41	53.65	50.09
Σ Omega 3 (n-3)	4.21	3.42	1.88	2.04	1.93	2.26
n-6/n-3	13.20	13.20	27.47	24.70	27.82	22.16

Fatty acids: total saturated (Σ SFA), total monounsaturated (Σ MUFA), and total polyunsaturated (Σ PUFA).

Results and discussion

In our study, only the dry matter value of drumstick meat was affected by genotype, with FG values being larger than SG ($p < 0.05$). The O system resulted in the biggest values for all the important nutrient compositions of breast and drumstick meats ($p < 0.05$), with the exception of the ether extract values of breast and drumstick meats and the dry matter value of the drumstick meat. Protein content was affected to a much greater extent by the rearing production system than the ether extract content in our study. Similar to our findings, the breast meat of free-range chickens contained significantly more dry matter ($p < 0.01$) and protein ($p < 0.05$) than that of chickens raised without outdoor access (Mikulski et al., 2011). On the other hand, Dou et al. (2009) examined slow-growing Gushi chickens under free-range and indoor rearing production systems and found no differences in the fat content of the meat. Our results differed from those of Holcman et al. (2003), who found that fattening under indoor and free-range rearing production conditions did not affect the chemical composition of the breast and leg muscle with skin in broilers aged 56 days. In most studies, the differences in the chemical composition of broiler meat can be attributed to broiler foraging activity (Castelini et al., 2002b) and to natural ambient conditions such as fresh air and sunlight (Bogosavljević-Bošković et al., 2011) because of structural manifestations in both tissues and organs, as well as their effects on metabolic biochemical processes.

Table 2. Nutrient composition of the breast and drumstick meats of slow- and fast grown broiler female chickens (n = 10)

Treatment	Breast Meat, %					Drumstick Meat, %				
	Dry matter	Crude Ash	Crude protein	Ether extract	pH ¹⁵	Dry matter	Crude Ash	Crude protein	Ether extract	pH ¹⁵
SG-O	26.83 ^a	2.40 ^a	23.89 ^a	1.18	6.86 ^a	24.57	1.70	19.89 ^a	2.22	6.87 ^a
FG-O	26.56 ^a	2.49 ^a	23.42 ^a	2.03	6.87 ^a	25.99	1.69	19.72 ^a	3.07	6.86 ^a
SG-C	24.17 ^b	1.10 ^b	22.95 ^{ab}	0.39	6.47 ^b	23.10	0.91	17.82 ^b	1.43	6.49 ^b
FG-C	24.99 ^b	1.06 ^b	21.72 ^b	0.98	6.41 ^b	25.09	0.92	17.86 ^b	3.27	6.38 ^b
SEM	0.31	0.17	0.29	0.32	0.04	0.43	0.16	0.35	0.35	0.04
Genotype										
SG	25.50	1.75	23.42	0.83	6.73	23.84	1.31	18.86	1.82	6.74
FG	25.78	1.78	22.57	1.55	6.73	25.54	1.31	18.89	3.17	6.71
System										
O	26.70	2.45	23.66	1.60	6.87	25.28	1.70	19.81	2.65	6.86
C	24.58	1.08	22.34	0.67	6.44	24.09	0.92	17.84	2.35	6.43
p values										
Genotype	0.669	0.936	0.142	0.280	0.953	0.046	1.000	0.961	0.051	0.724
System	0.000	0.000	0.016	0.154	0.000	0.176	0.012	0.002	0.683	0.000
Genotype x System	0.001	0.000	0.030	0.362	0.000	0.108	0.117	0.027	0.228	0.000

SG: Slow grown, FG: Fast grown; O: Organic, C: Conventional; pH¹⁵, pH values at 15 min post-slaughter. Values with different superscripts within a column differ significantly ($p < 0.05$)

Table 3. Total fatty acid composition of the drumstick meats (g/100 g lipid) of slow- and fast-grown broiler female chickens (n = 10)

Treatment	Σ SFA	Σ MUFA	Σ PUFA	Σ Omega 6 (n-6)	Σ Omega 3 (n-3)	n-6/n-3
SG-O	27.910 ^a	37.367 ^{ab}	26.522 ^c	24.485 ^c	2.037	12.06 ^b
FG-O	27.018 ^a	38.477 ^a	24.866 ^c	22.959 ^c	1.908	12.15 ^b
SG-C	23.598 ^b	32.254 ^c	36.144 ^a	34.896 ^a	1.248	28.16 ^a
FG-C	25.610 ^{ab}	33.867 ^{bc}	31.331 ^b	29.667 ^b	1.664	19.68 ^b
SEM	0.614	0.935	1.413	1.499	0.125	2.240
Genotype						
SG	25.754	34.811	29.690	31.333	1.642	20.11
FG	26.314	36.172	26.313	28.099	1.786	15.92
System						
O	27.464	37.922	23.722	25.694	1.972	12.10
C	24.604	33.061	32.281	33.737	1.456	23.92
p values						
Genotype	0.670	0.493	0.272	0.280	0.590	0.374
System	0.011	0.003	0.000	0.000	0.030	0.002
Genotype x System	0.036	0.027	0.000	0.000	0.096	0.004

SG: Slow grown, FG: Fast grown; O: Organic, C: Conventional. Fatty acids: total saturated (Σ SFA), total monounsaturated (Σ MUFA), total polyunsaturated (Σ PUFA). Values with different superscripts within a column differ significantly ($p < 0.05$)

Sales (2014) stated that despite no significant differences at the final pH values of breast muscles, their findings indicated a trend toward increased pH, when chickens had access to pasture. However, we found significant differences between O and C for pH, wherein the pH¹⁵ values in the O system were higher than those in the C system in breast and drumstick meat ($p < 0.05$). This situation could be explained by the likelihood that a higher pH can be correlated with greater movement in the O system, which improves oxidative metabolism and increases the number of mitochondria in alpha-white fibers and hence converts them into alpha-red fibers.

The total SFA, total MUFA, and total omega 3 were significantly higher in the O system, whereas the total PUFA and omega 6 and n6/n3 values were significantly greater in the C system in our study. Castelini et al. (2002a) determined similar patterns with respect to SFA and total omega 3 values in the drumsticks; however, their measured PUFA content was not agreement with our results for 81-d-old Ross chickens. Similar to our study, the Sales (2014) study reported that total omega 3 fatty acids showed a positive tendency and the n = 6/n = 3 values tended to be negative with access to the pasture. Leopold Centre Researchers (2007) suggested that O broilers had a lower proportion of SFA and MUFA as compared to C system broilers. They also stated that the O system broilers, on the other hand, had significantly higher levels of PUFA and the values of omega 3 and omega 6 fatty acids were higher in O broilers as compared to C broilers.

In conclusion, organic system values were higher for dry matter, crude ash, crude protein, and pH¹⁵ values in breast meat, and for crude ash, crude protein, and pH¹⁵ values in drumstick meat ($p < 0.05$). Total saturated fatty acids, total mono-unsaturated fatty acids, and total omega 3 were significantly higher in the organic system than in the conventional system. Thus, organic system positively impacted female chicken meat quality, primarily the ash, protein, and total omega 3 fatty acid profiles compared to the conventional system.

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Data on organic animal husbandry and livestock products: status quo, possibilities and challenges

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Key words: data on organic animals, data on organic livestock products

Abstract

In many countries, organic animal and livestock product data are either not collected or only available on a highly aggregated level, and their publication is often greatly delayed. Livestock data is far more complicated to collect than data on the organic land area, and it needs more harmonisation and quality checks. Currently, data on livestock is collected in 83 countries worldwide, mainly in Europe and Northern America; data on production volumes are available from 55 countries. This does not mean that in the other countries animal husbandry does not play any role, but at the moment, Europe is the only continent where a more detailed analysis of the organic livestock sector is possible. Data gaps, different classifications, lack of definitions and poor data quality are the main challenges when it comes to improving organic livestock production. This paper provides recommendations on how to improve the availability and comparability of organic livestock data.

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Introduction

In many countries, data on organic livestock are either not collected or only gathered on a highly aggregated level, and their publication often has a considerable delay. Many different classifications are used. Thus, data often cannot be used for the purpose for which they were collected: to predict market trends, provide empirical basis for policy-making and market actors and prevent fraud. This paper describes the status quo of data collection on organic animals worldwide based on the annual FiBL global survey on organic agriculture and provides recommendations, some of which were developed in the EU project OrganicDataNetwork. It shows data gaps and quality issues. It also compares definitions and data collection methods and provides possible quality checks for data collectors.

Material and methods

For many years, FiBL and AMI (for Europe) have collected data on agricultural land and livestock under organic management and organic farms, international trade and retail trade for the global annual data collection effort "The World of Organic Agriculture" (Willer/Lernoud 2017). FiBL and AMI use a worldwide network of data suppliers (authorities, control bodies, organic associations, and experts). Data are surveyed with the help of an Excel questionnaire and stored in an SQL database. For animals, the questionnaire uses the Eurostat classification for livestock but is extended in some cases for special needs. Data are quality checked with the help of a Pivot table: comparison with the country's total, comparison with the previous year's data, and the relation of the number of animals to their output, i.e. the volume of milk produced should fit with the numbers of cows. In the case of potential inconsistencies, the data suppliers are consulted and data is either improved or deleted in case no satisfactory explanation is received. However, due to many data gaps and many insecurities, data on organic animals worldwide is not yet published in the statistical yearbook "The World of Organic Agriculture." Some aggregated data is shown below.

Results

For many years, FiBL has published data on organic areas and on the organic market worldwide, but, as explained above, for organic animals, such an overview has not been possible until now, even though data that are available are stored. The available data show:

- Out of the 178 countries with data on organic agriculture, 83 countries provide data on organic livestock numbers. This, however, does not mean that this data is necessarily updated each year. Also, the data is not complete in all cases (not all animal types are covered; data for covered animal types is not complete).
- By continent, the following picture emerges: six African countries provide data on organic livestock; nine countries in Asia, eleven in Latin America, two in North America; and in Oceania data is only available for Australia (incomplete data from a survey in 2009). In Europe, however, almost all countries provide data on organic livestock; numbers are available for 41 countries.

3 Data from 2009, not complete. Please note that Australia is the country with the largest organic area in the world, most of this being extensive grazing areas for the production of beef and sheep. Hence it may be assumed that the figure presented here is by far not complete.

- Data on the production volume of livestock in metric tons is available from 55 countries, again the majority of these being in Europe.

Furthermore, some countries provide retail sales, export and import volumes, and values for organic livestock products, again, mainly in Europe.

Table: Development of organic livestock by livestock type 2011-2015

Region	Bovine animals			Sheep			Pigs			Poultry		
	Million heads	5 year change	Share of total	Million heads	5 year change	Share of total	Million heads	5 year change	Share of total	Million heads	5 year change	Share of total
Africa	0.003	+625%	0.0%	0.007	+15%	0.0%				0.006	+416%	0.0%
Asia	1.5	+114%	0.3%	5.2	n/a	1.0%	0.1	-39%	0.0%	1	-19%	0.0%
Europe	3.6	+15%	3.0%	4.6	+8%	3.6%	0.9	+23%	0.5%	41	+33%	1.9%
Latin America	0.04	-60%	0.01%	0.9	-22%	1.3%			0.0%	0.007	+57%	0.0%
Northern America	0.6	+3%	0.5%	0.01	+41%	0.2%	0.04	+82%	0.1%	28.5	-24%	1.2%
Oceania	0.1 ¹	n/a	0.3%		+98%					0.3		0.3%
Total	5.8	+26%	0.4%	10.7	+97%	0.9%	1.1	+11%	0.1%	70.9	1%	0.3%

Source: FiBL-AMI survey based on national data sources, Eurostat and data from control bodies

Please note that for many countries data are not available or not complete, in particular for Africa, Asia, Latin America and Oceania. Please note that some of the increases are due to better data availability (e.g. Africa).

While the table above shows that there are still many challenges in the data collection process such as data gaps and inconsistent reporting, a clear picture emerges that organic livestock plays an important role mainly in Europe and in North America, the two largest markets for organic food and drink. While it might seem that the small importance of organic livestock on the other continents may be due to lack of data, it may be assumed that organic livestock and organic livestock products do not play such big a role in these countries. Only ruminants such as beef cattle, sheep and goats play an important role in extensive grazing areas such as Latin America and Oceania. Monogastric animals such as poultry and pigs are mainly kept in Europe and North America. According to the FiBL-AMI data collection on organic animals and livestock products in Europe, there were 3.6 million cattle and 4.6 million sheep in Europe in 2015. A total of 940'000 dairy cows produced more than 4'000 metric tons of organic milk. So far, Europe is the only continent where a more detailed analysis is possible; i.e. by livestock type, production, and retail sales of livestock products (see Table 1).

The following data issues emerged during the OrganicDataNetwork project and the annual FiBL-IFOAM data compilation for the yearbook "The World of Organic Agriculture":

Data gaps: Many countries still do not provide data on organic livestock; this may partly have to do with the fact that livestock does not play an important role in many tropical countries but clearly, in many countries, there is no reporting. It may also be that for some countries for which the data are collated by international certifiers, not all certifiers provide data, so livestock data may not be complete. Gaps also arise due to aggregations; e.g. only the number of cattle is published not saying if the animals are dairy cows or calves or beef cattle, and thus the data is of little help when it comes to forecasting milk or meat production. The same is the case when only the number of pigs is counted with no information of whether these pigs are fattening pigs, breeding sows or piglets. With this data, no predictions or forecasts of the market can be made. Because of missing data, estimations are often used, in particular to calculate the production in metric tons. Coefficients are used to convert one data type into another (e.g. average animal stock related to slaughtered

animals), but the coefficients have to be determined for the country in question and adapted to organic farming conditions. These coefficients should always be published together with the data (metadata).

Classifications: Similar to data on area, livestock has many different classifications. Alone Eurostat uses three different classifications for animals in different types of statistics (conventional production, organic production, international trade). In particular with dairy products, it is often difficult to make a country-by-country comparison, as these products are often available for the group but the groups are composed differently. They could be dairy products including eggs, dairy products excluding cheese, etc.

Lack of definitions: Often “livestock numbers” is the only term surveyed in different questionnaires and it is unclear what exactly is meant: all stock on a certain day in the year, or average stock in a defined period (year), or animal places (capacity) over a defined period (year), or even slaughtered animals. Often it is not clear at which end of the production chain animals are counted, either at the beginning of the fattening period or in the slaughterhouse. Furthermore, livestock that does not have organic status, despite being reared on organic farms, is reported as organic livestock.

Data quality: Data quality can be very poor. Often, it is obvious that no quality checks with previous year’s data or with the country’s total have been made. Sometimes the number of animals and the production of milk, meat, or eggs do not fit together if compared to the average production in a country.

Discussion

In order to improve the data availability and quality on organic livestock or livestock products, the authors of this paper have adopted the recommendations of the EU project OrganicDataNetwork (OrganicDataNetwork 2014) for the specific issues related to organic livestock.

Recommendation 1: Set up collection systems and strengthen existing efforts

We recommend using already existing data collection systems as much as possible by either including an organic identifier or by adding new product codes for organic products. Thus, the current infrastructure can be used, and data is directly comparable and probably as detailed as conventional livestock data. The most important existing data collection system would be the animal census that many countries in the world carry out annually or even semi-annually. If the extension of conventional data collection systems is not possible, is too expensive, or needs larger changes in statistical laws, it would be possible to install new data collection systems for organic animals (see Zanoli et al., 2014).

Recommendation 2: Improve and harmonise methods to increase accuracy of data collection

Currently, organic livestock data are collected with a wide range of methods, the most common being the collection of such data among organic certifiers (e.g. most countries in the European Union). Others collect the data in the framework of the farm structure survey (often based on samples; e.g. U.S.A.) or in the framework of the agri-environmental programmes (Austria, Switzerland). While the non-harmonised collection systems may seem a minor problem in the overall context, it has to be said that incomplete data and data gaps associated with some of the methods are not helpful when it comes to international comparisons and the assessment of the importance of organic agriculture, and the harmonisation of collection systems would be very useful.

Recommendation 3: Harmonise classifications, nomenclatures and definitions

Many countries have individual classification systems for organic agriculture data. Furthermore, definitions need to be harmonized; e.g. what “heads” of e.g. pigs mean — it can be data on average stocks, the number of slaughtered animals, or places.

Recommendation 4: Establish a system of routine quality checks

Data providers should establish a system of routine quality checks for organic data by applying plausibility checks. Comparing new data with the production of previous year(s) can give important hints on potential inconsistencies and help improve the quality of the data.

Recommendation 5: Strengthen collaboration and improve data access.

At the national level, the collaboration between authorities in charge of collecting data on the organic sector could help improve data quality and their availability. International exchanges, training, and the analysis of case studies are also needed. Better access to the data is one important prerequisite for this exchange. While the Eurostat databases on livestock and livestock products strive to give international access to data on organic livestock, livestock products, and other indicators are not provided on a country level, and data are often not shared or are hard to find.

Additionally, technical developments provide new technical solutions to use different data sources and bring them together. The usage of Big Data, be it the data of control bodies on production, processing, and trade volumes; the data on milking robots; GPS data; international trade data; or panel data on the consumer level for the sales volumes of meat or dairy products, can be an important solution for getting deeper insight into the whole supply chain. Furthermore, Big Data in real-time applications can help to prevent fraud. Certification data fed into an electronic internet-based data collection system gives real-time information on the certification status of an enterprise.


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Counting and Assessing the Status of India's Pastoralists

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Key words: pastoralism, India, economic importance, numerical significance

Abstract

Pastoralism is a widespread food production strategy in India, but there were no estimates of its numerical and economic significance, which led to its neglect by policy makers. In order to revise this situation, experts from 14 organizations examined various methodological approaches to arrive at an estimate of the number of pastoralists in the country and gauge their economic contribution to overall livestock production. Before such calculations can be undertaken, there needs to be clarity on the definition of pastoralism in the Indian context and the following criteria were identified: dependence on common pool resources (CPR), mobility, primary income from livestock, existence of traditional knowledge systems and association with specific breeds. The contribution to the Gross National Product is significant, with 53% of India's milk and 74% of its meat deriving from extensive, CPR-based systems.

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Introduction

The principles of pastoralism are different than those underlying conventional agriculture in which native vegetation is replaced with cultivated crops or sown pasture. By contrast, pastoralism makes use of available vegetation or crop by-products, requires no fuel or fertilizer (in fact contributes organic fertilizer), makes it possible to produce food in marginal areas (deserts, high mountains) and unlikely ecological niches (for instance marine areas), besides benefitting local flora and fauna. For these reasons, pastoralism is not only gaining increased international recognition as a livestock production system, it also very much conforms to the principles of organic farming. However, despite being ubiquitous in India, it continues to be ignored by policy makers. One of the obstacles preventing decision makers from taking notice of pastoralists is that there are no estimates about their numerical significance and their economic importance. There is a frequently repeated statement that they make up 6% of the Indian population, apparently based on Khurana (1999), but it is not clear what this assessment is based on.

Material and methods

In order to define the term in the Indian context and establish a methodology for estimating numbers and assessing trends, 14 experts from all over India met in Kullu (Himachal Pradesh) from 13-15 May 2016. They agreed upon the following criteria as characteristics of pastoralist households: dependence on common pool resources, mobility, primary income from livestock, existence of traditional knowledge systems and association with specific breeds. The participants compiled a list of known pastoralist communities in India and then proceeded to calculate the number of pastoralists for individual states, using various sources of data, including national and statewide livestock census data, breed census data, National Sample Surveys and Human census data, anthropological reports, own field data and observations, and numbers of grazing permits.

Results

A very dynamic picture emerged, characterized by great regional diversity. While Himalayan pastoralism appears to be stable due to a system of fixed grazing permits, in the western states of Rajasthan and Gujarat, pastoralism is under pressure. However, on the Deccan Plateau, many non-traditional pastoralists are entering the field, leading to an increase of livestock numbers kept in pastoral systems.

Table 1. Percentage of Indian livestock depending on Common Pool Resources (population data based on Livestock Census, 2012).

Category	Total Livestock Population (No.)	Assumption for Proportion of Total under Extensive Feeding System (%)	Extensive Feeding System (No.)
Indigenous cattle (male)	1,784,114	100	1,784,114
Indigenous Cattle (less than 2 years + breeding + draught)	59,097,703	50	295,48,852
Indigenous Cattle Female	146,899,534	90	132,209,581
Buffalo Male (only others)	356,647	100	356,647
Buffalo Male (non-others)	15,157,223	50	7,578,612
Buffalo Female total	88,581,515	60	53,148,909
Yak	76,237	100	76,237
Sheep (indigenous)	60,145,718	95	5,738,432
Crossbred sheep	2,531,749	100	2,531,749
Goat	129,080,808	80	103,264,646
Pig, indigenous	70,99,587	100	7,099,587
Mules and donkeys	267,498	100	267,498
Camel	350,000	100	350,000
Total	511,428,333		395354,863

The meeting highlighted the difficulties and gaps of information that prevent the establishment of precise number of pastoralists. While there are a good number of specialized pastoralist communities in India, such as the Bakkarwal, Raika, Dhangar, Kuruba, and many others, in most states no caste-based data have been collected since the beginning of the 20th century. Apart from that, caste-based figures have limited meaning because an unknown, but substantial, proportion of members of castes and tribes with a pastoralist identity and heritage have left their traditional occupation. On the other hand, people from castes with no previous history of pastoralism continue to enter the occupation.

However, livestock census data, information about average herd sizes, and knowledge of the extent of production systems provide a basis for calculating the percentage of livestock kept in traditional extensive systems relying on CPRs.

While the actual number of pastoralists thus remains fuzzy and they may not number more than 1% of India's population, the experts concluded that around 77% of India's livestock is kept in extensive systems and dependent on CPRs.

A large proportion of these animals are kept not by pastoralists in the narrow sense, but by smallholders for whom livestock may not be the primary source of income, yet still make an important contribution to family income and/or nutrition.

The contribution of livestock dependent on CPRs to the Gross National Product is significant, with 53% of India's milk and 74% of its meat deriving from such systems. It also has to be taken into account that an increasing number of scientific publications suggest that the animal products generated on pastures are more nutritious and tastier than those from intensive stall-fed operations. Finally, livestock kept in extensive system, contributes organic fertilizer with an estimated value of Indian Rupees 3,35,000 crore annually.

Discussion


In the *Kullu Call for the Recognition of the Importance of Common Pool Resources (CPRs) and Pastoralism for India's Livestock Sector*, the experts call for a re-orientation of India's livestock policies from a focus on stall-fed systems, intensification, and breed improvement to the creation of an enabling environment for mobile livestock keeping and especially the conservation and upkeep of Common Pool Resources. Specifically, the experts recommended the following strategies and activities to maintain the strength of India's livestock sector:

Recognition of the contribution of extensive livestock systems and pastoralism to the national GDP and to livelihoods.

1. Considering the paucity of data, field research and national census/surveys are urgently needed to determine numbers and economic contributions of extensive livestock keepers.
2. Development of livestock policies that support extensive livestock keepers and which are sensitive to their specific needs, including mobile services.
3. Securing tenure, access and rights to common pool resources for these livestock keepers.
4. Appreciation of the role of pastoralism in adaptation to climate change and in biodiversity conservation.

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Prospects of Organic Meat Production in North-Eastern region of India with special reference to Mizoram state

Bikash Borthakur ¹, Mahesh Chander ²

Key words: Organic Animal Husbandry, North eastern region, Mizoram, Pig, Poultry

Abstract

A study was carried out in Mizoram State of India to identify the potential and constraints in organic farming, including training needs of the farmers. Mizoram state formally recognised organic farming by passing an Organic Farming Act (2004) to introduce, adopt areas for, promote and regulate organic farming in the State. Accordingly, substantial efforts were made in the capacity-building of trainers and farmers in different aspects of certified organic production in Mizoram. This study revealed that there is a high potential for organic pig and poultry production in this state. Almost every household in Mizoram rears pig and backyard poultry. The traditional rearing practices are very close to the organic farming standards set under the National Programme for Organic Production (NPOP), however, organic livestock farming is still in infancy in Mizoram. The extension functionaries need to concentrate on capacity development measures in organic livestock production to make organic farming a sustainable venture for the farmers.

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Introduction

The Government of India identified the North-Eastern Region as ideal for the promotion of organic farming. Several forms of organic farming are being practiced in diverse climates, particularly in rain-fed, tribal, and hill areas of the North-Eastern Region. Considering the hill ecology, its tribal customs of land tenure, economic strength in terms of livestock ownership, and limitations of terrain and irrigation, organic farming is seen as a promising avenue for development. Mizoram state of North-Eastern India formally recognised organic farming by passing Organic Farming Act on 12 July 2004 to introduce, adopt areas for, promote and regulate organic farming. Accordingly, substantial efforts were made in the capacity-building of trainers and farmers in different aspects of certified organic production in Mizoram. This study (Borthakur 2011) was carried out in Mizoram to identify the potential and constraints including training needs of the farmers in the area of organic farming.

Material and methods

For this study in Mizoram, exploratory research design methods with a multi-stage purposive-cum-random sampling procedure was adopted. The study utilised both primary and secondary sources of information to determine the status, problems and opportunities for organic farming development in the state. Out of the eight districts of Mizoram, three districts were selected purposively i.e. Kolasib, Aizawl & Champhai. In these three districts, the maximum number of training programmes on organic farming were held. In each of the selected three districts, a list of villages was made where the maximum number of organic farming activities was identified according to information from the Directorate of Agricultural Research and Education. From these three districts, five villages were randomly selected from each district. From each of the 15 selected villages, 10 farmers were randomly selected from each village, thus the total sample size for the farmers was 150 across three districts. In addition, the development officials from the central agencies and state development departments involved with organic promotion were selected to ascertain their views.

Results

1) Initiatives and actions taken

The State Government of Mizoram adopted the National Policy and Programme for organic production as the State Policy and Programme with some modifications as found necessary by the state government. The organic agriculture development programme was implemented through service providers as well as through necessary inputs and training for carrying out organic farming activities in the state of Mizoram. The Department of Agriculture, Mizoram, introduced the Organic Farming Project in 1996, and ran a trial at Lungmuat village, with very promising results. This was followed up by the formation of an 'Organic Cell' at the Directorate of Agriculture during November 2006. The State-level Committee on organic farming was formed during June 2007. Since then, all the Departmental farms were converted into model Organic Farms, wherein, various activities on organic agriculture were carried out. The Department has ten Model Organic Farms which are certified by SGS Certification agency.

1.1) The status of organic certification

The District Agricultural Officers of all eight districts were engaged to look after the Internal Control System (ICS) of various Organic Farmers Groups. All the service providers had formed Organic Farmers Groups totalling 1,500 members under each service provider covering 750 ha. One Cert Asia Agri. Certification (P) Ltd. was engaged for Group Certification. Field Inspectors were also engaged for the administration of the Internal Control System of various districts.

The Department had established 25 vermiculture hatcheries costing INR 37.50 lakh with funding from the National Centre for Organic Farming (NCOF). The small vermiculture units were set up at farmers' fields in each district. In all, 400 units were established by giving assistance @ Rs. 15,000/- per unit to each individual farmer, in addition to 166 units already distributed to the organic farmers during 2008-09 at various districts. To motivate and encourage the organic farmers, and also to raise awareness, two market outlets were established at Aizawl and Dartlang where various organic products are sold under Organic Mizoram Label.

For the composting of fruits and vegetable waste, composting units were established at MIFFCO's Food Park, Chhingchhip and at Thingdawl Model Organic Farm. The Department had set up 35 vermiculture hatcheries and extended assistance to 566 farmers for setting-up small vermiculture units. In order to encourage the local production of vermicompost, the Department purchased 200 Mt of locally produced vermi-compost from the assisted farmers from various districts under the macro-management of Agriculture (CSS), and distributed to the deserving organic farmers.

A state biological Control Laboratory was established at Neihbawi Model Organic Farm. A State Bio-fertilizer production unit was established at Neihbawi Model Organic Farm, and a Mizo Organic Commodities Board was formed in 2007 comprising 13 members. Mizoram Vermicompost Producer Association was formed in November 2009 comprising 25 members. The APEDA conducted WEB-based traceability training in 2009. The SGS organic certification agency certified various organic producer cooperative enterprises in different villages in all districts of Mizoram in February 2009 (Table 1).

Table1: Status of Organic certification in 2009

Organic producer company	District	Area certified (ha)	Products
Mizo Organic Lawngtlai Products Producer Company Limited	Lawngtlai	833.3	Turmeric, ginger, orange, banana, chili, passion fruits and mango.
Mizo Organic Mamit Producer Company Limited	Mamit	466.8	Turmeric, ginger, orange, banana, chili, passion fruits and mango.
Mizorganics Kolasib Farmer Producer Company Limited	Kolasib	1691.8	Turmeric, ginger, orange, banana, chili, passion fruits and mango.
Mizorganic Champhai Producer Company Limited	Champhai	783.1	Turmeric, ginger, orange, banana, chili, passion fruits, pine apple and mango.
Mizo Organic Aizawl Producer Company Limited	Aizawl	763.9	Turmeric, ginger, orange, banana, chili, passion fruits, pine apple and mango.
Mizo Organic Lunglei Farmer Producer Company Limited	Lunglei	834.7	Turmeric, ginger, orange, banana, chili, passion fruits, pine apple and mango.
Mizorganics Serchhip Farmer Producer Company Limited	Serchhip	338.0	Turmeric, orange, and mango
Mizorganic Saiha Producer Company Limited	Saiha	403.5	Turmeric, ginger, orange, banana, chili, and mango.

2) Extent of adoption of organic animal husbandry standards by the farmers:

The extent of adoption is defined by the extent to which one makes use of organic farming practices or adopts a recommended practice in his/her farming operations. Table 2 shows that all (100%) the farmers were full adopters of organic farming standards of land holdings, local breeds, natural breeding, sufficient fresh air, natural daylight, lying and/or resting area, ample access to fresh water and feed, transport and slaughter and no respondents used medicine and vaccines for

their animals. As Mizoram is very hilly, the free movement of animals and grazing is restricted in almost all parts of the state. So, about 50% of the farmers were low adopters of organic farming standards relating to the free movements of animals and grazing; 30% were partial adopters, and 20% were high adopters. About 50% of the farmers were low adopters of the organic farming standards relating to protection against excessive sunlight, temperature, rain and wind; whereas 30% were partial adopters, and 20% were high adopters.

Table 2. Extent of adoption of organic farming standards by the farmers

SI No	Requirement	Low adopter (Upto 33%)	Partial adopter (34%-66%)	Full adopter (67%-100%)
1	Land holdings	-	-	150(100)
2	Free movements of animals	75(50)	45 (30)	30 (20)
3	Grazing	75(50)	45 (30)	30 (20)
4	Local Breeds	-	-	150(100)
5	Natural Breeding	-	-	150(100)
6	Sufficient fresh air and natural daylight	-	-	150(100)
7	Protection against excessive sunlight, temperature, rain and wind.	75(50)	45 (30)	30 (20)
8	Enough lying and/or resting area	-	-	150(100)
9	Ample access to fresh water and feed	-	-	150(100)
10	Organic Feeding Standard	75(50)	45 (30)	30 (20)
11	Use of Medicinal treatment	-	-	150(100)
12	Vaccination	-	-	150(100)
13	Transport and slaughter	-	-	150(100)
14	Record keeping	75 (50)	60 (40)	15(10)

* Figure in parenthesis indicates percentage

3) Bottlenecks

3.1) *Problems encountered by the organic farmers:* The lack of organised marketing facilities for the organic products was the major problem reported by 100% of farmers, followed by certification procedure and cost (80%), market demand and consumer preferences (70%), and poor technical support by the departments (60%). About 30% of the respondents reported unavailability of organic feed, whereas only a few farmers (20%) reported lack of financial support.

3.2) *Constraints faced by the functionaries in promotion of organic farming:* The lack of organised marketing facilities was reported by 100% of the functionaries, followed by shortage of trained staff (80%), market demand and consumer preferences (70%), delay in releasing the organic development fund (60%) and certification procedure and cost (60%).


Discussion and Conclusion

The government of Mizoram has done appreciable work in setting-up Model Organic Farms and organic villages, with substantial efforts made in capacity-building. The survey and case studies revealed that there is high potential for organic pig and poultry production in the State due to the natural advantages of traditional rearing systems and the preference by local people for traditional

products. Almost every household in Mizoram rears pig and backyard poultry. The traditional rearing practices are very close to the organic farming standards set under NPOP. So, the State Animal Husbandry Department should take initiatives in this regard with the Government of India assistance. Organic market outlets should be developed and promoted to ensure good prices for organic products. The smooth channelling of funds for the development of organic farming would go a long way in the development of organic farming in Mizoram and elsewhere in North-Eastern region, so the concerned agencies may want look into it.

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Co-Evolution of grass and grazers – Hidden Potentials for the Ecology and the Climate

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Key words: grazing management, eco-cow, climate protection, perma-culture, biodiversity

Abstract

With the last ice age grassland became the biggest biome of the world's landmass. The contemporary bread baskets – the American Prairie and Pampas and the Black Earth of the Ukraine – are steppe soils created in co-evolution between grass and grazer – mainly ruminants. The Aurochs roamed between Western Europe and Eastern Asia and in North Africa, the bison in Eurasia and North America and the guanaco in South America.

Land-use-changes and intensification are leading to soil compaction, loss of soil fertility, water storage capacity and biodiversity. This is the case for grassland too – since it is increasingly under pressure. It is often viewed as having little potential, a bad image of grazing has developed and cows are even perceived as climate killers.

But worldwide steppe soil is the biggest CO₂ store. Today sustainable grazing systems offer the biggest natural capacity to increase soil fertility and to sequester carbon. In this way ruminants serve as climate protectors – and are not competing with human nutrition.



Introduction

Those data indicating livestock as the world's largest *consumer* of land are average values and lead to wrong and even contra-productive conclusions – especially for ruminants. Because the data also includes a significant portion of sustainably used grasslands (Sutti et al 2005), the approach needs to be scientifically adapted: The major issue is how the land is managed and the livestock fed (Don et al 2011).

As an outcome of the co-evolution between grass and grazers grass became special: The growth dynamics of perennial grass societies are different from those of annual crops and those of perennial forests. Grass needs to be bitten and unlike forests it is not subject to saturation, this is predominantly not reflected in agricultural research, education and practice (Idel 2010).

The amount of grassland biodiversity and its biomass productivity is much more dependent upon grazing or mowing activity than on the initial grass seed mixture (Klapp 1953, Voisin 1988). Which is why sustainable grazing, on the world's biggest biome has an excellent agrarian potential for climate relief.

Results 1

Focus on reducing damage

Despite its intrinsic potential to increase soil fertility, agriculture is still contributing more to climate change, than it is to mitigation. (Schulze 2010). The goals and the scientific measures to *reduce* damage caused by loss of soil are different from those needed to identify potentials to *increase* soil depth. The average soil loss from arable land is reported to be 13 metric tons per hectare per year (t/ha/yr) in the United States (Pimentel 2009) and 15 t/ha/yr in the Ukraine (Fileccia et al 2014). Seventy percent of the world's agricultural area in use is grassland, but research is still mostly focused on arable fields: reducing soil erosion– e.g. by making use of no-till, often with transgenic plants and glyphosate.

Worldwide the major driver for climate change is land use change from (rain-) forest and grassland – to field or non-agricultural purposes. Nitrous oxide (N_2O) from agriculture is the most powerful greenhouse gas (GHG), causing agriculture's main contribution to climate change. It is more than 300 fold more harmful than CO_2 and more than 12 fold as methane which is 25 times more harmful to the climate than CO_2 . N_2O is primarily released through the application of synthetic nitrogen fertilizer: On average 2-5% is converted into N_2O , the role of soil management is explained by the European Nitrogen Assessment (ENA). The more the soil is compacted the more N_2O , formed by soil micro organisms, will be released (Sutton et al 2011). In Europe 70% of the total N_2O emissions (and 90% of all ammonia emissions - NH_3) are caused by livestock farming (Schulze et al 2010), levels increasing with increasing amounts of concentrates (Delgado et al 2011). Schulze et al (2009) believe that the damage caused by N_2O as calculated by the Intergovernmental Panel on Climate Change (IPCC) is an underestimation and suggest doubling the estimation.

The degree of GHG emitted by livestock depends on the agricultural system and not on the absolute number of animals. Greater standardization and specialization in industrial agriculture is closely related to the de-linking of crop and livestock production. In addition, breeding for high performance leads to highly specialised breeds. Thus, many ruminant animals in particular are dependent upon concentrates and are losing their ability to produce both milk and meat. Last but not least they are losing their capacity to serve as work animals. The latter are still a pillar of agriculture in many countries.

Results 2

Challenges and options for research and practice

The wide range of grasslands need a wide range of breeds, which are able to make sustainable use of them. Increasingly in the last 10 years a lot of questions regarding grazing management have been explored. A main driver was the goal to make grazing an option even for high performing dairy cows. Therefore, the focus is on a short lawn pasture to obtain a large amount of milk directly from high-energy and nutrient-rich young sweet grass (for example: Thomet et al 2011, 2010). All these studies, even with data from New Zealand or Ireland, which focus on yield per hectare instead of litres per cow, value the data from a given demand of the grazing animals. But all the data are needed and are extremely helpful for farmers trying to survive in the current milk market.

But different research is needed in addition – and is on its way. In mid June 2017, the first meeting of the European Focus Group *Grazing for Carbon* took place. This Focus Group is expected to explore grazing management practices from ruminants and associated business models that have a beneficial impact on soil quality and more specifically on carbon content. The Focus Group is asked to look for “various examples which can be found in the EU taking into account different regions, soil types and climate” (FCCT 2017).

This approach suggests the use of grazing animals as a tool. And by also focusing on *soil quality* can protect from the exercise of carbon sequestration as an end in itself. It's important to take into account that fact that the status quo of most pasture is far behind its capacity. The Focus Group has been asked to evaluate different soil types, the problem is much less the soil type but more a non-adapted and non sustainable grazing system. It's important to perceive the hidden *potential* of pasture behind the status quo – as has been done in the certification process of the Forest Stewardship Council.

Teague et al (2016) conclude that to ensure long-term sustainability and ecological resilience of agroecosystems agricultural production should include ruminant grazing – with its potential to mitigate large quantities of anthropogenic GHG emissions.

Discussion and conclusions

More multi-disciplinary research is needed focusing on the potentials of sustainable grazing and grassland management, taking into account different local and regional conditions. Grass societies are very efficient at root generation and they have long production periods. This is in contrast to trees where photosynthesis can only start in spring, when leaves are sprouting and generating enough chlorophyll to start and continue photosynthesis – until late summer when the leaves become yellow.

To tie in with the (still) amazing fertility of today's bread baskets it is useful to explore, how soil fertility has developed, *before* man became sedentary – to understand the role and capacity of grazing herds.

Whether the whole amount of root biomass will be eventually available to be transferred by micro-organisms to the topsoil. depends mostly the grazing system exercised. The break from grazing must benefit every single grass plant. Instead of a fixed interval, experience and further research is mandatory to evaluate the current grass growth of each species and adjust accordingly.

On parts of the pampas and the prairie it's common practice to establish perennial pastures on non-arable land and even to have equal amounts of grasslands and non arable land. Therefore, it's important to bring together good soils and sustainable grazing management to explore the potential to (re-)establish even higher fertility soils.

A broad range of perceptions and findings regarding biomass production will evolve from research relating to the role of above and below ground biodiversity and the role of grazing management regarding root development and eventually belowground net production.

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An innovative solution for boosting organic sheep and goat production by nomad pastoralists (case study in Baft, Kerman Province, Iran)

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Key words: nomad, rangeland, goats, sheep, organic products

Abstract

A comparative study of three production systems (Organic based on EU regulation 834/2007, conventional and nomadic) shows the potential for boosting organic systems via sheep and goat production by nomad pastoralists. Nomadic livestock products i.e. meat, milk, wool can be innovatively considered as organic or beyond organic due to the ethical aspects of production. Further regional and/or international studies are required, surveillance, the adoption of regulation and a suitable certification system.

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Introduction

Organic sheep and goat production based on grazing (Rahmann 2014) could be a valid alternative for animals kept in intensive or industrial systems fed with standard rations of concentrates. The relatively low cost of the sheep and goat farming (local breeds-well adapted to their environment plus extensive free communal grazing areas) and the increasing demand for expensive organic products in domestic and regional export markets encourages Iranian nomads to shift to organic production.

Nomads play an important role in sheep and goat production mainly because they keep 58.5% of the sheep and 39.7% of the goat population of Iran. Attempts were made in this study to address constraints and shortcomings of a sustainable nomadic system to boost organic livestock production.

Material and methods

A comparative study among production systems (1) organic based on EU regulation 834/2007, (2) conventional and (3) a nomadic system, based on 30 nomad settlements chosen at random within \pm 20 km of Baft city in Kerman province (Ansari-Renani et al., 2013 and 2012) was made. A structured questionnaire was completed for each individual nomad family. Final information was gathered primarily through in-depth interviews with nomadic men and women livestock producers and also through specialist and field observations.

Results and discussion

Nomad herders frequently emphasized that the diversity of plant species consumed was responsible for the superior taste and healthiness of sheep and goat milk and meat. Most of these plants have medicinal value. Nomadic farming systems with well diversified livestock populations in terms of species and breeds is ideal for organic livestock production. As nomadic sheep and goat production is largely extensive, animal welfare is hardly compromised compared to an intensive or conventional type of animal production. Nomadic livestock products can be innovatively considered as organic or beyond for their ethical aspects of production. This requires the building up of further regional and/or international studies, surveillance, adoption of regulations and a suitable certification system.

Table 1. Characteristics of conventional, organic and nomadic animal husbandry

	Conventional*	Organic (834/2007)*	Nomadic
Breeds origins	Highly performing, special breeds and cross-breeds according to product aimed for	Only animals reared on organic farms, diversity of breeds, sometimes rare breeds, natural breeding	Native breed, locally adapted, natural breeding
Management (buildings and free runs)	Animal protection laws (requirements for keeping of animal according to species)	Special requirements for keeping animals oriented toward animal welfare (stock density, space, grazing, tiding, etc.)	Animal are kept in rangeland oriented toward animal welfare

Feeding	According to current food stuffs legislation (permitted food additives such as enzymes, synthetic amino acids, etc.)	Food stuffs produced as much as possible on site, feeding rations according to animal welfare (e. g., minimum use/parts of roughage) only specifically permitted additives, no synthetic amino acids, no GMO	Rangeland is considered the main source of livestock nutrition, no synthetics, no GMOs, no pesticides and chemical fertilizers, livestock are not fed in stables or in restricted areas but they move and graze freely in extensive open grazing areas.
Management and treatment	Managed breeding, if necessary stable-wide prophylaxis, legally required waiting periods according to drug prescription law	No prophylaxis (exception: legally required vaccination), only three allopathical treatments per year for long live animals (>1 year) respectively 1 treatment for livestock, which is not used more than one year; double the waiting period after use of drugs, minimum 48 hours. Restricted interfering with the animal's integrity (no polling, beak trimming, tail clipping, etc.)	No prophylaxis (exception: legally required vaccination), minimal allopathical treatments per year, no tethering, polling and tail clipping.
Transport	Animal transport regulation	Animal transport regulation with short transport ways	Animals mainly moved through migration , some transportation by trucks

*Adapted from Rahmann, G. 2014


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The significance of pastoralism for sustainable soil health in India

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Key words: Pastoralism, manure, soil fertility, India, penning

Abstract

In order to uphold soil fertility, farmers throughout India engage in manure contracts with pastoralists, remunerating them for “penning” herds and flocks on their fields with cash and/or food. Focusgroup discussions indicated an average income of Rs1000/acre from penning, a significant contribution to pastoralists’ livelihoods. India’s 64 million sheep are producing Rs 14.7 billion worth of fertilizer annually. While the government is incentivizing city compost making to overcome the country’s shortage of fertilizer, no such support exists for pastoralists. It is recommended that the enormous contribution of nomadic pastoralists in ensuring soil health in India is recognized and supported by developing a national support policy for pastoralism.

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Introduction

This paper draws attention to the role of pastoralists in India in the provision of organic manure, soil fertility and return for the country's food security. About 77% of India's livestock, including cattle, buffaloes, sheep, goats, camels, yaks, donkeys and even ducks is kept in extensive systems, being herded in forests, village common, fallow fields and other types of common pool resources. According to a recent estimate by livestock experts, they contribute an estimated 53% of India's milk and 74% of its meat, while also generating organic manure with an estimated value of Rs3,35,000 crores (LIFE Network et al, 2016), but these enormously important agro-ecological services of pastoralists and smallholders remain unacknowledged and practically unresearched.

Material and methods

Focused group discussions (FGDs) were held with more than 3500 farmers (both women and men) to understand their soil fertility management practices and the socio-economic web that underlies them. Using a guided check list, these FGDs were conducted in arid and semi-arid districts of Telangana (Medak, Nalgonda and Mahbubnagar), Andhra Pradesh (Kurnool, Prakasham and Anantapur), Madhya Pradesh (Sehore, Rajgarh, Gwalior, Morena, Ujjain and Dewas), Uttar Pradesh (Lalitpur), Jharkhand (Hazariabagh), Rajasthan (Jhalawar, Kota and Udaipur) and Karnataka (Tumkur). In addition, Participatory Rural Appraisal sessions were undertaken with pastoralists in Northern Karnataka (Bagalkot and Belgaon districts) and in Southern Rajasthan (Udaipur and Palidistricts) to obtain an in-depth understanding of the issues related to the "penning" of sheep, cattle, donkeys and camels. Secondary data were collected from sources such as the Bureau of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Government of India, including the Livestock Census report of 2012, and literature on organic fertilizers.

Results

The FGDs with farmers in different Indian states revealed that farmers in arid and semi-arid regions of India actively manage soil fertility and other soil properties through a wide range of practices that are based on local resources and knowledge. There is a strong interest in 'low external input' and organic farming practices (Butterworth et al, 2003). Often farmers seek to reduce the amount of chemical fertilizers and instead use organic manures, because of the high costs of the former. They also perceive negative long term impacts of chemical fertilizers on soil quality, and believe in organic practices to grow better quality produce. Pastoralists are playing a crucial role in this regard by "penning" their animals on fields during the night for the purpose of fertilizing with organic manure. "Penning" is an arrangement in which pastoralists let their herds stay overnight on fallow fields, at the request of, or with the consent of the landowner (Reddy 2011; Sriveda and Srihitha, 2015). During the day, their flocks and herds feed on Common Pool Resources (such as uncultivated land and forest), transferring nutrients to the cultivated land at night.

In some areas, such as northern Karnataka, lightweight wooden pens are set up. In other cases animals are enclosed by or kept away from standing on crops by ropes. The resting places are moved every night to ensure the entire field is fertilized. According to local perceptions, the practice of penning improves soil condition in multiple ways. The body heat and pressure of the lying sheep pulverizes the soil and improves its water retention capacity. The turning over of the soil by the hooves of the sheep exposes insects and pests to the sunlight and kills them ("solarization"). It also attracts birds, triggering the "biocontrol" of pests.

The perceived advantages and disadvantages of sheep penning are summarized in Table 1.

Table 1: Local perceptions about sheep penning

Local perceptions about sheep penning	
Advantages	Disadvantages
<ul style="list-style-type: none"> Improves soil structure and water holding capacity Increases yields significantly More fertile than FYM from cattle Does not contain stalks such as FYM Kills some weeds and pests. 	<ul style="list-style-type: none"> More weeding may be needed as seeds of weeds (especially acacia) are spread Generates lot of heat in the soil when applied and can lead to crop burning if there is no rain Expensive - shepherds may need grain, or cooked food and beedi (local cigarette) expenses.

Discussion and conclusions

Adult sheep produce between 0.5 and 1 kg of manure and 1.2 l of urine per day. The standard calculation is that 100 animals fertilize 2.5 acres in 6 nights. The concentration of nutrients is higher in urine than in manure, so the former is rated more highly by farmers. According to published data, the N, P and K content of sheep urine are 1.5% ,0.05% and 1.96% respectively, while sheep manure contains N= 0.7%, P=0.51% and K=0.29%(Kolay, 2007).

Based on a total population of 10 million sheep in Karnataka, Athani et al (2015) calculated that they produce 10 million kg of manure and 12 million kg of urine per day, supplying a total amount of 250 t of nitrogen, 57 t of phosphorus and 264.2 t of potash daily, equivalent to a market value of Rs2.3 million per day or Rs 8650 million per year. They note that sheep deposit this directly on the field and trample it directly into the soil, incurring no costs for transportation.

The growing interest in and demand for organic soil amendments is not yet matched by a corresponding increase in information and support in the use of these practices. Most agricultural department staff and even many Non-Governmental Organizations (NGOs) do not have sufficient knowledge and experience with the wide range of organic practices and are, therefore, unable to give appropriate advice to farmers. Moreover, agricultural services (including subsidies and crop loans) are geared towards 'modern' and commercial agriculture, too often with inadequate support for subsistence or low-income farmers.


When using a combination of traditional soil fertility management practice such as farmyard manure, green leaf manures and tank silt in sufficient quantities, nutrient imbalances are rare because these materials contain all plant nutrients (Reddy, 2015). Organic matter also alters the physical and chemical environment of the soil, potentially making nutrients in the soil more readily available to the plants. Practices such as sheep penning not only provide an important source of income for shepherds, but is a valuable source of manure for farmers.

Interestingly, the present government of Telangana is extending financial support to all sheep rearing families during the financial year 2017-18 by way of helping them to purchase 20 sheep per family. This will give a big boost for the sheep penning activity with positive implications for sustainable soil health.

India imports large amounts of urea which is heavily subsidized. To become self-sufficient, the government has recently incentivized city compost making by paying Rs 1500/ton. However, no such support is forthcoming for pastoralists who have been contributing to food security through penning. The authors recommend that the traditional integration between crop-farmers and pastoralists that is present in many, probably most, parts of India be supported and promoted, possibly by providing opportunity for some kind of organic certification. The government should recognize and reward the enormous contribution of nomadic pastoralists in ensuring soil health by developing a national support policy for pastoralists.

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Breeding program for organic dairy cattle in the Netherlands

Wytze J. Nauta¹

Key words: dairy production, selective breeding, organic, artificial insemination

Abstract

Organic breeding is not yet well established in legislation and this means that most organic dairy farmers use conventional breeding stock where the breeding goals and reproduction techniques are not in line with organic principles. In view of this, Bio-KI started an organic dairy breeding programme and has so far sold 8,000 doses of semen to dairy farmers in the Netherlands. The first five bulls sired 449 daughters milking at organic farms, and breeding values were estimated by the Dutch Herdbook Organisation. This is the first initiative in the world to set up an organic breeding programme. However, while preliminary research showed that farmers do support organic breeding, sales of semen are still very low. This is mainly because the selection of bulls is too small and farmers have long-standing relationships with national breeding cooperatives or companies. Bio-KI must, therefore, explore ways of increasing its market. The rise of new Genetic Modification (GM) technologies, and gene editing in animal breeding on conventional farming, might incline organic farmers towards more organic breeding.

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Introduction

Organic animal breeding is not clearly prescribed in legislation for organic production. However, the following aspects are mentioned in legislation that also include breeding: organic production must follow natural processes and be animal-friendly, animals must be able to express their natural behaviour and animals have to be able to adapt to the local environment (EU, 1999). Artificial insemination (AI) is allowed but organic farming prohibits the use of super (or multiple) ovulation of cows and embryo transfer (MOET). The use of a bull for natural service on the farm can be seen as the purest form of organic breeding. However, since bulls are dangerous, many farmers keep using AI services for breeding. However, conventional breeding schemes are heavily based on MOET and conventional breeding bulls are mostly produced by MOET and other modern reproduction techniques like collection of oocytes followed by IVF. Further, conventional breeding schemes focus on the selection of animals for high-input systems, i.e. requirement feeding with high input of purchased (concentrated) feed and standard use of medicines like antibiotics and anthelmintics. This kind of selective breeding does not fit organic farming principles.

In the Netherlands, the first initiative for an organic dairy cattle breeding program was launched in 2009. Since then one to two young bulls are selected from the best performing cow families from organic farms each year. These bulls are raised on the organic farm until they are 14 months old when they go to an AI station for semen collection. From each bull, 1,000-2,000 doses of semen are collected. The breeding goal is a high lifetime production of organic cows which is conditional on good health and functional traits, such as good locomotion, strong legs and claws and good fertility. An additional trait in the breeding goal is high solubles, fat, and protein in the milk. Lifetime milk production of the bull mothers is given in Table 1.

Table 1: Milk production and composition of bulls's mother + bull grand-mothers

Year	Bull name	Breed	Lifetime production bull mother + grandmother		
			Kg milk	%Fat	% Protein
2009	Bio Wytze P	Holstein	56.708	4.50	3.53
2010	Bio Jaap	Red Holstein	120.063	4.89	3.61
2010	Bio Henkieboy	Holstein	135.900	4.04	3.32
2010	Bio Jeroen	50% Holstein 50% Dutch white face	158.998	4.07	3.35
2010	Bio Arkemheen 110	Dutch Friesian	94.254	4.26	3.62
2013	Bio Doru PP	Fleckvieh	75.573	4.32	3.54
2013	Bio Peter	50% Holstein 50% Brown Swiss	96.860	4.82	4.10
2014	Bio Bram	Meusse-Rhyn-Yssel	103.985	4.00	3.56
2015	Bio Thiago Twa	Dutch Friesian	85.618	4.55	3.57
2015	Bio Boris	Meusse-Rhyn-Yssel	110.117	4.65	3.82
2016	Bio Eva's Appel	Red Holstein	150.360	4.50	3.67

Results

So far, semen from eleven bulls has been put on the market and four more will become available in 2017. In total, more than 8,000 doses of semen have been sold to about 100 organic farms, one third of all organic dairy farms in the Netherlands (Figure 1). We decided to store 2,000 doses of the first bull, Bio Opneij Wytze Pp, since there was such a high demand for the semen at the beginning of the project. The other bulls produced about 1,000-1,250 doses each.

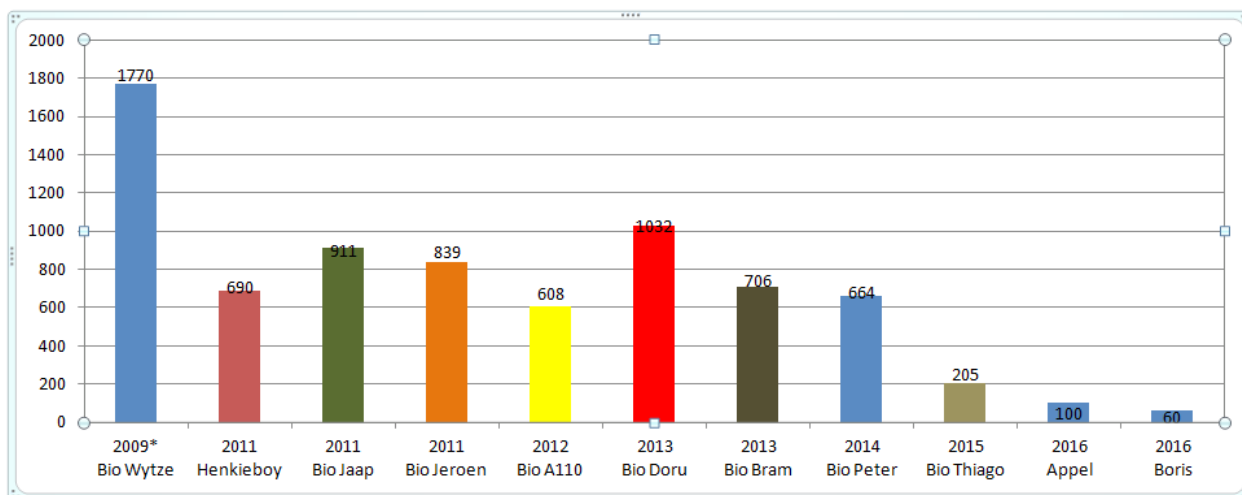


Figure 1: Total sales of semen (doses) of the Bio-KI bulls.

Due to cattle's long generation interval, the first results of the daughters' performance, based on multiple lactations, are now becoming available. Five bulls now have 449 lactating daughters at, on average, 30 farms. Based on these daughters, their breeding values are estimated by the Dutch herdbook organisation. Almost all semen is sold to organic farms, so these daughters are producing under organic conditions and breeding values are based on organic production environments. The breeding values are based on different breed standards and show high variations for different traits (see Table 2).

One particular organic farm, the Bouma farm, has used only Bio-KI bulls since 2009. In the autumn of 2015, they had 85 lactating daughters from the five bulls in Table 2. The average estimated production in 305 days of the 1st calf daughters was 5,222 kg milk, 4.15% milk fat and 3.60% protein. For 2nd and 3rd calf daughters these figures were 5,995 kg, 4.13%, 3.48% and 6305 kg, 4.00%, 3.68%, respectively. Because the farm had switched completely to organic bulls, the daughters could not be compared to herd mates of the same age. However, milk yield and protein percentage were slightly higher for the organic-bred daughters compared to the previous herd estimates.

Table 2: Estimated Breeding values of the five oldest Bio-KI bulls.

Bull Name	Breed	R	# D	# F	Kg M	% Fat	%Prot	INET	LS	UH	Fert.	CI	SCC	Pers	BCS
Bio Wytze	HF	96	230	71	515	-0,38	-0,17	7	491	99	96	102	97	103	96
Bio Jaap	HF	81	46	19	-397	0,05	-0,01	-94	319	101	98	6	99	97	104
Bio HenkieBoy	HF	81	36	15	-749	0,2	0,06	-130	15	99	106	101	97	94	103
Bio Jeroen	GxHF	89	72	22	356	-0,12	-0,27	-6	233	99	95	91	93	99	89
Bio A 110	DF	82	65	32	-427	0,1	0	-104	-453	101	103	98	95	90	94

R = reliability, D = daughters, F = farms, Kg M = kg milk, INET= Dutch index for milk yield, LS = life span, UH = udder health, Fert = fertility, CI = calving index, SCC = somatic cell count, Pers = persistence of milk production, BCS = body condition score. (Source: GES, Dutch Herdbook Organisation, 2017).

Discussion

To our knowledge, this is the first organic dairy cattle breeding programme in the world. The programme is based on a 'young bull' system as described by Bichard (2002). In such a breeding system, bulls are not tested before use but a group of young bulls is selected from the best dairy cows in the population based on their parent's estimated breeding values and phenotypic value. Semen of these bulls is used evenly over the population. In this way, with a group of bulls, the average breeding value of the bulls will be relatively high and will be spread over the herd quickly, resulting in a short generation interval. Using this system, similar breeding progress can be achieved as in a testing scheme (Bichard, 2010, personal communication). The main reason for using a young bull system is the low cost. A testing scheme would be too expensive for the relatively small organic dairy sector (Nauta, 2009).

The estimated breeding values of the first Bio-KI bulls are not yet impressive. Selection of Bio-KI bulls is based on lifetime performance of the bull mothers and grandmothers. Conventional breeding schemes focus more strongly on early-maturing animals, whereas organic farming aims more for robust, later-maturing cows with good longevity. This raises the question whether the estimated breeding values are accurately reflecting the breeding goal of Bio-KI as they are still based on the first lactations of the bull daughters. In a number of years we expect to see if these animals indeed live longer and achieve higher lifetime yields.

Sales of semen are still relatively low. Only about 2% of the Dutch organic dairy cows are inseminated with Bio-KI semen. In the year 2000, Dutch farmers endorsed the development of organic breeding (Nauta, 2005). But now that organic bulls are available, the uptake is below expectations. Partly because more and more farmers (up to 25%) are breeding with natural serving bulls. This is the ultimate way of natural, organic breeding, however, mature breeding bulls are dangerous and proper housing and safety protocols should be implemented. A small number of farmers do use almost only Bio-KI bulls and others use it now and then. However, many other farmers do not see the need for organic breeding bulls since it is not required under organic production regulations and consumers say they are not aware of it either. Furthermore, most Dutch farmers have longstanding ties with conventional breeding organisations and do not easily buy semen elsewhere. These breeding organisations put a lot of work into marketing and customer relations, visiting farms to sell semen directly. This personal contact with farmers seems to be very important for sales. Bio-KI does not have the capacity yet for such pro-active marketing which would, however, also increase the price of semen.

Farmers want to have more choice but Bio-KI still only offers a very small selection of eleven bulls. This, in turn, is due to the low sales of semen. If sales would go up, more finances would become available for selecting more young bulls and getting the ball rolling. Bio-KI is seeking possibilities to break this vicious circle. In 2016, a crowd funding campaign was organised and aimed at consumers. This resulted in a joint investment of 15.000 euro from 120 people. Forty-five participants received a packet of meat from a bull in return, others just wanted to support organic breeding. However, more finance is needed to supply of more bulls and wake-up the sector. Up to 100,000 euros is needed for 30 more bulls. In general, organic farmers have to use organic genetics when these are available, just as for plant seeds. If Bio-KI can offer 5-6 bulls of each of the most popular breeds, the sector can no longer ignore organic breeding stock.

Another very urgent reason for organic breeding is arising. Today, it is becoming relatively easy to alter the genomes of animals directly using crispr-cas9 technology (Hou, 2016). With this technology, genes can be turned off or added to the genome with great accuracy. Expectations of this technology are very high. For example, the best breeding bulls could be modified with the gene for polledness (Bruce, 2017). This would be a quick solution to the unpleasant task of dehorning young calves and will probably become mainstream in dairy breeding worldwide. IFOAM considers

the crispr-cas9 technology as genomic manipulation (IFOAM, 2017). Also, the biodynamic dairy sector attaches great value to horned cows. The introduction of genetically modified bulls in conventional breeding will result in a ban on the use of such bulls in organic farming which bans GMO very strictly. These developments in conventional breeding could lead to a bigger need and demand for organic breeding and stimulate organic breeding programmes.

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Novel traits make local dual purpose breeds more suitable for Organic Farming?

Gerdine Kaptijn¹, Egbert Lantinga², Wytze Nauta³

Key words: dairy, dual purpose, novel traits, , grazing, breed differences

Abstract

In the EU funded 2-ORG-COWS project local, dual purpose cattle breeds are studied to find novel traits that make them more suitable for extensive, pasture-based organic dairy systems. Such cattle breeds are known to produce relatively more milk from grass. In a pasture-based system, the performance of the high yielding Holstein Friesian breed is often not superior to dual purpose breeds. So how do dual purpose cows cope better under more extensive, pasture-based conditions? To answer this question, ear-attached movement sensors (SensOor) were used for the first time to study the grazing behaviour of dairy cows of Dutch-Friesian and Holstein-Friesian breeds. The first results demonstrated that SensOor performed very well for cows outside on pasture. Furthermore, there were indications that the Dutch-Friesian cows could cope better with more warm and humid weather conditions.

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Introduction

Holstein Friesian cows are bred for the more intensive production systems and they do not cope well in an extensive, pasture-based system (Dillon et al, 2006). A literature study was carried out to compare the popular Holstein Friesian (HF) breed to local dual purpose cattle breeds. This revealed that local dual purpose breeds display an advantage over the Holstein Friesians in many traits such as health, fertility, meat quality and longevity. Additionally, dual purpose cows are better able to cope with a harsh environment and a low quality diet. Therefore, many organic farmers cross their HF cows with more robust dual purpose breeds which are more resilient and cope better with outdoor, pasture-based production systems (De Haas et al., 2013).

The question is, however, how do such breeds behave better in a harsh environment? In other words: which specific 'novel' traits make them more resilient and, moreover, can such traits be used for selection? This is the central question in the EU funded 2-ORG-COWS project which includes seven countries and six different local, dual purpose breeds. In the Netherlands the grazing behaviour of one of the Dutch dual-purpose breeds, the Dutch Friesian, the ancestor of the HF breed, is compared to the Holstein Friesian. For this purpose, the monitoring system SensOor (AGIS) was used. SensOor, developed by AGIS, registers four main behaviours of cows, namely eating, ruminating, resting and other activity (such as walking, standing, etc.). The system expresses the time the cows spend on these behaviours in percentages per hour or per day. However, the SensOor system was never validated under grazing conditions and we tested it for the first time on pasture. Additionally, the SensOor output was used to compare grazing behaviour of pure-bred DF and HF cows. The ultimate knowledge would be to discover if the SensOor data can be used for estimating the real intake of grass per cow in the pasture and if such a trait is heritable and can be used for selection. A plan for such research is on its way.

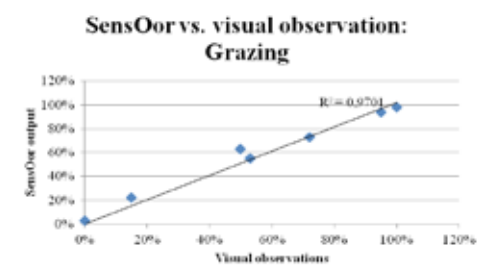
Material and methods

SensOor was placed in the ears of the cows of two dairy herds, both mainly consisting of cows of the Dutch Friesian breed, one herd (56 head) was managed under organic conditions and the other herd (105 head) was conventionally managed and included also 20% crossbred animals (DF x HF) and 5 purebred Holstein cows.

Six cows of the organic herd were visually observed in the pasture and their behaviour was classified according to the four SensOor activities (grazing, ruminating, resting and being active). The results were converted to percentages on an hourly basis and compared with the output of SensOor. In the conventional herd, five purebred DF cows and five purebred HF cows, all of about the same age and lactation stage, were observed to discover if differences could be detected in their behaviour (the same four activity classes).

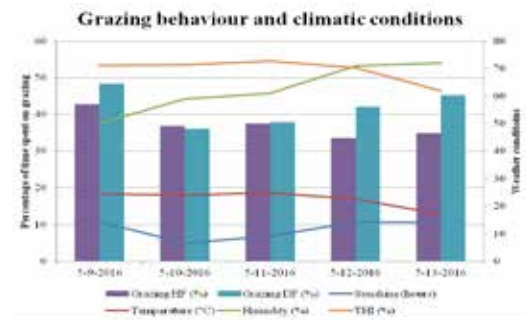
Results

Figure 1 shows a scatter plot of the SensOor output and visual observations of the grazing behaviour of six different cows (Kaptijn en Lantinga, 2016). The trendline and its R^2 value (0.97) indicates that the visual observations correlated very well with the output from SensOor. When in the field the cows were observed as grazing, SensOor detected this activity as eating. A 2-sided paired t-test was performed using SPSS to test this result. A positive correlation was found between the



observed and detected activities of grazing, ruminating and resting ($p \leq 0.05$). For the behaviour class 'Active' this positive correlation was not significant ($p > 0.05$).

In Figure 2 the grazing behaviour of the DF and HF cows on pasture is shown together with climatic conditions (Kaptijn en Lantinga, 2016). The most striking difference in the behaviour of the cows during this week was that the grazing activity of the DF cows increased from May 10th onwards, while the grazing activity of the HF cows tended to decrease after May 11th. The cows were all on the same paddock for all five days, although they got access to new parts of the pasture area every 2 days. An explanation for



this increased grazing behaviour of the DF cows might have been the changing weather conditions. Throughout the week the average air humidity increased (from 50% to 72%), whereas there was a gradual decrease in the mean temperature (from 19.9 °C to 11.8 °C). May 10th and 11th had less sunshine (6.5 and 9.2 hours) compared to the other days, which were extremely sunny (around 14 hours of sunshine). To assess the effects of temperature and humidity on the grazing behaviour of cows, the temperature humidity index (THI) was calculated using the method of Charlton et al. (2011). During the week the relative humidity increased, while temperature decreased. This resulted in a more or less constant THI during the first 4 days, which was around 72 (range: 70 - 73). Therefore, it is possible that during those days the cows suffered from heat stress which might have reduced their grazing time. The average grazing behaviour of the HF cows decreased during the week. In contrast, the grazing time of the DF increased from May 10th. This suggests that the HF cows suffered from heat stress whereas the DF cows are less susceptible to heat stress. This agrees with the findings of Sharma et al. (1983) who states that smaller cows are less affected by heat stress than larger breeds such as the Holstein Friesian.

Discussion and Conclusions

The results of this study should be considered as preliminary findings regarding the behaviour of dairy cattle in the pasture. The SensOor system was never previously validated for cows grazing on pasture. Our results indicate that the SensOor equipment is a useful instrument for farmers and researchers when cows are out on pasture. Our findings of differences in grazing behaviour between the DF and HF breed indicate a very interesting case, do DF cows have less heat stress than HF cows and because of this, do they have a higher intake of roughage during more humid and warmer days? These results are from a very small number of cows and only five days of observations. In 2017, we will gather more data on this aspect to look for differences between breeds and also within breeds. When differences within breeds is the case, probably this can be used for the selection of better grazing behaviour.

Further research will also include the correlation between the eating/grazing and/or the real intake of grass in kg during grazing of a cow. Collecting data on this aspect has always been very difficult and expensive (Oldenbroek and Van Eldik 1980). If SensOor can also be used for the selection of better grazing cows that have a higher intake of grass, this can be used in selective breeding. Within the 2-ORG-COW project we now plan a study to measure the total amount of grass intake after a cow has been actively grazing for a certain time. In spring 2017 individual cows will be followed in the pasture and before and after active grazing the cows will be weighed on a portable scale to measure the gain in body weight. The results of this study will be presented at the IFOAM OWC 2017 in New Delhi, India.

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Organic Breeding of Laying Hens, the Vredelinger

Wytze J. Nauta¹, Wim Vredevoogd

Key words: organic breeding, laying hens, dual purpose, purebred

Abstract

The organic poultry sector is entirely dependent upon conventional breeding companies for breeding stock. The multinational breeding companies are not equipped to set up small breeding schemes for organic production only. Therefore in 2009 we launched a breeding project with hybrids aimed at developing a new breed. Resulting in a new breed, the Vredelinger, with black and white feathers (Sussex like), 2145g body weight, a laying percentage of 72% and light brown eggs of 58-60 g average. Cockerels grow to 1.2 kg slaughtered weight in 16-18 weeks. The breeding is based on kinship breeding and the focus is now on building up breeding groups in different urban areas and selling meat and eggs as niche products and premium prices. Later on, the goal is to sell the new breed to larger scale farms. Selection on performance is important. The breeding of this new dual purpose breed may become a solution for the killing of too many one-day-old cockerels.

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Introduction

The organic poultry sector is entirely dependent upon conventional breeding companies that produce special layer or broiler hybrids for free-range and organic poultry farms. The pure, inbred lines on which these hybrids are based are not kept in organic conditions, nor are they selected in organic farming systems. To develop breeds that suit organic production, a selective breeding scheme under organic conditions is needed. The multinational breeding companies are not equipped to set up small breeding schemes for organic production only. Several farmers and institutes are trying to breed a native breed or crossbreed layer for organic systems (Fibl, 1998; Günther, 2017), however egg production levels are often too low. Traditional, native breeds lack productivity, since they have been bred only for hobby and shows, not for commercial production. Egg production of such breeds is usually less than 150 eggs per year, while at least 260 eggs per year is necessary for commercial viability (Maurer et al., 1998). Therefore in 2009 we launched a breeding scheme with hybrids aimed at developing a new breed with a high genetic potential for production (Nauta, 2014). We selected hybrid hens and roosters from the brands Lowman Brown, Silvernick and Amberlink and also two purebred Sussex and Haghewheyder roosters. With these animals five separate families were formed and we started breeding with these families according to the kinship breeding system (Nauta et al., 2005).

Results

>> Performance <<

At the main breeding unit in Amersfoort, the five families are housed separately. In 2017 the 11th generation was reached and this new breed was named "Vredelinger". The base families consist of 12-18 hens and 2 roosters. The breeding goal is a robust dual-purpose laying hen and cockerels that are suited for meat production. The layers must produce at least 250 eggs per year in their first laying period and be able to be used for more laying periods. Robustness must result in low disease incidence and low mortality. Egg quality must be good and the colour of the eggs brown.

The hens' average egg production is 72%, or about 250 eggs/year (Table 1). The eggs are (light) brown and weigh 58-60 grams on average. Hens have an average weight of 2145 grams. Surplus cockerels are raised for meat. They consume up to 8 kg feed and reach an average slaughtered weight of 1283 grams in 18 weeks.

>> Breeding groups <<

Currently, groups of 50-100 hens with 5-10 roosters from each of the different families are produced for other farms in the Netherlands, resulting in different regional breeding groups.

Table 1: Overview of performance of the 10th generation Vredelingers

Breeding stock 2016-2017: 77 hens and 10 roosters and surplus cockerels	
Body weight hens:	2145 g (s.d. 240)
Body weight roosters:	3256 g
Average production:	72% (55 eggs/day)
Average egg weight	58-60 g
Colour of eggs:	light brown to brown
Slaughter weight surplus cockerels 18 weeks:	1283 g (s.d. 250)

This breeding project mainly serves small-scale, multifunctional farms with secondary activities such as social care, local food production/consumption cycles and recreation. Such farms are often situated close to urban areas. We are now developing breeding groups around Amsterdam, Rotterdam, Zwolle and Amersfoort. The chickens provide the farms with fresh eggs and meat. Caring for the animals is also a therapeutic activity for social care clients. Moreover, farm animals enhance visitors' and clients' farm experience. In particular, the raising of young chicks to mature layers and roosters enables such farms to engage more with organic principles.

With this breeding approach, we spread the risk of losing animals due to diseases like avian influenza. If there is an outbreak in one area, we will not lose all the genetics. Currently the whole population consists of 1200 birds spread over 25 farms in the Netherlands.

>> Economics <<

The focus is firstly on small-scale production and niche markets. For example, a system of 100 layers per farm, producing around 25,550 eggs (70%) a year. At a retail price of €0.25, this results in €6387 per year. Costs depend greatly on the way the hens are fed, housed and who is doing the labour. If purchased, the feed for the hens costs about €2000 (3.65 tonnes at €0.55/kg). However, other feed stuff from the farm can be fed as well, such as farm grown cereals and wastes from gardening and so on. The average labour requirement is 30 minutes per day. Every year, new young stock must be raised – incubation of 300 brooding eggs will result in enough replacement animals. The profit of the meat production pays for the raising of the hens. The young layers replace their parents, which can be slaughtered and sold as soup chickens. Again, production costs greatly depend on the situation at the farm: is surplus housing, available for raising the animals, are there people to care for the animals, is there alternative feed, waste products for feeding available etc? Will the products be sold at the farm gate or by retailers?

Other aspects that can be taken into account are the added value of having chickens on a multifunctional farm. For example, what is therapeutic benefit of the chickens?

Discussion

Organic animal breeding is of concern to many organic poultry farmers (Nauta et al, 2003). However, they can only buy new layers of a certain 'brand' that is offered by a supplier. These hens are raised under organic conditions but the parents of the hens, the breeding stock, are not kept under organic conditions, i.e. outdoor access, organic feed, organic management. To meet consumers' expectations, selection and breeding of layers should also become certified organic. However, economically, a lower production of the hens is not feasible in large-scale specialised operations (Nauta et al., 2003). The situation is different for small-scale multifunctional farms where the laying hens serve multiple purposes besides production and eggs are sold as a niche product. At such farms chickens are often kept in a mobile henhouse in the field with dairy cows (Joel Salatin, p.c.), where they eat insects and larvae and spread the cows' manure. Such farmers see the added value of chickens that are organically bred, are raised on the farm and become part of the system. Consumers, too, recognise this added value for which they are willing to pay more. This is the reason why this breeding project first focuses on this type of farm. Step by step, the Vredelinger breed will be integrated and become better known in the sector. At a later stage, we hope to supply this breed to larger farms, but this will require more research and a different approach to the markets on the part of those farmers.

Production and quality of the eggs is an important issue in selection. During breeding of the first 11 generations, we selected for egg production only on the female side by brooding only the best quality eggs from a collection period of no more than 12 days. In this way, the most productive

hens with the best eggs automatically gained more influence. However, more individual selection of hens is needed. Roosters from the best hens must be selected for breeding the next generation. However, what is the optimum production level of laying hens? With selection we must seek to maintain production at a level of at least 70-75% or 250 eggs per year to keep up profitability (Maurer et al., 1998).

Another issue that must be discussed is the matter of surplus cockerels, the brothers of all the laying hens. In the 1960s breeding companies started separate breeding schemes for layers and broilers. This resulted in the killing of all one-day-old male chicks (Leenstra et al., 2010). In our project we decided to keep the cockerels and raise them for meat, thus breeding a dual-purpose breed. These cockerels, however, can never compete with organic broilers that grow in twelve weeks to about 2 kg live weight (Leenstra, 2010). More genetic predisposition for meat will lead to lower egg production. Further, there is not a big enough market for the meat of all surplus cockerels. A solution to this could be using the layers for two or even three laying periods. This will result in fewer surplus cockerels.

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An investigation into organic milk and dairy production and utilization by Raen nomads in southern Iran

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Key words: nomad, goats; sheep, milk, dairy products

Abstract

Investigations into livestock products of Raen nomads in Baft city of Kerman province in southern Iran indicated that milk production can be innovatively considered as organic or beyond for ethical aspects. Results showed that of the total milk produced, about 5% is processed into butter, 5% into ghee, 31% into local cheese and the rest is either drunk fresh or processed into other products. Nomads process the milk into butter and yoghurt for immediate use, and ghee and hard, dry curds for storage. Animal rennet is added to heated milk to make cheese.

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Introduction

Nomadic farming systems of Iran with well-diversified livestock populations in terms of species, breeds less susceptible to diseases and stress, are ideal for organic livestock production. In addition, the use of limited external inputs including those for animal production and maximum on-farm reliance brings this extensive farming system even closer to organic systems. The nomadic pastoralist system of Baft is characterised by low population density, self-reliance on basic needs, and movement of livestock between grazing sites in different seasons. Currently, data on nomadic pastoralist organic production of Iran is very limited. Accordingly, the present work was designed to investigate organic production of milk and dairy products and its utilization in the nomadic region of Baft city in Kerman province of Iran.

Material and methods

This study was undertaken in the nomadic regions of Baft city in southern Kerman province of Iran. Kerman province is a highland region 2,270 metres above sea level with a latitude of 29°17'N, longitude of 56°36'E and <250 mm annual rainfall. Summer is hot and dry (up to 35 °C), and winter is moderate. This region has two main livestock breeds: the Raeini goat (Ansari-Renani et al. 2012, 2013) and the Kermani sheep. Thirty nomad settlements, belonging to the Siahjel sub-tribe of the Raen tribe, were chosen at random within ± 20 km of Baft. A structured questionnaire was completed for each individual nomad family. Final information was gathered primarily through in-depth interviews with nomadic men and women livestock producers and also with specialist and field observations.

Results and discussion

The results showed a high percentage of Does in different herds (Table 1) and this is a strong indicator that milk production is a major reason for goat-rearing among nomadic goat farmers.

Table 1. Ranking in descending order of importance of keeping goats.

Reasons	Bucks		Does	
	Ranking	% of importance	Ranking	% of importance
Cashmere production	6	33	7	25
Milk production	-	-	6	21
Selling and meat Consumption	5	27	5	18
Breeding	4	20	4	14
Wealth, status and saving	3	13	3	15
Social activities	2	5	2	5
Cashmere production	6	33	7	25

Of the total milk produced, about 5% is processed into butter, 5% into ghee, 31% into local cheese and the rest is either drunk fresh or processed into other products. Milk among Raen nomads is processed in several stages (Figure 1).

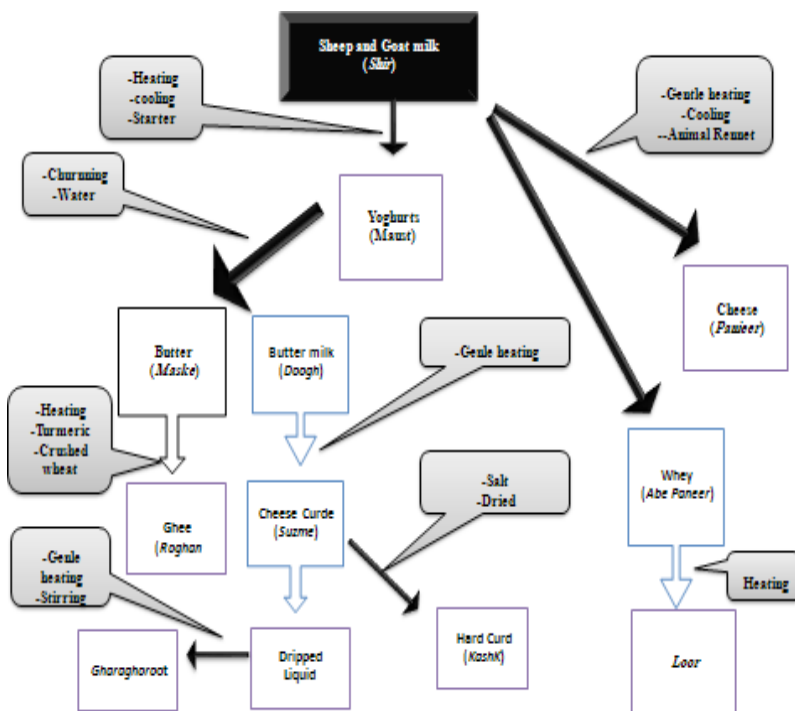
First, milk is simply filtered into a pot and heated and allowed to cool. Then, a small amount of yoghurt is added to the cooled milk as a starter. Yoghurt (Maust) is transferred to an inverted cattle or sheep skin bag (Toolom or Mashk) which acts as a churn. Water is added to the churn containing yoghurt at a ratio of 1:1. The churn is then suspended by a tripod and rocked back and forth until butter granules form. The butter (Maske) can be scooped out by hand or the buttermilk can be

drained off by pouring. After removal of the butter, the remaining buttermilk (Doogh) may be consumed or further processed into hard, white cheese curds.

Buttermilk is placed in a pot and gently heated on a low flame to make cheese curds (Suzmeh). Curds are put into a porous textile cloth sac and kneaded with a handful of salt while the remaining liquid continues to drip out. The curds (Kashk or Ghoroot) are shaped into balls, sun-dried and stored and becomes rock-hard with time. Dripped liquid can be heated while stirring with a wooden scoop to produce a soured brownish substance called Gharaghoroot, which is used as a paste for making stew. Ghee or clarified butter is made by removing most of the water from butter by gently heating the butter and stirring it continuously in a pot to which salt and turmeric are added.

To make cheese (Paneer), milk is placed in a pot and gently heated on a low flame. Animal Rennet made locally is added to the heated milk. Milk is allowed to coagulate at room temperature overnight. Whey is placed in a pot and gently heated to make Loor which can be consumed for breakfast.

Figure 1: Steps in processing milk into yoghurt, butter, curds, cheese, *gharaghoroot*, loor and ghee. Words in *italic* are local terms



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Validating Indigenous Technical Knowledge (ITK) for management of mastitis in dairy animals of Uttar Pradesh, India

Reena Mukherjee¹ & U. K. De²

Key words: Mastitis, Indigenous Technical Knowledge, dairy cattle, India

Abstract

Indigenous Traditional knowledge (ITK) and a large number of associated traditional practices are in use for treatment and management of different disease conditions of animals all over the world. In India too, large number of ethno-veterinary practices including for mastitis are used for animal health care, reproductive disorders, internal and external parasites, skin ailments and debility etc. Validation of some of the traditional practices used for these conditions has indicated their potential value, especially as an adjunct therapy. Such ITK, however, need to be properly collected, documented, validated, standardized for therapeutic effects, including the side effects, following thorough scientific procedures as described in this paper.

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Introduction

Ethnoveterinary medicine practices cover the knowledge gathered by the people as they care for their animals and keep them healthy. The knowledge is acquired through practical experiences and has traditionally been passed down orally from generation to generation. Ethnoveterinary practices using plant products and local household practices are often effective against some diseases and are available to the villagers as the only source of treatment (Chander and Mukherjee, 1994).

The developing countries like India have huge reservoir of ITK for a variety of diseases, pests and parasites, which need to be properly documented and validated for their efficacy, side effects, cost effectiveness and environmental implications and should be given to animals only on the advice of the qualified veterinarian. Some herbal preparations have shown promising results against infectious agents, thus, were reviewed by the author (Mukherjee, 2001 & 2001a) especially in context of mastitis in dairy herds. The validated ITK may prove to be boon to organic production systems, where, many conventional treatments including antibiotic therapies are restricted (Mukherjee & Chander, 2005). The authors were involved in one such validation exercise on collection, documentation and validation of ITK.

Material and methods

Validation of ITK by Quantification of Indigenous Knowledge (QulK) & Experimental studies

Field Validation of traditional veterinary practice was done by experienced persons through QulK technique (De Villers, 1996). In QulK, matrix ranking is combined with an interview designed to elicit numerical data from experienced farmers. Quantitative data was obtained through preliminary discussions with farmers and respondents were asked to evaluate the ITK in comparison with modern veterinary drugs (MVD) for its performance on different criteria i.e. cost effectiveness, quickness in healing, ease of preparation, side effect and availability.

Experimental studies

In phase I, 9 cows and 6 buffaloes were taken from a commercial dairy farm. In Phase II, 15 lactating cows (5 Clinical cases, 9 Sub-clinical cases) were taken. The stem part of *Azadirachta indica* and green leaves of *Chenopodium album* were washed under running water and made to a fine paste in the mechanical grinder. The paste was then put in a closed container for 48 – 72 hours for fermentation. Nine hundred grams of leaf paste /cow was thoroughly applied over the quarters and teats of the diseased udder once daily for 7 to 9 days depending upon the clinical recovery. 10 ml. of milk was collected in sterile tubes before initiation of the treatment and 10 days post treatment (PT). The California Mastitis Test (CMT) point score, Somatic Cell Count (SCC) and bacterial isolation in response to *C. album* treatment in lactating cows was observed.

Results and Discussion


There was significant reduction of SCC and Total Bacterial Count (TBC) 10 days post treatment indicating the therapeutic effect of *Azadirachta indica* against mastitis in lactating cattle and buffaloes. Many investigators have observed lymphoproliferation, enhanced production of interleukins and enhanced immunomodulation in mice model treated with *A. indica* (Upadhyay et al. 1992).

C. album: No literature was available on use of *Chenopodium* to control mastitis. The use of *C. album* was restricted to only a few farmers having only 2-3 animals, since, it was effective only in early stages of mastitis and its role was limited to only reduction in swelling. The QulK study revealed that *C. album* was not as effective as the allopathic and homeopathic medicines, but given its locally

available low cost technology nature, it may be quite useful under the circumstances, where the farmers do not have readily available modern drugs for the disease. Besides, this may not have side effects usually associated with many allopathic medicines, especially the antibiotics that are commonly used in case of bovine mastitis. The paste of *C. album* reduced the edematous swelling in the infected gland and it also reduced the blood in the milk. The efficacy of the paste increased when used along with lime and Vitamin E/ Selenium in case of clinical mastitis.

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Managing Mastitis through a Validated Ethnoveterinary Herbal preparation for Organic Milk Production

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Key words: Mastitis, EVM, PHC in livestock, herbs, organic and clean milk

Abstract

Indian farmers have long been using ethnoveterinary medicine (EVM) for organic livestock production. Since 2002, Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), India has had government funded programmes to train farmers and veterinarians in EVM. The results of EVM herbal treatments (Aloe, turmeric and lime) used by farmers and veterinarians in managing mastitis have been remarkable at multiple locations. The herbal combination has been successfully tested in-vitro for anti-inflammatory and antimicrobial activities in the laboratory. The recipe has been cross validated clinically across India in the EVM network programme of the Indian Council of Agricultural Research Herbal resources for EVM are available locally making the farmers self-reliant in livestock primary health care (PHC).

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Acknowledgments

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Introduction

A variety of synthetic antimicrobials are extensively used to treat mastitis, but no parenteral antimicrobial has yet been found to have favourable pharmacokinetics into the udder. The efficacy of intramammary infusion is also questionable, since it may introduce new infection or may not diffuse well into the interstitial tissue (Hillerton and Berry, 2005).

Since 2007 TANUVAS has been associated with the Trans Disciplinary University, FRLHT, Bangalore, India, working towards mainstreaming EVM into veterinary curriculum and research.

As of 2016, forty veterinarians have completed the post graduate diploma in EVP, including university faculty and field vets from three southern states of India. Over the span of a decade thousands of farmers and hundreds of veterinarians have been trained to use EVM in a standalone mode to treat mastitis, wounds, rumen disorders, parasitism, reproductive disorders and Foot and Mouth disease.

Material and methods

The pathobiology of the mastitis-affected udder requires powerful antimicrobial and anti-inflammatory therapy, free from the adverse effects of synthetic drugs, such as drug residues in milk and antimicrobial resistance. The *in-vitro* anti-inflammatory and antimicrobial validations of the ethnoveterinary antimastitis herbal preparation containing *Aloe vera*, *Curcuma longa* and Calcium oxide were carried out as described below.

Determination of antimicrobial activity:

The agar well diffusion method was used to determine the antimicrobial activity of the fresh anti-mastitis herbal preparations against *Escherichia coli* (*E.coli*), *Staphylococcus aureus* (*S. aureus*) and *Pseudomonas aeruginosa* (*P. aeruginosa*). MacConkey agar, nutrient agar and eosin methylene blue agar plates were streaked using a sterile wire loop. Wells were made in each of the plates using a sterile cork borer. Approximately 100µl of different concentrations of the solvent extracts (30,20,20,5 and 2.5 mg/ml) of fresh anti-mastitis herbal preparations were added. Control experiments comprised DMSO 5% (Negative control) and Ciprofloxacin / Tetracycline (Positive control). The plates were incubated at 37 C for 18-24 hrs.

Xanthine oxidase inhibition assay for anti inflammatory activity;

Using the procedure of Kristanty et al (2012) with modifications, the following solutions were prepared for the assay. A solution of xanthine as a substrate, a solution of xanthine oxidase and a sample solution. Test solutions were obtained by dissolving DMSO at the concentration of (100,200,300 µgm). Each 1.0 ml of the sample was transferred in to a separate reaction tube, and added with 2.9 ml of phosphate buffer solution, and 2 ml of xanthine and then pre incubated at a temperature of 30 °C for 10 minutes. Xanthine oxidase 0.1U/ml was added and incubated at a temperature of 30°C for 30 minutes. After the incubation period, 1.0 ml of 1N hydrochloric acid was added immediately into the mixture to stop the reaction and homogenized. Absorbance was measured at 295nm in triplicate.

Field results were collated from treatments given at Sabar Dairy Gujarat to quantify the *in vivo* success of the EVM remedy.

Results

The minimum inhibitory concentration of extracts of fresh anti-mastitis herbal preparation against *E.coli*, *S. aureus* and *P. aeruginosa* was determined. The preparation showed antimicrobial activity against the common microbes such as staphylococci, pseudomonads and *E. coli*. Among those, *E. coli* was very susceptible to aqueous and ethyl acetate extracts of the herbal preparation at 5mg/ml concentration as shown in Table 1.

Table 1: Minimum inhibitory concentration of extracts of fresh anti-mastitis herbal preparation against *E.coli*, *S. aureus* and *P. aeruginosa*

Minimum inhibitory concentration (mg/ml)			
Organisms	Aqueous extract	Ethanol extract	Ethyl acetate extract
<i>E.coli</i>	05	10	05
<i>S.aureus</i>	20	20	20
<i>P.aeruginosa</i>	20	10	05

For the *in-vitro* anti-inflammatory bio assay the antimastitis herbal preparation was subjected to xanthine oxidase inhibitory activity. The results given in Table 2, show that the ethanol extract exhibited the highest activity in a dose dependent manner.

Table 2: Inhibition of xanthine oxidase activity – fresh herbal formulation

Extracts	Percentage inhibition		
	100 µg/ml	200 µg/ml	300 µg/ml
Aqueous	64.47±10.4 ^a	65.69±1.0 ^b	71.2±6.2 ^b
Ethanol	79.2±5.5 ^a	86.48±1.77 ^a	90.64±3.1 ^a
Ethyl Acetate	59.13±12.83 ^b	63.43±8.8 ^b	72.15±5.44 ^b
Allopurinol	84.15±2.5 ^a	86.89±1.6 ^a	94.5±2.5 ^a

All values are Mean ± SD of three replicates. Values with different superscripts on the same column are significantly ($p < 0.05$) different

The results of treatments given to cattle at Sabar Dairy in Gujarat are given in Table 3

Table 3: Use of fresh EVM recipe-Data from Sabar Dairy,Gujarat,2016

Mastitis type	No of animals treated	Recovery status				
		Complete	%	Partial	%	Not recovered
Acute	223	199	89	18	8	6
Chronic	10	4	40	6	60	0
Sub clinical	8	6	75			2


Discussion

The anti-mastitis herbal preparation revealed anti-inflammatory and broad spectrum antimicrobial activity under *in-vitro* conditions in our study, justifying its clinical success in acute clinical mastitis (Mariappan and Shanthi, 2012; Sawant and Godghate, 2013; Mekala et al 2015, Nair et al 2015; Punniamurthy and Nair, 2016). In the xanthine oxidase inhibitory activity test, the ethanol extract exhibited inhibitory activity comparable to that of the standard as reported elsewhere (Akram et al., 2014).

In India, EVM is increasingly being taken up as a clinical modality and academic research is growing. The Ethnoveterinary herbal formulation (*Aloe vera*, *Curcuma longa* and Calcium hydroxide) was clinically evaluated and found effective against mastitis in a stand-alone mode i.e. without antibiotics and anti-inflammatory drugs. The recipe was subjected to phytochemical evaluation and reverse pharmacology to validate antimicrobial and anti-inflammatory activities necessary for clinical success in the field. The anti-mastitis herbal preparation revealed antimicrobial and anti-inflammatory activity under *in vitro* conditions. The study proved that the traditional wisdom on herbal medicine is rational, safe, cost effective and clinically successful. Many traditional recipes of EVM (mostly containing herbal materials) practiced over hundreds of years could be potentially effective in therapeutic situations in livestock rearing. EVM can reduce the use of antibiotics and chemicals, facilitating organic milk production. The animal health group of the National Dairy Development Board (NDDB) of India, has uploaded a video on EVM for mastitis to You tube: Ethno Veterinary Medicine Mastitis Therapy; June 15, 2016.

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Prevention of mastitis in cattle during dry period using an Ayurveda formulation – A pilot study

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Key words: Veterinary Ayurveda, Ethnoveterinary Practices, Dry cow therapy, Organic milk, Mastitis

Abstract

Bovine mastitis is one of the important production diseases of dairy animals which affect the economy of the farmers. A dry period of at least 40 days is needed to achieve optimal milk production. If it is shorter than 40 days, milk production will be reduced. This period allows the lining of the udder to be repaired and restored, so that when lactation starts again, milk production is optimal. Dry cow therapy generally involves use of intra-mammary antibiotics. The present study aimed to assess the efficacy of Ayurveda formulations in the prevention of mastitis during the dry period under field conditions in comparison with regular antibiotics therapy.

The study area was the north Bangalore, KMF, India. Group I: A Standard modern veterinary drug preparation (Dry cow therapy) – Ampiclox (Ampicillin+Cloxacillin) in oil base. Group II: Ayurveda formulation and Group III: Control. The Observations included physical changes such as swelling of quarters, colour, odor and consistency of milk. The milk was tested for pH and Somatic cell count (SCC). Collection of milk samples was done on the following days: Day -0(Partial weaning), Day -15(complete weaning), Day of calving and 5th day after calving.

The pilot study indicated the positive impact of the Ayurvedic herbal intervention in the quality of milk produced. The use of the natural plant based formulation helped to contain the microbial infection of the udder during the crucial dry period. The data showed a comparatively better activity of the herbal formulation than the regular antibiotic dry cow therapy, in terms of restoring optimal pH and SCC of the milk during early lactation. This finding suggests an elaborate study to confirm the possibility of avoiding antibiotics in dry cow therapy to enable organic milk production.



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Introduction

Bovine mastitis is one of the important production diseases of dairy animals which directly or indirectly affect the economy of the farmers and ultimately affect the economy of the country. Despite this fact, where state or provincial census data are available, herd prevalence levels range from 11% (Alberta, 1991) to 47% (Vermont, 1985)¹. The dairy industry in particular, plays a strong role for the livelihood of poor people because the availability of agricultural land is shrinking and farmers are increasingly dependent upon the dairy sector. The livestock capital as part of the overall agricultural capital amounts to more than a quarter. Estimated losses of \$200/cow/year on average is 12% of what: Direct losses from clinical mastitis, 17%; Lost milk due to elevated SCC, 35%; Excess culling and death, 36%; Price reduction with elevated SCC (Fetrow et al., 2000).

Ethno-veterinary practice (EVP)² or Ayurveda can address the current problem through intervention, preventing the mastitis during the dry period. EVP has decentralized local resource based applications which are both safe, efficacious & have much fewer adverse effects in the animals³. The objective of the current study is to assess the efficacy of ethno veterinary formulations in prevention of mastitis during dry period under field conditions.

Material and methods

The present study was conducted in North Bangalore, (BAMUL) of KMF.

Sample design: Simple random design techniques were used to allocate the animals for each group. The selection of animals was based on exclusion and inclusion criteria. Informed consent was taken from the owner of the animals. The study period was 45 days plus 5 days after lactation

<i>Inclusion criteria</i>	<i>Exclusion criteria</i>
Breed of the animal: cross breed	Native breeds
Age of the animal: greater than 3 years	Less than 3 years
Calving status: first calving onwards	First calving and after 5 calving

Parameters for Assessment

1. Milk	2. Nature of udder
Color	Swelling/Hard mass
Consistency	Tenderness
pH	
Somatic cell count	

Table 1: Study grouping

SL No	Group Number	Drug Intervention	No of Animals	Dose
1	I	Ayurveda (Ethnoveterinary) Formulation For single day application	20	250 gms of <i>Aloe vera</i> 50 gms of <i>Curcuma longa</i> 10 gms of <i>calcium hydroxide</i>
2	II	Modern Medicine (Dry cow therapy) Ampiclox oil base	20	Single Dose
3	III	Control	20	NA

Method application of and drug preparation:

The Ayurveda (Ethnoveterinary) formulation consisting of *Aloe vera* 250 gm, *Curcuma longa* 50 gm and *Calcium hydroxide*.

Preparation: Take 250 gm of *Aloe vera* fresh leaves clean with fresh water, remove the thorns and the sides of the leaf blade and cut into small pieces, add 50 gm *Curcuma longa* powder to it and 10 gm *Calcium hydroxide*, grind well without adding any water. Divide the paste into two parts. Take one part of the paste, add 500 ml of water and stir well so that the ingredients are well-mixed. Clean the udder with fresh water and apply this watery paste across the udder with gentle massage. The prepared medicine is applied twice a day, once in the morning and once in the evening. The evening application is carried out with the remaining one part adding 500 ml of water to the paste, preparing a watery solution and applying on the udder as above, through the dry period.

The antibiotic group was treated with Ampiclox (Ampicillin+Cloxacillin) in an oil base. The drug is inoculated intramammary and retained throughout the dry period. The control group was not treated with any type of medication

Method of milk sample collection:

- Day -0 (Partial drying off)
- Day - 15(Complete drying off)
- Day of calving
- 5th day after calving.

Results

A Comparative three group controlled field level study. Milk colour and consistency: the colour of the milk was normal on partial day of drying in all the three groups. On complete drying day, there was a slight change in the colour of two animals in the control groups. On the day of calving there was slight yellowish colour of the milk in the animals of all groups, but after 5th day of calving the colour and consistency was normal in EVP group. The nature of the udder was very soft and no hard mass felt during the intervention and post intervention in EVP group. In the antibiotic group there were slight changes in the contour of the udder on two days prior to calving in three animals and on the day of calving in two animals.

Table 1: Comparison of pH and SCC in three groups studied

	EVP group (I)	Antibiotic group(II)	Control group(III)	P value	EVP vs. Antibiotic
pH	5.69±0.80	6.18±0.77	5.43±0.72	<0.001**	<0.001**
SCC	1.48±0.74	1.60±0.61	2.08±1.06	<0.001**	0.628

SCC is significantly less in EVP compared to Control and Antibiotic. pH is significantly less in EVP (5.69) compared to 6.18 in Antibiotics group with P<0.001**.

The comparison of SCC and milk pH in the different groups (Tables 2 &3), showed significantly low(P<0.001**) SCC and milk pH in Group I (EVP) compared to group II (antibiotic)

Table 2: Comparison of variables in three groups studied: Day of partial drying

Day of partial drying	EVP group (I)	Antibiotic group (II)	Control group (III)	Total	P value
pH	6.16±0.67	6.83±0.30	5.48±0.79	6.16±0.83	<0.001**
SCC	2.00±1.17	1.33±0.57	1.68±0.85	1.67±0.92	0.069+

Table 3: Comparison of variables in three groups studied: Day of complete drying

Day of complete drying	EVP group (I)	Antibiotic group (II)	Control group (III)	Total	P value
pH	5.66±0.83	6.69±0.63	5.56±0.71	5.97±0.88	<0.001**
SCC	1.48±0.55	1.50±0.69	2.13±1.37	1.70±0.97	0.054+

Table 4: Comparison of variables in three groups studied: Day of Calving

Day of Calving	EVP group (I)	Antibiotic group (II)	Control group (III)	Total	P value
pH	5.51±0.76	5.67±0.60	5.31±0.63	5.50±0.67	0.240
SCC	1.25±0.34	1.90±0.60	2.15±0.95	1.77±0.77	<0.001**

Table 5: Comparison of variables in three groups studied: 5th day of calving

5th day of calving	EVP group (I)	Antibiotic group (II)	Control group (III)	Total	P value
pH	5.45±0.79	5.53±0.45	5.36±0.76	5.44±0.67	0.747
SCC	1.18±0.24	1.65±0.46	2.35±0.95	1.73±0.78	<0.001**

Chi square tests also indicated significantly lower SCC and milk pH in group I compared to Group II (table 1). Comparison of milk pH and SCC at different time periods, showed that on the day of partial drying, significantly higher SCC and pH in group I (table 2) and day of complete drying (table 3), on day of calving and 5th day calving has less SCC and pH (table 4 &5). The pH has linear trend of decreasing with increasing day of drying. (Table no 2,3,4 &5).

The study revealed better response in reduction of milk pH and SCC in EVP group compared to standard treatment with antibiotic.

The Ethnoveterinary preparation used as a dry cow therapy was found to be effective in preventing mastitis was it or was it effective in lowering SCC and pH.

The efficacy of the Ethnoveterinary formulation consisting of *Aloe vera*, *Curcuma longa* and *Calcium hydroxide* is likely due to the rational combination of the herbs and healing properties of these herbs. This formulation improves the status of metabolism (Agni deepana), cleanses the toxins of whole animal and the udder (Ama pachana), pacifies the aggravated Pitta dosha and Raktha dooshya⁵ (Pitta and Raktha Shamaka), cleanses the channels of lactiferous glands (Srotoshodaka). Cleanses the wounds of Lactiferous glands (Vrana shodaka and ropaka), pacifies the inflammation due to Infection (Shothahara) and Decreases the microbial load (Krimihara). Many research articles have confirmed the pharmacological activities of these herbs and their anti-inflammatory⁶, antimicrobial, analgesic and galactopurifying actions.

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Capacity Building of field veterinarians and farmers for Organic dairy development

Subrahmanyeswari Bodapati¹

Key words: perception, organic dairy standards, information needs, empowerment, stakeholders

Abstract

India is already leading in high value organic crops and is also keen to promote organic animal husbandry due to rising global demand for the organic livestock products. However, the standards are not yet known to the stakeholders indicating the need for the capacity building. Organic producers need to be familiar with livestock standards, well versed in good livestock production practices and regulatory requirements applicable to production prescribed by the designated authorities such as APEDA, BIS, FSSAI etc. Organic crop producers in India often also maintain some livestock and many would like to venture into livestock production. This drives a need for empowered advisors about organic livestock production. A study in Andhra Pradesh emphasized the need of capacity building of both the field veterinarians and farmers who had medium perception towards the organic dairy standards. This paper, thus, deals with the need and the means of empowering the main stakeholders of organic dairy production.

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Introduction

Organic agriculture has been rapidly growing around the world including in India where the main focus is on high value crops having export potential. The Government of India is keen to promote organic animal husbandry and the livestock standards were notified in 2015, however, the standards are not yet commonly known indicating the need for capacity building of the main stakeholders (Subrahmanyeswari & Mahesh Chander 2015). Organic production systems are knowledge intensive, where the producers need to be knowledgeable about production and processing norms prescribed and approved by the authorities such as APEDA, BIS, FSSAI, etc. The farmers producing organic crop products would like to venture into livestock production too, as their livestock production systems are more or less organic by default. This expansion of organic livestock production creates a need for empowered information providers who are knowledgeable about organic livestock standards. Thus this paper deals with the needs and capacity building requirements of the main stakeholders of organic dairy production.

Material for the case report

Secondary data was taken from the reports of the research that have been conducted in the state of Uttarakhand among 180 registered organic farmers of Uttarakhand Organic Commodity Board (UOCB) through direct interview during doctoral dissertation work by the author during 2006. Further research work done among 60 dairy farmers who are the organic crop cultivators and 60 veterinarians by a post-graduate student under the guidance of the author in 2016 in the state of Andhra Pradesh. In the state of Uttarakhand, organic farming is being promoted systematically by the Uttarakhand Organic Commodity Board through formation of organic producer groups, whereas, in Andhra Pradesh, organic farming is being taken up by farmers through formation of association at various levels with the encouragement by both government and non-government organizations. In both the states, farmers can market organic crop produce and would also like to venture into organic dairy farming, but this development requires support and capacity building at various levels. The study in Andhra Pradesh emphasized the need for capacity building of both the field veterinarians and the farmers who had medium level of knowledge about the organic dairy standards (Naidu baadireddy, 2017).

The studies revealed that the majority of farmers were motivated by the values of organic farming due to their similarity with the Indian traditional farming system. Other reasons for wishing to adopt organic farming were bad experiences with the methods of conventional farming, the price premium for organic products with the rising future market, etc. However, organic farming as a social obligation to produce quality food and as a social status was, among other reasons, also the reason for some farmers to take up organic farming. These farmers are inquisitively looking for guidance with regard to organic dairy farming. The majority of farmers were found to have a favourable perception and attitude towards the organic dairy standards (Subrahmanyeswari 2007), however, they have a low level of knowledge in this area. A majority of farmers expressed information needs in the areas of management of animal in organic systems, preparation of organic balanced ration for dairy animals, animal health management in organic system, processing and packaging of organic livestock products etc.

A study among the veterinarians of Andhra Pradesh revealed a favourable perception of veterinarians towards organic dairy farming. However, they were lacking in knowledge with regard to organic dairy production and were keen to learn and expressed interest to know more about the animal therapy system in organic systems, feeding patterns of animals along with certification and marketing procedures (Naidu baadireddy, 2017).

Discussion and conclusion

The findings of the studies revealed that the organic farmers need to be strengthened through provision of information and practical orientation. This should begin with capacity building of veterinarians, who will be working with farmers at farm level. For promotion of organic dairying, capacity building of two main stakeholders i.e. veterinarians and organic farmers needs to be done at various levels.

Capacity building of veterinarians: the following continuing education programmes need to be carried out through;

1. Regional workshops on organic animal husbandry by Indian Council of Agriculture Research, State Veterinary Universities and other promoting agencies to popularise the concept of organic farming and importance of animals in organic system.
2. Training programmes at various levels.
3. Encouraging veterinarians to document indigenous farming practices of farmers and linking them with research stations for scientific validation for ensuring applicability in organic systems (Mahesh Chander & Subrahmanyeswari 2010).
4. Encouragement to conduct research in organic dairy through public private partnership in the various agro-climatic regions of India.
5. Awareness about the need to conserve germplasm of local breeds, which play a vital role in promotion of organic farming.

Capacity building of organic farmers:

1. Wider awareness creation among the farming community with regard to organic principles and standards.
2. Scientific validation of farmers' indigenous knowledge.
3. Documentation of farmers traditional farm practices.
4. Establishment of demonstration farms about feasibility of organic dairy units at various regional levels.
5. Orienting and training the dairy farmers about organic production and processing.
6. Encouraging farmer to farmer networks for effective dissemination of organic farming practices.
7. Supplementation with information material in the vernacular languages.
8. Provision of incentives to farmers who are conserving native breeds.
9. Production and marketing of dairy products can be encouraged on co-operative lines.

A systematic approach with the main stakeholders will result in development of organic dairy production especially in countries like India, where natural farm resources are abundant and farmers have values that are similar to the principles of organic farming.


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Pastoral Livestock Production in Tanzania Under Threat

- a changing system as an opportunity to go organic -

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Key words: pastoralist eviction, pastoralist-farmer conflict, changing livestock system, organic livestock production

Extended Abstract

Introduction

A large number of pastoral livestock herds were forcibly moved into the study area following a Government eviction order to leave traditional grazing grounds in central Tanzania. The study aimed at understanding the dynamics of forced livestock movements, pastoral livelihoods and resulting potential development options for the livestock sector in the country.

Material and methods

Data were collected through structured interviews from 60 pastoralist families, from native farmers and from Government offices in southern Tanzania and analysed using descriptive statistics. The interviews focussed on (1) the challenges to livestock management after the eviction, (2) the marketing opportunities for livestock products in the new settlement areas and (3) the requirement for a new direction for pastoral livestock production.



The summarised major interview questions were:

1. What challenges and what opportunities exist for livestock production in the new area?
2. What kind of assistance is required from the State to establish livestock production in the new area?
3. What marketing opportunities for the livestock sector can be tapped in the new area?
4. Which support and infrastructure is required to tap potential marketing opportunities?
5. Will your production system face similar situations of resource competition (land related conflicts) as compared to the areas you resided in prior to the eviction?
6. In case it will, which are future options for pastoral livestock production?

Results

The study showed that the pastoral system is hardly able to adapt to the new environment, which is not adequately equipped to support a livestock economy.

However, prior to the arrival of pastoral herds local communities had been prepared. The communities had started formulating land use plans but the quality of those plans and the support to the planning processes was insufficient. The resulting conflicts about grazing grounds, herding routes and water access between crop farmers and livestock herders could not be prevented.

Yet, pastoral livestock herders were actively searching for innovation through, for example, reduction of herd size while simultaneously intensifying production from selected animals. Further on herders tried, sometimes successfully, tapping new meat and milk markets, also using the argument that their products are organic, meaning not contaminated in their understanding.

Discussion and conclusion

The large-scale eviction of pastoral herds is synonymous with the crisis of the pastoral system in the country. The Government aim is for modern livestock production. Modernity in this case means systems based on fossil fuel, external protein inputs, increasing pesticide use for fodder production and increasing use of veterinary drugs.

Pastoral livestock systems in Tanzania and elsewhere are very energy efficient and their environmental services are increasingly recognised.

Such a situation is a challenge for the livelihoods which depend on the current pastoral livestock production pattern, but can also be an opportunity for re-defining livestock production in a more holistic and possibly organic manner. The current low external input system that characterises mobile pastoral livestock production in the country is a favourable basis for a change towards organic livestock production.

The Government of Tanzania is familiar with certified organic production in coffee for which a demand outside the country exists. This is not yet the case for livestock products. However, concerted promotion activities could help to establish a niche market for organic livestock products in the country.

The marketing potential in external markets is not clear. However, a demand for organic livestock products does exist in developed countries and this could be an opportunity for Tanzanian exporters.

Combining and propagating these two significant advantages into a market vision and argument for organic livestock production could offer development chances to the livelihoods of

pastoralists, to the meat export plans of the country and to the landscapes which are challenged by environmental degradation.

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The role of self-sufficiency on the sustainability at organic dairy cow farms in Turkey

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Key words: dairy cows, sustainability, environment, self-sufficiency

Abstract

The aim of the study was to evaluate some of the sustainability parameters on organic dairy cow farms in Turkey. A questionnaire was prepared, and farmers were interviewed face-to-face. A total of eleven farmers from four different cities in Turkey (3 farms from Gümüşhane Kelkit, 1 farm from Çanakkale, 6 farms from Erzurum and 1 farm from Manisa) were chosen to do the survey. These areas have a high potential for organic dairy production in Turkey. There were 5 main themes in the questionnaire. A: Information on survey participant, B: Information about the farm (the size of the farm, the use of land, grazing practices, the quality of land, nutrient flows inside the farm), C: Production on the farm, D: External nutrient inputs and E: Number of animals. After completing the questionnaire, the farms were divided into three groups according how much fodder was sourced on the farm: (GROUP I, own fodder less than 50 %, GROUP II, own fodder 50 % - 75 % and GROUP III, own fodder more than 75 %). The results suggest that in GROUP I there are many more nutrients in inputs (purchased fodder) than in outputs (sold products); GROUP II has a slightly positive nutrient balance and GROUP III is close to balance or even in negative balance. Our preliminary findings, critical from sustainability point of view, are (1) Animals are not grazed at all in GROUP I (2) Maize is grown most in GROUP I, indicating heavy fertilization (3) crop rotation is less diverse in GROUP I than in other groups (4) Positive nutrient balance indicates poor nutrient recycling and high loss potential in GROUP I.

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Introduction

An integrated dairy farming system consists of a range of resource-saving practices. The aim of it is to achieve acceptable profits and high and sustained production levels, while preserving the environment and minimising the negative effects of intensive farming. Based on the principle of enhancing natural biological processes above and below the ground, the integrated system represents a winning combination that increases crop yields, soil biological activity and nutrient recycling; reduces erosion; intensifies land use, improving profits; and can therefore help reduce poverty and malnutrition and strengthen environmental sustainability (Rota and Sperandini, 2010). The increasing pressure on land and the growing demand for livestock products makes it more and more important to ensure the effective use of feed resources, including crop residues in Turkey. Self-sufficiency in feeding has a major impact on sustainability. When fodder is purchased from external sources the source is losing the nutrients and the potential of recycling, thus, nutrients are either being depleted, or scarce supplies are being used. The system receiving purchased fodder has the potential for environmental harm, e.g. eutrophication and this can lead to a severe waste of nutrients. In addition, the imbalance between the land and animals is a potential risk for other environmental problems e.g. poor crop rotation and erosion. The aim of the study was to evaluate organic dairy cow farms in Turkey for some of the sustainability parameters. Sustainability can be assessed in different dimensions. Our study dimension was the role of self-sufficiency and aimed to assess the consequences of different self-sufficiency levels on feeding.

Material and methods

A total of eleven farms from four different cities of Turkey (6 farms from Erzurum, 3 farms from 1 farm from Çanakkale and 1 farm from Manisa) were chosen to do survey (Figure 1). These cities have a high potential for organic dairy production in Turkey. There were 5 main themes in the questionnaire. A: Information on survey participant, B: Information about the farm (the size of the farm, the use of land, grazing practices, the quality of land, and the nutrient flows inside the farm, C: Production on the farm, D: External nutrient inputs and E: Number of animals.

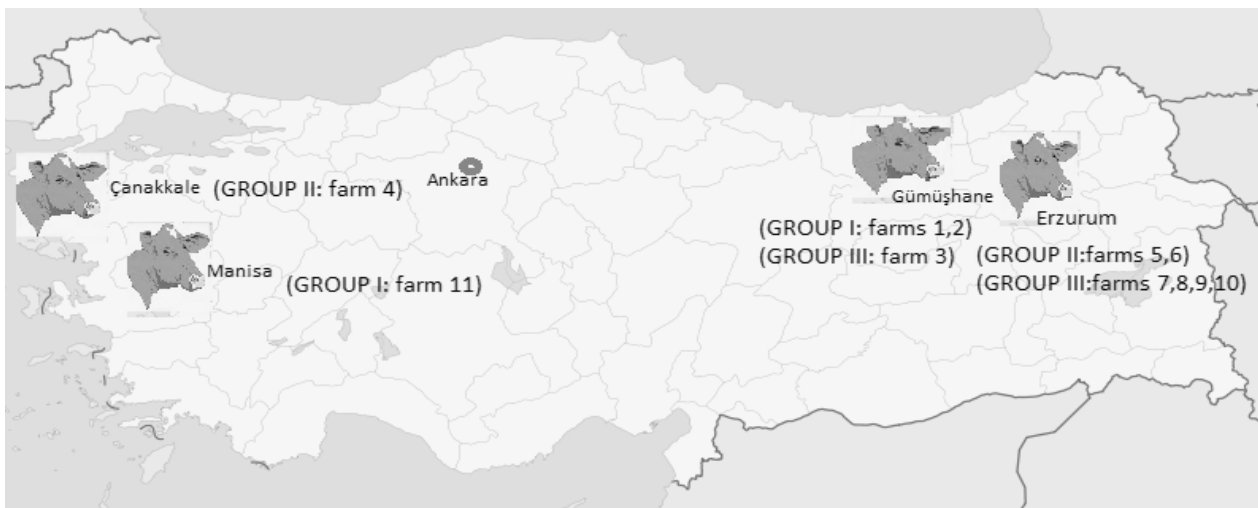


Figure 1: The locations of farms surveyed in Turkey.

The crop yields on the farms were calculated based on the number of animals and animal production (milk, beef). The fodder requirements for dairy cattle were estimated using the following equation:

Dry Matter (DM) intake (kg) = live weight (kg)/40 + milk yield (kg)/10 (Sevgican, 1996). The fodder requirements of young cattle for weight gain were estimated with the help of a constant value: 3250 kg DM/500 kg live weight (Sevgican, 1996).

After the total fodder requirements had been evaluated, they were classified as: grazing, own fodder produced on the farm (excluding grazing) and purchased fodder – all based on the questionnaire. Information about cash crops was also gathered in the questionnaire so cash crops could be excluded from fodder production with respect to area and yield.

Results

The figures in Table 1 indicate the yields in fodder production of the farms.

GROUP I provided less than 50 % (30 – 50 %) of their own fodder. They were large farms (75 – 310 ha) with a high number of cows and high cow density (1.5 – 2.6 cow/ha). There was no grazing at all. Maize and barley were grown as well as legumes (alfalfa, trefoil). No cash crops were grown. Yields were relatively high (5 – 9 t/ha DM) as were milk yields (7 – 9 t/cow). All types of fodder, roughage, concentrate, and protein were purchased.

GROUP II supplied 50 – 75 % of their fodder on-farm. They were large farms (30 – 230 ha) with a high number of cows and a high cow density (1.0 – 2.0 cow/ha). Grazing rate varied (0 – 60 % of total fodder), some cash crops were grown (olives and wheat). Less maize was grown than in GROUP I but similar types of crops are grown. Yield levels were similar to GROUP I (6 – 10 t/ha DM); but milk yields were slightly lower (5 – 8.5 t/cow).

GROUP III grew 75 – 100 % of the fodder on-farm. They were small farms (19 – 105 ha) with a low number of cows; cow density being notably lower than in the other groups (0.4 – 1.0 cow/ha). Grazing was an important feeding strategy on most of the farms. Some cash crops were grown on most of the farms. Fodder crops were similar to the other groups, but maize was only grown on one farm. Yield level was slightly lower than in the other groups (3 – 7 t/ha DM) and milk yields were lower (5 – 7 t/cow).

There was also a positive correlation between cow density and yield level, but a causal connection cannot be proven because of limited data.

Table 1: Characteristics of the farms in each group, mean (range)

	GROUP I, (n=3) own fodder less than 50%	GROUP II, (n=3) own fodder 50 % - 75 %	GROUP III, (n=5) own fodder more than 75%
Own fodder, %	40 (30-50)	70 (70)	90 (80-100)
Field, ha	188 (75-310)	153 (30-230)	44 (19-105)
Cow/ha	2.0 (1.5-2.6)	1.6 (1.0-2.0)	0.7 (0.4-1.0)
Yield* kg DM/ha	6433 (5000-8700)	7267 (5600-10200)	4260 (1800-6500)
Grazing, %	0	22 (0-60)	35 (0-65)
Cash crop,%	0	11 (0-32)	24 (0-42)
Milk yield kg/cow	8167 (7000-9000)	6167 (5000-8500)	5400 (5000-7000)

DM: Dry matter *Yields are excluding grazing and cash crops.

Discussion

Animal production based on purchased fodder makes it possible to accumulate an excess of nutrients. Furthermore, this makes it possible to ignore crop rotation from a nutrient point of view. Organic systems are most likely to be short of nitrogen. Nitrogen can be supplemented by legumes. In this survey, there was a tendency to grow maize more at a low self-sufficiency level than at high level. This indicates a surplus of nitrogen in farm yard manure as maize is high yielding but one of the most nitrogen demanding crops

The data in this survey indicated a very wide range of self-sufficiency in feeding (30 – 100%), cow density (0.4 – 2.6 cow/ha) and grazing practices (0 – 65 % of total feeding). Thus, no “typical” Turkish organic dairy farm could be defined. However, the key issue in organic production is ecological sustainability. The present practice of organic production pays a lot of attention to organic nature of inputs (e.g. purchased fodder), but less attention has been paid to the real origin of inputs. There is a huge difference if fodder is purchased from distant regions, or if its origin is the neighbouring farm. There was a clear negative correlation between the self-sufficiency and milk yield per cow in this case-study. This demonstrates the reality, that farms which have low self-sufficiency are able to choose high quality fodder. The farms with high self-sufficiency are highly dependent on on-farm biomass production. They could improve the quality of fodder for dairy cattle if animal production was more diversified. Beef cattle, sheep and goats can utilise lower quality biomass more efficiently compared to modern breeds of dairy cows. But diversification of production on the farm is not an option in most cases because of economic and technical limitations. So, more diversity in animal production can be implemented by integrating neighbouring farms.


The regional integration between the organic farms could be enhanced. The crop farms are losing a lot of nutrients in the form of cash crops, and at the same time there is surplus of nutrients on the less self-sufficient animal farms. With the help of close regional integration between the farms a more balanced system could be created. However, support by public authorities will be needed in most cases. Additionally, legislation on organic production should pay more attention to the functioning of the systems. Locality cannot be ignored as a fundamental pillar of sustainable agriculture. Also, some practical evaluation tools could be developed in order to evaluate the sustainability of systems. As Seuri (2013) has shown, the present nutrient balances (farm gate balance, surface balance) cannot evaluate the role of nutrient circulation correctly i.e. no difference between the primary and secondary nutrients is identified by those tools. Primary nutrient balance (Seuri, 2013) could be a step forward; however, some systematic data from farms need to be provided.

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Organic Farming in Europe 1977-2017: The Journey of a Small Organic Livestock Farmer from Austria

Robert Paget¹

Key words: Organic farming, Slow Food, regional, small farmer

Abstract

In 1975, when I started farming with goats, the concepts of “Bio” and “Eco” in Austria and Europe were new and not well defined. They were hazy notions taking a negative approach with an emphasis on not doing “the wrong things”.

By the 1980s a significant change started. Chemicals used in agriculture and gardening were replaced by traditional cultivation methods and applications of herbal extracts. New concepts of animal housing, providing adequate light, space and activity, entered livestock husbandry. Rules for organic farmers formed the new guidelines for small scale agriculture. A green movement had confidently begun, but the structure of the movement was fragile. Intense discussions were held on the future goals, out of which emerged a handful of clearly delineated movements.

Around the turn of the century the mainstream food market companies discovered the potential of the niche organic food market and started to integrate products into their ranges (about 5-10% Europe wide).

The last ten years have seen a dramatic change. Big organic farms are growing and receive support through subsidies and from industry. Regional production now has little meaning and quality has lower value. Local production and sale networks cannot compete with international transport strategies, thus small farmers are losing their place and their power.

In response, I have aligned with the International Slow Food Movement, where “good, clean and fair” are the key words of a new generation of farmers who are self-confident, flexible, small scale and visionary, linking traditional knowledge with modern techniques. And where “joy and justice” are essential parts of a farmer’s life.

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Introduction

In the late 70`s peoples dreams and visions of a self-determined life drove various farming enterprises in Austria and in Europe. Young people started to run farms in the more remote and poorer areas of the country. They cultivated vegetables, baked bread and made juices. Some "newcomers" to farming, as my wife and I were, started rearing goats or sheep and experimenting with cheese and milk products, backyard poultry and other kinds of small animal husbandry. Cottage based, handcrafted and traditional techniques were the mainstay of this new sensitive lifestyle. Concepts such as "Eco" farming or "Bio" were only hazy ideas approached with a set of "don't do rules" such as: don't use fertilizers, don't use pesticides and don't use herbicides.

There were no eco-markets or organic shops for home made products such as goat cheese, nor were any chefs interested in the products. Soon we learned that to become a successful farmer one needs more than just passion. One needs to be innovative, patient, sensitive and strong. In addition, many other interests and skills are required, such as marketing, business and finance management and the use of technology.

Success for us meant a modest living from various home-made products, healthy and productive animals and a joyful respect for nature and all things natural.

By the 80`s a significant change started in small scale farming. Chemicals, recently used in agriculture and gardening, were gradually being replaced by traditional cultivation methods and the application of herbal extracts. New concepts in animal housing were introduced whereby animals were provided with adequate light and space to move. Very quickly though, these changes were transformed into "rules and regulations" and caused huge controversy between different groups of "eco-activists", who claimed they were the original, the best and the most reliable "knowledge bank" on organic farming and livestock rearing. Topics such as composting, artificial insemination, hybrids and dehorning dominated discussions. The foundations of "biological (or organic) farming" were fragile and this turned out to be the new challenge, especially for small farmers.

What does it actually mean to be an organic farmer – is there any precise answer? The green movement became partners with organic farmers worldwide and made biological farming a political statement. Other schools of thought also emerged of which "Bio" and "Demeter" evolved as the most successful and promising in Europe.

By the late 90`s, and through the turn of the century, the large mainstream food marketing companies discovered the potential of the niche organic market and started to integrate milk products, bread, vegetables and even meat from ecological farms into their ranges. These products contributed to about 5% of European food production. In order to integrate with this supply chain, many European farmers expanded and invested in machinery, dairy equipment, slaughter equipment and other technical inputs, to enable them to produce sufficient quantities to compensate for falling prices.

This can be marked as a crucial juncture of the European "eco" movement:

Discussion and Conclusion

Eco-farmers such as myself are committed to sustaining local food cultures which depend on regionally or locally available plant and animal resources. My farm, which I rent is eco certified and comprises 17 hectares of land. This is significantly less than the European standard. I rear about 50 goats and 10 water buffalo. I cultivate all the fodder required by my animals on this land. I can offer about 6 months of fresh grass, lucerne and other green crops during the summer as well as hay and silage for 6 months in winter. I have one assistant who helps me with making and selling cheese, growing and managing the fodder and conducting workshops on cheese making. Our farm is not heavily mechanized as we focus on high quality processing by hand.

The raw milk on the farm is processed into cheese and other dairy products and sold to a network of shops and restaurants in nearby regions. This network has been built up over the last 40 years. The 70-80 liters of milk produced per day is processed into a wide range of cheeses, including fresh Cheese, Camembert, Blue, Taleggio and Mozzarella. Approximately one third of the production is sold through a shop on the farm, enabling clients to understand the farm and how it functions. A large vegetable garden and orchard, along with pigs and poultry helps to support the family.

We are committed to the concept of small units and hand crafted products, viewing them as invaluable treasures of local food cultures. We prefer to market directly without resorting to several intermediaries, in other words we have a short value chain. It's not the price but the product itself which is valued.

On the other hand, the "capitalistic" approach which was introduced into eco-farming has initiated a heavy emphasis on rules and regulations. To cater to the requirements, farm and production units had to grow or go. Subsidies, lobbies and industry helped some farms grow but under this approach local small scale production and the quality of produce lost its meaning. Small producers cannot compete with large international and multinational corporations and gradually small farmers are losing their place and their power. Viewed from a distance, European organic agriculture is following the "capitalistic" path of expansion. Computers and robots have been introduced into farm management and low priced "Bio Soya" transported from South America feeds livestock on large animal farms.


Since 2010 I have organized my farm according to the philosophy of Slow Food, an International NGO, which started in Italy in the 1970`s and has evolved into a world-wide movement. There is a functioning Slow Food movement in India. Good, Clean and Fair are the key tenets of this philosophy which is providing the umbrella for a new generation of self-confident, dynamic and visionary small farmers.

Staying small and specializing into niche markets has enabled me to establish a living and livelihood by enriching the "fine food Palate" rather than fighting over prices. A living, where animal husbandry is not measured by figures and number of animals but by the relationship with the animals. Milk and meat are measured by their quality rather than the quantity produced.

Using permaculture concepts, I have developed methods of recycling on my farm so that the notion of waste does not exist. Dung plays a crucial role in this process as does whey and other by products.

On our small scale production unit payments are received in cash and kind. Labour is valued, respected and appreciated. In our way of farming, the changing seasons and the annual rhythm of the animals reflect on the farmer in a meditative way, wherein we farm with nature rather than against it. Close personal contact with animals and the land are still very important and cannot be easily replaced by machines and technology.

Our way of farming respects the value of traditional knowledge and gently links it to modern Life. A way of farming, where joy and justice are essential parts of the entire system. Small is beautiful!



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Investigation into organic cashmere, yarn and knitwear production by nomads of southern Iran

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Key words: nomad, cashmere, goat, yarn, neat wear

Abstract

The use of limited external inputs for animal production plus on-farm reliance brings extensive nomadic farming systems in Baft city of Kerman province in southern Iran closer to organic systems. Investigations indicated that goat coarse hair is spun and woven into tent material, ropes and blankets without using chemicals. The raw cashmere is washed and dyed using natural organic dyes such as Henna, Rubbia, Walnut husk and Onion peel, spun into yarn using different traditional spinning wheels and drop spindles, and different knitwear are woven using simple long needles.

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Introduction

Cashmere is the fine undercoat of special goats and is regarded as a luxury fibre and one of the softest and warmest animal fibres principally used for clothing. Iran is one of the main producers and exporters of cashmere in the world; ranked third after China and Mongolia (Ansari-Renani, 2015). Of the 25 million goats in Iran, five million are cashmere-producing goats. Nomads play an important role in sheep and goats production mainly because they keep 58.5% of the sheep and 39.7% of the goat populations of Iran (Ansari-Renani et al. 2013).

More than 90% of Iranian cashmere is produced in the eastern part of the country mainly by two breeds of goat; Raeini in Kerman and Birjandi (Baluchi) in the South Khorasan provinces. However, Raeini goats, kept mainly by nomad farmers in Baft city in southern Kerman province of Iran, are the most important cashmere producing breed both in terms of population and volume of cashmere produced. The use of limited external inputs and maximum on-farm reliance brings nomadic extensive farming closer to organic systems. The aim of the present work was to investigate organic production of cashmere, yarn and neat wear in the nomadic region of Baft city in Kerman province of Iran.

Material and methods

This study was undertaken in the nomadic regions of Baft city in southern Kerman province of Iran. Kerman province is a highland region 2,270 meters above sea level with a latitude of 29°17'N, longitude of 56°36'E and < 250 mm annual rainfall. Summer is hot and dry (up to 35 °C), and winter is moderate. Thirty nomad settlements, belonging to the Siahjel sub-tribe of the Raen tribe, were chosen at random within ± 20 km of Baft. A structured questionnaire was completed for each individual nomad family. Final information was gathered primarily through in-depth interviews with nomadic men and women livestock producers and also with specialist and field observations.

Results and discussion

The results from a study of 686 samples taken from 29 nomadic herds in Baft city are given in Table 1 and summarised below:

Mean fleece weight	507.3	± 182.6 g
Percentage cashmere yield (CY)	56.5%	$\pm 12.2\%$
Mean fibre diameter	19.7	± 1.5 μm
Fibre diameter standard deviation	4.5	± 0.6 μm
Fibre curvature	62.9	± 8.5 °/mm
Staple length	54.2	± 7.0 mm.

(Ansari-Renani et al. 2012)

Table 1. Overall mean, standard deviation (SD) and range of fibre characteristics for Raeini goats.

Trait	No of animals	Mean	SD	Minimum	Maximum
Fleece weight (g)	643	507.3	182.6	100	1250
Cashmere yield (%)	686	56.5	12.2	9.5	87.1
Mean fibre diameter (μm)	686	19.7	1.5	14.9	25.2
Fibre diameter standard deviation (μm)	686	4.5	0.6	3	7.4
Fiber curvature (°/mm)	686	62.9	8.5	33.9	93.6
Staple length (mm)	686	54.2	7	40	79

Cashmere produced naturally with limited external inputs is handspun into yarn by using a spinning wheel or drop spindle. The yarn is spun thick or thin and can later be dyed or left as a natural colour. Handspun yarn is used for knitting, and weaving products. The characteristics of spun yarn vary according to the material used, the fiber length and alignment, quantity of fiber used, and degree of twist. A simple method of spinning yarn is with the spindle, a straight stick 8 to 12 inches long on which the yarn is wound after twisting. Traditional spinning wheels are used for spinning and yarn production. Different knitwear such as hat, socks, gloves etc are woven using simple long needles.


Dyeing is normally done in a special solution containing organic dyes without any use of chemicals where the temperature and time control are two key factors in dyeing. Nomads use mainly plant dyes for dyeing cashmere. Most common natural dyes originate from Henna and Rubia plants and Walnut husks.

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Bio-Diversified Integrated Natural Farming: A Case Study

Braj Pal Singh¹ Narendra Khode²

Key words: Bio-diversified, integrated natural farming, livestock, poultry, production

Abstract

The present study was conducted to explore the feasibility of the low cost, natural, bio-diversified integrated livestock rearing practices followed by Mr. Aman Lakra Abhaypur, a farmer of Bareilly district, Uttar Pradesh, India. The data were collected personally by interview and observation. He has 55 bighas (22.02 acres) of agricultural land and started livestock and poultry rearing integrated with crop during 2013. He is producing 16 liters of milk/day from dairy animals and 115 quintal of fish/annum. He is earning approx. Rs. 2500 – 3000 (37.26 -44.71US\$) /month from selling eggs and live poultry birds, and approx. Rs.10,000 (149.09US\$)/annum from the goat unit. He is producing about 20 kg honey per month in an effective season and generating employment for college going youth with the intent of developing their skills in agricultural based enterprises. His farming is characterized by low-cost inputs, less dependence on markets and effective labour utilization. Chemical free farming and natural management of livestock and birds has led to the high demand for his farm produce.

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Aman Lakra, 63 years old, resident of Abhaypur village, Bareilly district (U.P.), India paved the way to the success of natural integrated farming. He is a post-graduate in economics and he served in many departments of the Government of India. He shifted from Latihar district of Jharkhand to Bareilly (U.P.) in 1992. Initially, he purchased 1.5 bighas of land, currently he is the owner of 22.02 acres of land, completely earned through the adoption of a Natural Integrated Farming System under the continuous guidance of Krishi Vigyan Kendra - IVRI, Izatnagar. Under the Natural Integrated Farming System, he rears poultry, ducks, goats, pigs and buffalo and also generates income from fish production, bee-keeping and agriculture.

Common enclosure for all livestock and poultry birds



Poultry unit



Goat unit



Pig unit

Buffalo rearing

Mr Aman Lakra has 6 buffaloes (3 are in lactation) which yield 15-16 litres of milk/day. He is selling milk @ Rs. 50/litre and earning Rs. 750 per day, due to the maintenance of quality and goodwill. He follows semi-intensive livestock rearing. During winter, he provides a mixture of jaggery, cumin and mustard-cake twice a week to protect the animals from the cold. Berseem clover and oats from his own farm are also fed. So far, he has never vaccinated the buffaloes and has not observed the prevalence of any disease. His monthly expenditure is Rs. 5000 on buffalo feeding. Following the advice of KVK, he ensures the addition of a mineral mixture in the feed, supporting an improvement in the productive and reproductive performance of the buffalo.

Poultry rearing

Mr Aman Lakra rears 55-60 indigenous birds including the fighting bird 'Aseel' which is in high demand. He produces on average 25 eggs/day, which he sells @ Rs. 5 to 7/egg and thus earns Rs. 150 to 175/day. The mortality rate in birds is about 5-6 per cent, mainly attributed to predators and adverse climatic conditions. He also receives a good price for live birds @ Rs. 250/kg which are in high demand locally. Thus, he earns Rs. 4000 by selling live birds and Rs. 4500 to 5250/month by selling the eggs. He is earning about Rs. 45,000 to 50,000 annually by selling *Aseel* poultry.

He calculates that the poultry unit requires 5 kg *bajra* (pearl millet), 4 kg wheat bran, 5 kg *sorghum* and 5 kg boiled fish daily for the flock of 55-60 birds. Sometimes, he adds duck eggs into the poultry feed to increase the protein content in the poultry's diet. He adds 15-20 drops of honey in the drinking water as a nutritional feed supplement and uses neem water weekly as an alternative to antibiotics. With the exception of sorghum, all the ingredients utilized in the poultry feed are produced at his own farm. He reports no major disease incidents in his semi-intensive poultry rearing unit. He has constructed four small houses/cages for laying and hatching to provide more natural conditions for the poultry. During the day all birds are free range, while during the night all poultry are placed inside an enclosure. Expenditure on poultry rearing remains minimal due to the natural integrated farming system. Every year, he purchases 15 day old chicks during March and September to maintain a sufficient and manageable flock size at his farm.

Goat rearing

He keeps 4 goats of the *Black Bengal* breed and feeds green fodder, banana leaves and other trees from his farm. Annually, he sells 3-4 goats and thus earns Rs. 10,000-12,000. He deliberately reduces the flock size during winter.



Duck-cum-fish unit



Bee keeping



Banana plantation

Pig rearing

He rears a very prolific White Yorkshire breed of pig and earns good profit from this small unit. Initially, he purchased the pigs as a parent stock from the livestock unit of IVRI. He uses Berseem clover, banana stumps, wheat and salt to feed the pigs. At present, he has 6 pigs and sells the progeny at 17 months of age. Annually, he sells on an average 7 pigs @ Rs. 80 – 150 per kg body weight and thus earns Rs. 12,000 to 26,000 per pig. Approximately, Rs. one lakh per annum are earned through pig farming.

In the morning the pigs are fed 4 kg of *sorghum* mixed with wheat bran and berseem clover. However, in the afternoon they are fed 30-40 kg of chicken waste, purchased @ Rs. 5/kg from the meat shop. Their low cost semi-closed shelter is constructed in a yard with an area of 250 square yards. He castrates the piglets himself and applies a paste of turmeric, ash and mustard oil which he reports cures the injury in 10-15 days. Mortality in the piglets is mainly caused by crushing under their nursing mother. Therefore, he is planning to build a farrowing crate to reduce the mortality in piglets.

Duck cum fish rearing

There are two fish ponds of 3000 and 2500 square yards for the duck-cum-fish unit. He rears mostly Magur, Rohu and Katla, grass carp and common carp breeds of fish. He uses slaughter house waste, purchased @ Rs. 5/Kg. to feed the magur fish. The wastage from the poultry, goat and

buffalo units is also fed as is berseem clover. The annual fish production is 10-12 quintal of *magur* and 8-10 quintal of other fish and he earns Rs.2 –3 lakhs per annum solely from fish production. He purchases one inch catfish @ Rs. 1 and 2.5 inch fingerlings of Rohu/Katla @ Rs.250/kg from the local fish hatcheries. Along with the fish, he rears 75-80 ducks on the same ponds. He applies lime and potassium permanganate to the fish ponds to prevent contamination. He also adds two buckets of cow dung weekly to the pond as nutritional supplement for the catfish. Keeping the catfish, *Rohu* and *Katla* together in one pond is a unique practice followed by him.

Bee keeping

Mr Aman Lakra keeps 7-8 boxes of Italian honey bees producing about 20 kg honey per month in an effective season which sells @ Rs.300/kg. The honey from his farm is very popular in nearby areas because of its purity as well as being the product of natural conditions. He will often extract the honey in front of the customers at their request. In the previous year, he had about 30 bee boxes which were destroyed in a flood, now he is planning to increase the number of bee boxes again and is also learning how to manufacture the boxes himself. He has cultivated mustard crops in his fields and is planning to sow sunflower for the honey bees.


Labour management

He generates income by following diversified entrepreneurial activities and uniquely provides part time jobs on an hourly basis to the college students of the village. Currently, he pays Rs. 30/hour to each labourer. He employs on an average five labourers daily for the farm operations and spent Rs. 600/day on labour charges. He provides accommodation for labourers, who work for more than 7 hours/day. He considers that the non-availability of labour for daily farm operations is the most serious constraint.

Beside livestock and poultry, he cultivates cereal crops (wheat and rice) oilseed crops (mustard), legume fodder e.g. Berseem clover, vegetables e.g. pumpkin, spinach, drumstick, kundru etc. He grows fruits such as banana, papaya, date palm, pindara, sapota, pear, orange, lemon, mango, coconut, water apple, custard apple, fig, star fruit, jamun and guava. He also cultivates spices such as dalchini, tej patta and turmeric, along with teak, arjun and tapioca trees. Biodiversity is truly being maintained through the utmost care of each and every plant and animal on his farm.

Conclusion

The farming being followed by Mr Aman Lakra is very close to an organic agriculture which sustains the health of soils, ecosystems and people. He controls the application of chemicals at his farm which has led to the popularity of the farm among consumers. He has introduced his own innovations like the feeding of honey and duck's egg to poultry and the rearing of Magur with Rohu and Katla. These methods are a combination of traditions, innovations and science. In the future, his plan is to expand his farm by establishing mushroom production units, a vermicompost unit and to develop eco-tourism on the farm. He has no challengers in organic agriculture since no other competitors exist in the area but he opined that consumers should pay more for organic produce in comparison to non-organic. All the operations, which are being conducted traditionally at his farm need to be organically validated. Moreover, he required formal training in organic agriculture to build confidence and to upgrade skills.



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Vulvar neoplasia in dairy cattle: Homeopathic treatment – Case Report

Fabíola Fernandes Schwartz

Key words: homeopathy, neoplasia, dairy cattle

Abstract

*At an organic dairy farm in Brazil, a 10 years old female crossbred cow ($\frac{3}{4}$ Holstein (H) and $\frac{1}{4}$ Gyr (G) breeds) exhibited vulvar neoplasia 4cm by 6cm. Squamous cell carcinomas (SCC) are malignant epithelial cell tumors, common in all species and most likely to develop in older animals. SCC can affect any part of the body, predominating in depigmented areas due to ultraviolet radiation consisting a major carcinogenic factor to its occurrence. Neoplasias can cause relevant productive consequences (reproductive impairment, vision loss, welfare reduction) that incur economic losses. The studied cow's vulvar SCC diagnosis was based on the lesion's macroscopic characteristics, which exhibited a papillary growth pattern, with keratosis and displaying a vegetative aspect. Abiding to organic production norms, the condition was treated non-surgically, with the use of homeopathy. Kreosotum (12 cH) was chosen due to the lesion's macroscopic characteristics and location. *Viscum Album* was also administered in ascending potencies (3 cH, 6 cH, 9 cH), considering the animal's history of ocular neoplasia (an eyelid tumor surgically removed 3 years before). Medicine was administered vaginally, 10 drops, twice a day, for 50 days. Within 40 days of treatment, there was a complete regression of the tumor and restoration of the animal's normal reproductive life.*



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I thank the workers at Antiga Fazenda da Conceição (Old Conceição Farm) in Lorena/SP/Brazil for administering the recommended treatment dutifully and with care. The positive results described in this article could not have been achieved without their dedication.

Introduction

Squamous cell carcinomas (SCC) are malign tumours in the epithelial spinous layer. There are many factors associated with their development, such as prolonged exposition to ultraviolet radiation, lack of epidermal pigmentation or sparse fur coverage in the affected region.

The tumour may present dermal hyperplasia, hyperkeratosis, parakeratosis, acanthosis, keratinocyte and dysplasia.

In the female reproductive system SCC occurs mainly in the vulva of sheep, goats and bovines living in areas exposed to high levels of solar radiation, common in tropical countries like Brazil.

This neoplasia may cause important productive and reproductive consequences, incurring economic losses due to reduced production and carcass condemnation in the slaughter process.

The most common treatment is complete excision or cryosurgery. In accordance with organic production norms, the condition was treated non-surgically, with the use of homeopathy.

Case report - Material and methods

At an organic dairy farm in Brazil, a 10 years old female crossbred cow ($\frac{3}{4}$ Holstein (H) and $\frac{1}{4}$ Gyr (G) breeds) exhibited vulvar neoplasia 4cm by 6cm.

The studied cow's vulvar lesion diagnosis was based on the lesion's macroscopic characteristics, which exhibited a papillary growth pattern, with keratosis and displaying a vegetative aspect, presumptive of SCC

Considering the varying results obtained from surgical and cryosurgical treatments and adhering to organic milk production handling norms (IN46 from 2011 by the Brazilian Ministry of Agriculture, Livestock and Food Supply, which commands in Article 60 that priority is given to the use of natural therapies in animal treatment, such as homeopathy, phytotherapy, acupuncture and others), the condition was treated non-surgically with the use of homeopathy.

The rubrics considered for repertorization in order to define the appropriate homeopathic protocol were "genitals", "female", "cancer" and "vagina". Kreosotum (12 cH) was chosen due to the lesion's macroscopic characteristics and location: epithelioma, mucous membrane puffed and follicles often hypertrophied, cauliflower excrescences around uterus (Hering C 1974; Vijnovsky 1978).

Viscum album was also administered after taking into consideration the animal's history of ocular neoplasia (an eyelid tumor surgically removed 3 years before). Viscum album is an antroposophical medication used to treat cancer, pre-cancer conditions and chronic multisystemic diseases. Mimicking the progressive dosing mode of use advocated by antroposophical theory, it was administered in ascending scale potencies (3 cH, 6 cH, 9 cH), with each potency administered vaginally for 10 consecutive days, once a day with 10 drops. After an interval of 7 days, the cycle of Viscum album was repeated in ascending scale potencies (3 cH, 6 cH, 9 cH), for 7 consecutive days each.

Kreosotum 12 cH, was administered vaginally for ten consecutive days, once a day with 10 drops.

While both medicines were administered during the same period, Kreosotum was used in the morning and Viscum in the afternoon.

Results

This clinic case is illustrated with the photographs below, highlighting the positive evolution of the lesion in the period. The pictures contained in figures 1-5 illustrate the evolution and resolution of the condition.

Within 40 days of treatment (figure 5), there was almost complete regression of the tumor and restoration of the animal's normal reproductive life (figure 6).



Figure 1 and Figure 2: Initial lesion aspect

Figure 3:
Lesion measurement
(4cm by 6cm), on 24.02.2016



Figure 5:
Lesi aspect 40 days after
treatment, on 08.04.2016



Figure 6:
Normal parturition:
on 15.06.2016



Figure 4:
Lesion measurement
(4cm by 6cm),
on 24.02.2016

Discussion

Ramos (2008) noticed that SCC are among the tumours with highest occurrence in bovines.

Despite being easily diagnosed, treatment in productive animals often becomes unviable considering condition stage, local infiltration level, animal value and post-surgical caring needs. Therefore, the alternative of using homeopathic therapy represents a possibility of cure within organic production norms using low-cost medication that allows a rapid return to normal productive and reproductive life, and avoids the need for surgical procedures or post-surgical lesion treatment and brief.

Regarding the choice for the use of an ascending scale of the homeopathic medicine, this is supported by Coelho et al. (2006) based on their assessment of the relevance of mimicking clinical conditions. In doctrinal terms, ascending potencies are always the way to go in chronic ailments. That way, a higher level of healing energy is made available for reaction by the vital force.

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Spermogram and Fertility Assessment of Cocks Semen, Extended with Coconut-water Extender Supplemented with Garlic Extracts

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Key words: Coconut-water, Garlic, Cocks Semen, Antioxidant and Fertility

Abstract

Coconut water (CW), is a natural sterile nutritious medium. CW possesses beneficial effects that can reduce oxidative stress. Garlic, is also known for its antioxidant effects. Treatment with coconut water and garlic is more natural, less expensive and may have less side effects, than chemicals. This study examined the combined effects of both CW and Garlic extracts on rooster sperm cells when used as an extender. Efficacy was assessed using routine semen characteristics and fertility protocols. Fresh and dried garlic extracts were assessed for their antioxidant activities. Coconut water extender was prepared and 6% of wet and dried garlic extracts each were added to the extender. The trials constituted four different treatments, viz: Neat semen(control), Coconut-water extender(CWE), Coconut-water fresh garlic(CWFGGE) and Coconut-water dried garlic(CWDGE). Pooled ejaculate of cock semen was divided into four equal parts and randomly allotted to these treatments in ratio of 1:3 (semen:extender). The results were subjected to ANOVA. The results of the study revealed that DG had higher antioxidant activities than WG with the values of 545.30 and 331.20/100g of samples respectively. CWDG had the lowest motility of 80.00% and was significantly different from all the other treatments in which motility ranged from 88.33% to 94.33% respectively. A Viability and Hypo osmotic swelling test (HOST) showed no significant difference within the treatments with values ranging from 95.00% to 91.33% and 93.00% to 86.7% respectively. The fertility percentage, a yardstick for reproductive ability was highest in NS followed by CWDGE, CWE and CWFGGE with the values of 84.60%, 80.00%, 75.00% and 15.38% respectively. This experiment suggests that CWDGE is the best extender of the three for poultry insemination, with a fertility record comparable to NS.



Introduction

Poultry breeding industries, considered as globally rapidly growing industries are exploring short generation intervals and high prolificacy. The use of artificial insemination (AI) in poultry has recently gained worldwide recognition, as it aids rapid development. The industry requires use of quality, cheap, affordable, available extenders which are non-toxic to sperm cells and hen oviducts. To date many of the extenders formulated in the poultry breeding industries are mostly made up of chemical components. Hence the advocacy and awareness regarding the employment of organic practices in livestock farming. Organic based diluents for AI are vital. AI is a means of increasing reproduction rate and subsequently increasing selection intensity and accuracy and rapid multiplication of germplasms and locally adapted species or breeds in various countries and or communities.

The scavenging ability of free radicals is of major concern as they can defend the body against the products of reactive oxygen species (ROS). It is believed that majority of the problems that sperm cells encounter both *in-vitro* and *in-vivo* is a result of the effects of high levels of free radicals both in the body and, or semen.

Although the body has a natural mechanism of producing these antioxidants or pro-oxidants which may inhibit or reduce the rate of damage by ROS species, they may not be at sufficient levels. Many chemical substances have been developed to mitigate free radical activity both *in-vivo* and *in-vitro*. However, there is an alarming increase of cancer in both human and animals which may be related to the increasing use of chemicals in both plants and livestock production. Hence the need for employing the use of natural additional sources to maintain or lower the free radical levels in the semen.

Coconut (*Cocos nucifera* L) water has a high and balanced electrolyte content which helps restore the level of electrolytes that has been lost through the skin and urinary pathways (Reddy & Lakshmi, 2014). Coconut water comprises 5% sugars such as glucose, fructose and sucrose, 0.02% proteins, 0.01% lipids and 94% balanced water. It is rich in minerals such as potassium, calcium, magnesium and manganese, and low in sodium (Reddy & Lakshmi, 2014). Coconut water is frequently used as a medicine (Prades *et al.*, 2012). In the Indian Ayurvedic tradition, it is described as “unctuous, sweet, increasing semen, promoting digestion and clearing the urinary path”. There are numerous references to medicinal uses of coconut in Sri Lanka. Out of the 40 raw or processed parts of the coconut plant cited by Ediriweera (Prades *et al.*, 2012) five involve coconut water. The antioxidant properties of garlic and different garlic preparations are well documented (Nuutila *et al.*, 2003). Diallyltetrasulphide is the bioactive organosulphur component of garlic and has antioxidant effects (Ola-Mudathiret *et al.*, 2008).

Material and methods

Fresh and dried garlic cloves were crushed separately in a blender. Forty grams of both samples were soaked with distilled water at ratio 1:4 (garlic to water) for three days. The samples were decanted and the filtrate was obtained from the residues.

Ten cocks and forty hens were purchased from a reputable breeding farm and housed in battery cages containing one rooster per cell and two hens per cell. The birds were managed as per the breeders' recommendations. Semen collection was carried out once a week throughout the study period according to the modified semen collection procedure outlined in Balogun *et al.*, (2015).

Fresh and dried garlic extracts were assessed for their antioxidant activities by a 2, 2-diphenyl-2-picryl-hydrazyl (DPPH) test. Coconut water extender was prepared and 6% of wet and dried garlic extracts each were added to the extender. The experiment constituted three different trials with four different treatments, viz: Neat semen (control), Coconut-water extender(CWE), Coconut-water

fresh garlic extender (CWFGE) and Coconut-water dried garlic extender (CWDGE). The pooled ejaculate of semen from 10 cocks was divided into four equal parts and randomly allotted to these treatments in ratio of 1:3 (semen: extender).

The pooled ejaculate NS was initially assessed for mass activities and progressive motility before extension. Neat and extended semen treatments were evaluated for motility and viability at the dilution rate of 10:200 (extended semen: extenders), for ease of assessment. Sperm motility was examined at a magnification of $\times 400$, sperm viability was examined with a microscope under oil immersion, and a hypo osmotic swelling test (HOST) was determined after 30mins of incubation under magnification $\times 400$.

The hen fertility assessment took place immediately after the completion of 3 weeks in-vitro evaluations of the treatment groups. Before insemination, the semen in each treatment group was examined for motility. Each hen was everted and semen deposited into the oviduct at a dose rate of 0.05ml. The hens were inseminated twice every week in the evening for a period of 2 weeks. Eggs were collected and stored after two consecutive inseminations for period of two weeks. The eggs were incubated and assessed for fertility and hatchability on days 18 and 21.

Statistical analysis: The data obtained were subjected to descriptive statistics and Analysis of Variance (ANOVA) at $P = 0.05$.

Results

The results of the free radical scavenging ability presented in Figure 1, reveal that DG had higher antioxidant activities than FG with the values of 545.30 and 331.20/100g of samples respectively

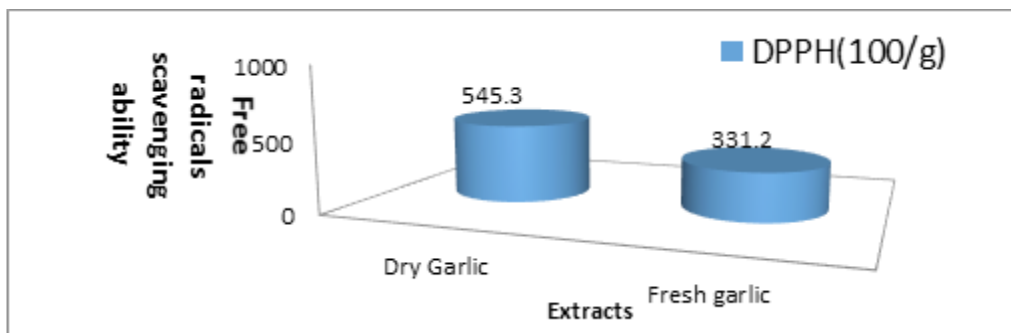


Figure 1: Free Radical Scavenging Abilities of Dry and Fresh Garlic Aqueous Extracts

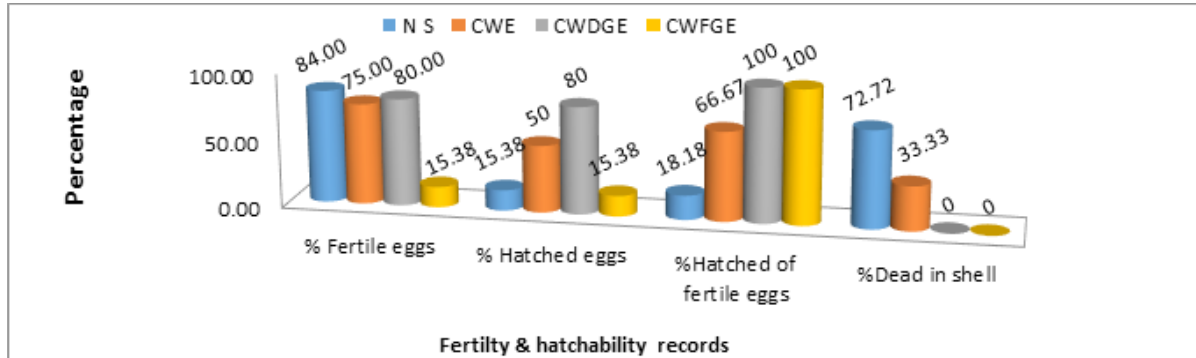
The *in-vitro* semen analysis results presented in Table 1, revealed that NS had the highest motility value of 94.33%, but not significantly different ($P > 0.05$) from values obtained from CWE and CWFGE which had 88.00% and 90.00% respectively. CWDGE at 80.00% was significantly lower than the other treatments.

Table 1: *In-vitro* Semen Characteristics of Cock Semen Extended with Coconut Water Supplemented with Fresh and Dry Garlic Extracts

Treatments	NS	CWE	CWDGE	CWFGE	sem
Motility (%)	94.33 ^a	88.00 ^a	80.00 ^b	90.00 ^a	1.992
Viability (%)	94.33 ^a	95.00 ^a	91.33 ^a	95.00 ^a	0.78
HOST (%)	86.67 ^a	93.00 ^a	90.00 ^a	87.67 ^a	1.24

NS- neat semen, CWE- Coconut water extender, CWFGE- coconut water fresh garlic extender, CWDGE- coconut water dry garlic extender, sem- standard error of mean.

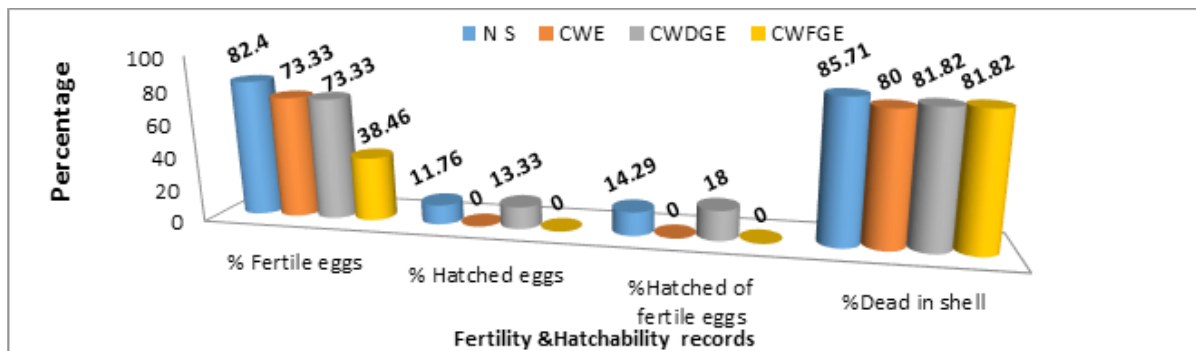
The results of the first week fertility and hatchability are given in Figure 2. NS had the highest percentage fertility value of 84%, which differed little from CWDGE and CWE, with values of 80% and 75% respectively. CWFGE had the lowest percentage fertility value of 15.38%. With respect to Hatchability CWDGE had the highest fertility at 80%. The low hatchability of NS and CWE was due to high levels of chicks dead in shell, 72.72% and 33.33% respectively CWDGE and CWFGE had the highest Percentage hatchability of fertile eggs at 100%.



NS- neat semen, CWE- Coconut water extender, CWFGE- coconut water fresh garlic extender, CWDGE- coconut water dry garlic extender

Figure 2: 1st week and fertility and hatchability records of hens inseminated with Coconut Water Garlic Extracts Extenders

The fertility and hatchability records for the 2nd week are presented in Figure 3. NS had the highest fertility value of 82.4% followed by CWE and CWDGE CWFGE which had 38.46 compared to 15.38% in 1st week fertility record.



NS- neat semen, CWE- Coconut water extender, CWFGE- coconut water fresh garlic extender, CWDGE- coconut water dry garlic extender

Figure 3: 2ND week and fertility and hatchability records of hens inseminated with Coconut-Water Garlic Extracts Extenders

Discussion

The sperm motility recorded in CWDGE was 80.00%, which was significantly lower than the other treatments, but was in the acceptable range for artificial insemination of hens. Similar sperm motility in fresh semen of cocks (73.9 to 83.2%) has been observed in earlier studies (Chalah et al., 1999). Extracts of fresh garlic contain antioxidant phytochemicals that prevent oxidant damage. These include unique water-soluble organosulphur compounds, lipid-soluble organosulfur components flavonoids, notably allixin and selenium (Ohnishi and Ohnishi.2001).

CWE had the highest values for motility, viability and HOST across all treatments which would imply that CWE extended semen may be used for poultry insemination without impairing fertility.

The closeness in values between CWDGE and NS, may be attributed to the synergistic effects of the coconut water and dried garlic extract antioxidant activities. In the study of Silagy and Haw (1994), a total of 261 patients from 30 general practices were said to have responded to garlic powder, mean serum cholesterol levels dropped by 12% in the garlic treated group and triglyceride and total lipid levels decreased by 17% and 19%, respectively compared to the placebo group. Lipid bilayers do not constitute a barrier for allicin penetration and its diffusion through the lipid bilayer and it does not cause membrane leakage, fusion or aggregation (Miron et al., 2000). Therefore, garlic may enhance sperm fertilizing ability.

The CWE exhibited a good fertility value compared to NS and CWDGE. However, Hatchability values were not encouraging, as only the CWDGE had a high fertility record. The low hatchability records recorded by NS and CWE was probably due to high percentage of dead in shell. CWDGE and CWFGE also had the highest Percentage hatchability of fertile eggs of 100% as there was no dead in shell recorded for the two treatments, while NS and CWE had lower values compared to acceptable standard in the poultry breeding industries. This may be traceable to the management/ nutritional/ incubator problem (insufficient humidity or temperature). Sharma *et al.*, (2008) stated that for optimum fertility and hatchability, selection and care of eggs, fumigation, storage and incubation conditions must be considered.

The fertility and hatchability records of the 2nd week generally followed same pattern as the first week indicating that there few management or hatchery effects.

CW and garlic may be effective as garlic may exert antioxidant actions by scavenging reactive oxygen species, enhancing the cellular antioxidant enzymes, superoxide dismutase, catalase and glutathione peroxidase and increasing glutathione in the cells (Ryu *et al.*, 2001). The dried garlic may be more effective due to the ability of water to extract its antioxidant components than the wet garlic. Balogun *et al.*, (2016) showed that the levels of antioxidant constituents present in dry garlic extracts is higher than fresh garlic extracts, when extracted with non polar solvent.

In conclusion, since fertility and hatchability records still remain the major yardstick of measuring the success of production of on commercial/research breeding farms, CWDGE is the best extender of the three formulated and tested extenders.

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The cold storage capability of coconut water supplemented with garlic extracts on rooster semen

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Key words: Coconut water; garlic; rooster semen; liquid storage and Antioxidant

Abstract

The most common procedure for the short-term storage of rooster semen requires suspending sperm in special diluents to retain their viability in-vitro. Coconut water (*Cocos nucifera* L.) contains proteins, fats and minerals such as sodium, potassium, magnesium and calcium electrolytes, while garlic has good antioxidant and antibacterial properties. An experiment was conducted to evaluate the combined preservative abilities of both coconut water and garlic extracts on rooster semen for periods of up to 72 hrs (three days). The experiment consisted of four different treatments viz: neat-semen (control), Coconut Water Extender (CWE), Coconut Water 6% Dried Garlic Extender (CWDGE) and Coconut Water 6% Fresh Garlic Extender (CWFGE). Pooled ejaculates of 10 roosters were divided into four equal parts and randomly assigned to each treatment in a ratio of 1:3 (semen:extenders). The semen was assessed for three properties: motility, viability and Hypo Osmotic Swelling Test (HOST) at 0 hr, 4 hrs, 24 hrs, 48 hrs and 72 hrs. The results were subjected to ANOVA. Results revealed that at 0 hr CWDGE had the lowest motility (80%) which was significantly different from all other treatments which had motility ranging from 88.00% (CWE) to 94.33% (control). Also, the viability and hypo osmotic swelling test (HOST) showed no significant difference within the treatments, with values ranging from 91.33% to 95.00% (viability) and 86.67% to 93.00% (HOST). At 4 hrs of chilling CWFGE showed the highest motility (91.00%), the same viability as coconut water (95.00%) and highest HOST (83.67%), although only the motility of CWFGE was significantly different from others. Its viability (95.00%) was significantly different from CWDGE (91.33%). At 24hrs and 48hrs of storage there was not much depletion in semen quality and no significant difference was observed within the treatments. At 72 hrs of storage, drastic depletion was observed in motility across the treatments, with values ranging from 43.33% to 46.67%. CWFGE had highest values of 70.00% (viability) and 76.00% (HOST). These results suggest CWFGE has most promising potential for short-term storage of rooster semen.



Introduction

The liquid storage of semen is commonly practiced in cattle breeding and in other mammalian breeding programmes. The liquid storage of avian semen and artificial insemination techniques are utilized in poultry to optimize the management of genetically superior males (Blesbois *et al.*, 1999). Encouragement of transfer of germplasm within countries (provinces and states) and between countries with close proximity can be achieved through these simple and cheap techniques. However, cryopreservation of poultry semen seems to be less achievable due to the unique structural characteristics of the sperm cells, making them prone to cryo-damage when preserved at the ultra-low temperature of minus 196 °C. When the semen is stored at refrigerator temperature (4 °C), there is a gradual decrease in the motility, functional integrity of spermatozoa membranes, and fertility (De Lamirande *et al.*, 1997). The appropriate method for storage of poultry semen is dilution with an appropriate extender with unique characteristics equivalent to that of seminal plasma and semen itself. The specialised extenders that allow the maintenance of the sperm cells for longer duration both *in-vivo* and *in-vitro* have common characteristics like alkalinity, antibiotics and antioxidants.

The antioxidant activity of the seminal fluid is important in maintaining spermatozoa motility and viability (Zini *et al.*, 2009). However, the endogenous antioxidant activity may not be sufficient to prevent the lipid peroxidation during prolonged storage (Aurich *et al.*, 1997). Among the natural fruits, vegetables and spices provided by nature, coconut water and garlic are unique in having common characteristics required to develop a natural poultry semen extender. It is conceivable that they may replace inorganic extenders currently haphazardly used in the poultry breeding industry. Several attempts have been made to enrich semen by adding substances such as carnitine (Neuman *et al.*, 2002), superoxide dis-mutase, catalase, trehalose and glutathione (Bucak and Tekin, 2007) glutamine and hyaluro-nan (Bucak *et al.*, 2009) in order to protect the spermatozoa of domestic animals against the harmful effects of the lipid peroxidation. Nevertheless, improvement in semen quality is still a challenge in poultry production. Flavonoids and some other phenolic compounds of plant origin have been reported as scavengers of free radicals (Gupta 2011).

Hence, the search for natural antioxidants is gaining importance.(Gupta 2011) It has been known that coconut water is a good source of various biomolecules like sugars, vitamins, electrolytes, plant hormones such as zeatin, and Kinetin. Garlic also has a long history of use as a food preservative inhibiting the growth of pathogens or preventing the spoilage of food by microorganisms. It is also used as a remedy for certain gastrointestinal disorders (Sato and Miyata, 2000). These properties justify the use of garlic and coconut water as extenders. The purpose of the present research was to investigate the combined antioxidant effects of coconut water and garlic aqueous extracts on spermatozoa survival and motility during the cold storage of rooster semen.

Material and methods

The fresh and dried garlic were purchased, the clove and bulb were separated, the garlic was crushed with a blender. Forty grams of both samples were soaked with distilled water at a ratio 1:4 (garlic: distilled water) for three days and was decanted, the filtrate was obtained from the residues.

Ten cocks and 40 hens were purchased from a reputable breeding farm and housed in battery cages containing one rooster per cell and two hens per cell. The birds were managed according to breeders' recommendations. Semen collection was carried out according to the modified semen collection procedure as outlined in Balogun *et al.* (2015), once a week throughout the study period.

Coconut water extender (CWE) was prepared and then 6% of fresh and dried garlic extracts were added to two further extenders. The experiment, based on a completely randomized design, consisted of four different treatments Neat semen (control), CWE, CWFGE and CWDGE with measurements taken at 0, 4, 24, 48 and 72 hours.

Ejaculated neat semen was initially assessed for mass activities and progressive motility before extension. Ejaculates (with greater than 80% forward progressive motility) obtained from the roosters were pooled and evaluated as a single sample. Pooled ejaculate was partitioned into four equal aliquots and randomly allotted to each treatments in ratio of 1:3 (semen:extender). Both diluent and semen were at a of temperature (37°C) during dilution. Semen of all treatment groups was stored for 72 hrs at 4°C during the trials. Neat and extended semen were evaluated for motility, viability and hypo osmotic swelling test (HOST) at the dilution rate of 10:200 (extended semen:extenders) for easy assessment at 0hr, 4hr, 24hrs, 48hrs and 72hrs intervals. Sperm motility was examined at a magnification of ×400, sperm viability was examined with a microscope under oil immersion, and HOST was also assessed after a 30-minute period of incubation under magnification × 400.

Statistical analysis: The data obtained were subjected to descriptive statistics, analysis of variance (ANOVA) at P = 0.05. Differences in mean value are considered significant at 5% probability level.

Results

The *in-vitro* cock semen analysis and results at 0 hr and 4 hrs intervals are presented in Table 1 and revealed that Neat Semen had the highest motility value of 94.33%, but was not significantly different (P>0.05) from values obtained from CWE (88.00%) and CWFGE (90.00%). CWDGE (80.00%) was significantly lower than all other treatments, but the value obtained was considered to be in a good range for artificial insemination in hens. CWE and CWFGE had the highest values for viability (95.00%) and CWE the highest value for HOST (93.00%), but was not significantly different (P>0.05) from other treatments. At the 4 hr period, CWFGE had a significantly higher motility (91% P<0.05) compared to the values obtained from CWE (85.00%) and CWDGE (80%). No significant difference (P>0.05) was observed in viability and HOST.

Table 1: In-vitro Semen Evaluation of Extended Cock Semen Preserved with Quail Egg-yolk Supplemented with Fresh and Dry Garlic Extracts at 0hr and Equilibration Period

Treatments	TIME PERIOD					
	0 HR			4 HRS		
	MOTILITY (%)	VIABILITY (%)	HOST (%)	MOTILITY (%)	VIABILITY (%)	HOST (%)
CWE	88.00 ^a	95.00 ^a	93.00 ^a	85.00 ^b	95.00 ^a	82.67 ^a
CWDGE	80.00 ^b	91.33 ^a	90.00 ^a	80.00 ^b	91.33 ^b	76.67 ^a
CWFGE	90.00 ^a	95.00 ^a	87.67 ^a	91.00 ^a	95.00 ^a	83.67 ^a
Neat Semen	94.33 ^a	94.33 ^a	86.67 ^a			
SEM	1.992	0.78	1.24	1.94	0.72	1.66

CWE - water extender, CWFGE - water fresh garlic extender, CWDGE - water dry garlic extender, SEM - standard error of mean

The results of the cock semen analysis at the 24 hr, 48 hr and 72 hr intervals are presented in Table 2. No significant difference (P>0.05) was observed within treatments for motility, viability and HOST after 24, 48 or 72 hrs of storage. CWFGE extender had the highest values for motility and HOST at 24 hrs and 48 hrs period of storage, while CWE had the highest motility at 72 hrs of storage. However, a drastic reduction of sperm motility was observed across the treatments at 72 hrs of storage.

Table 2: *In-vitro* Semen Evaluation of Extended Cock Semen Preserved with Quail Egg-yolk Supplemented with Fresh and Dry Garlic Extracts for Liquid Storage.

	TIME PERIOD								
	24HRS			48HRS			72HRS		
Treat-ments	MOTILITY (%)	VIABILITY (%)	HOST (%)	MOTILITY (%)	VIABILITY (%)	HOST (%)	MOTILITY (%)	VIABILITY (%)	HOST (%)
CWE	73.33 ^a	84.53 ^a	81.67 ^a	71.67 ^a	73.67 ^a	77.67 ^a	46.67 ^a	64.67 ^a	73.67 ^a
CWDGE	76.67 ^a	83.33 ^a	76.67 ^a	68.73 ^a	73.67 ^a	72.00 ^a	43.33 ^a	67.67 ^a	70.00 ^a
CWFGE	78.33 ^a	83.00 ^a	83.33 ^a	73.33 ^a	74.33 ^a	80.00 ^a	45.00 ^a	70.00 ^a	76.00 ^a
SEM	1.94	0.72	1.66	1.39	0.74	1.82	2.04	1.83	1.64

CWE - water extender, CWFGE - water fresh garlic extender, CWDGE - water dry garlic extender, SEM - standard error of mean

Discussion

The gradual decline experienced in extended semen motility, viability and HOST within the treatments from 0 to 48hrs, may be attributed to the individual or combined effects of garlic and coconut water. The antioxidant activities may have stabilised and enhanced sperm cell activities during *in-vitro* storage conditions. However, the drastic reduction that was observed in motility across the treatments at 72 hrs of storage may be an indication that the antioxidants and energy/ carbohydrate required for motility of sperm cells have been exhausted. Thus, spermatozoa lack the significant cytoplasmic component which contains sufficient antioxidants to counteract the damaging effects of the reactive oxygen species and lipid peroxidation (Bucak *et al.*, 2010). A likely result of greater amounts of polyunsaturated fatty acid (PUFA), is that avian spermatozoa is susceptible to lipid peroxidation, which was associated with the loss of viability, motility and fertilizing ability of spermatozoa *in-vitro* (Wishart, 2004). Antioxidants are important for limiting the damaging oxidative reactions in cells which may lead to a predisposition or development of oxidative stress disorders (Mirzaei *et al.*, 2016). Moreover, the values for HOST, viability and motility across the treatments and periods of storage were still at acceptable levels for artificial insemination. Mosenene (1999) reported similar results of lower motility of fresh semen of cocks (67.9% to 70.1%), and a lower proportion of live spermatozoa (72% to 82%) in cock semen has been reported by Siudzinska and Lukaszewicz (2008). This may reflect the plasma membrane integrity of the majority of the sperm up until a period of 72 hrs storage. The particular mineral composition and reasonable total sugar content makes coconut water a natural isotonic liquid (Reddy and Lakshmi, 2014), suggesting it is a promising *in-vitro* sperm-nourishing media, especially when combined with the antioxidant effects of garlic. These results suggest that CWFGE has most promising potentials for the liquid storage of rooster semen.

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Deval Gir Gaushala Farm; an Indian organic enterprise for closed nutrient cycles, healthy organic produce and maintaining native cattle breeds for India

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Introduction

India is one of the world's largest producers of milk. Due to urbanisation and population increase there is huge and increasing demand for milk and milk products. Many marginal and medium sized family dairy farmers and new entrepreneurs are investing in their business and the Indian government is supporting them. Today most farms have only 2-3 milking cows, as part of the household. Up to 50% of the milk is used at home or in the neighbourhood. Surplus milk is brought to a local collection centre and will find its way to the urban market. The government of India stimulates entrepreneurship in the dairy sector. More and more young dairy farmers want to invest in dairying and develop farms with 20 and more milking cows.

The Deval Gir Gaushala farm, owned by the Majhid Pathan family, is situated about 200 km east of Mumbai, south of the reservoir lake of the Ujani dam,. The family own 40 acres of land and 20 acres under contract. Water, which is the main limiting factor in this area, is available from the lake and for extreme drought periods, water is stored in a water basin. The farm has been family owned over many generations. The main goals of the Majhid Pathan family are 1: to produce along natural processes with integrated farming and market the different products (fresh milk, human healthcare products, different fruits) , 2: to play a role in breeding and improving local, native Indian cattle breeds and to encourage other farmers to use these breeds as well.



Farm land

The total area of the farm comprises 60 acres of land, mainly for feed production for the cows. To maintain soil fertility and soil organic matter, the land is fertilized with the cow dung from the farm and irrigated by flooding the fields regularly. An overview of the different crops is given in Table 1.

Next to the fodder crops the farm has a 10 acre orchard with 4 acres sweet lemon trees and orange trees, 6 acres apple and pomegranate trees, 250 plant coconuts and 400 mango plants.

Table 1: Overview of the different crops at the farm.

Crop	Acres
Sorghum	6,5
Maïs	20,0
Napier Grass	3,0
Alfalpa	10,0
Cow Peas	10,0
TOTAL	49,5

Farm animals, indigenous breeds

The herd contains 260 animals in total. The main breeds are Gir (38 milking, 42 dry cows, 3 mature bulls and 45 young stock) and Khillar (60 breeding cows, 10 bulls and 30 young stock). Additionally the farms breeds some Panganur, Deoni, and Kankrej. The Panganur is the smallest cow breed in the world.

The Milking cows are mainly Gir and some Deoni and Kankrey cows. About 25 cows are milked and the average production is 7 kg milk/day with 4.23% fat and 3,25% protein in the milk (March, 2017).

The Deval Gir Gaushala farm will become a centre for indigenous breeds. Indigenous breeds are more adapted to the Indian environment, the main adaptive trait is the lack of heat stress. In India temperatures can rise above 40 °C. Holstein cows cannot cope well with high temperatures and are more susceptible to diseases and infertility in such temperatures. Therefore, the Deval Gir Gaushala farm will encourage the use of the indigenous breeds of India. A semen collection centre will be set up and semen from the bulls will be sold to other farms.

Organic farming

Currently the farm is organically managed and application for certification is under way. The basis of the organic farming system is the internal nutrient cycle. Manure from the cattle is used for fertilization of the land and growing healthy crops and fruit. The cattle are fed with these crops and produce milk. The orchard is also fertilized with the manure and produces different fruit. The only input is concentrated feed for the milking cows. The concentrate feed is made of agricultural waste products of organic quality. The farm does not use antibiotics but grows different medicinal plants and trees for treatment and prevention of different diseases in the cattle. Herbs that are grown are for example:

Black tulsi or holy basil (*Ocimum sanctum*) - immunomodulatory, antimicrobial, anti-asthmatic, anti-tussive, diaphoretic, anti-thyroid, anti-fertility, anti-ulcer, anti-arthritis, adaptogenic, anti-stress, anti-cataract, anti-leukodermal and anti-coagulant activities. These pharmacological actions help the body cope with a wide range of chemical, physical, infectious stresses.

Gudvel (*Tinospora Cordifolia*) - Fruits used in diarrhoea, gastric troubles, constipation gonorrhoea, epilepsy, as a laxative, tonic, digestive, stomachic, dysentery, brain and heart tonic, ulcer, antiviral, anti parasitic (intestinal). The ripe fruit promotes digestion and is helpful in treating inflammation of rectum. The ripe fruit extract has shown antiviral activity against ranikhet disease virus. The fine powder of unripe fruit has shown a significant effect on intestinal parasites and is also effective against *Entamoeba histolytica*. It has been used in ethno medicine for its medicinal properties including astringent, antidiarrheal, antidysenteric, demulcent, antipyretic and anti-inflammatory activities.

Shatavari (*Asparagus racemosus*) use during pregnancy improves indigestion, acidity disorders, quality of milk and immunity of both mother and foetus. Traditionally, shatavari root powders are used for the treatment of productive, reproductive and udder ailments of livestock in several parts of India.

More milk from Indian breeds

The main questions are how can breeding and feeding of the cows lead to more milk yield per cow. Peak production of Gir cows is now up to 29 kg milk per day and average production is 7 kg milk/day. The ration fed to the dairy cows is up to 15 kg roughage containing 60% chopped green maize, 20% sorghum and 10% Napier and Marvel (*Dichanthium annulatum*) grass and fresh alfalfa. Milking cows get between 4 -6 kg of concentrate pellets.



To improve breeding, monthly milk recording started in March 2017. All the cows pedigrees are noted. Every month the total amount of milk per cow per day will be measured adding up evening and morning milk. Also, a sample of milk will be taken and milk solids measured per cow. Fertility data will be collected (calving date, inseminations/natural serving dates). Samples of the feed will be analysed for total energy, raw protein etc. This information will provide the farm with a more detailed knowledge of nutrient cycles, milk yield, performance (per lactation, day per lactation, solids in the milk), fertility data (Inseminations, days open, calving ease etc.) and more insight into heritability of traits. The feeding of the individual cows can be adjusted to their current milk production. This way breeding of cows and bulls in an organic, closed system will become more accurate. The farmer will start semen collection of his superior bulls for selling to other farmers in India that face similar environmental challenges, such as heat stress and drought.

Conclusions

In India, where farms are overall very small scale and produce mainly for local supply of milk and milk products, the Deval Gir Gaushala farm is a so called front-line farm, producing healthy organic food and health products for the Indian market in the city. On top of that Majhid Pawar also strives to increase the use of the Indian indigenous cattle breeds India wide. With more data recording, research and development the farm will develop knowledge that can be used on other farms to develop the Indian dairy sector. This is very important since urbanisation in India is ongoing and people in the cities create a market for healthy dairy products. Since India is facing large problems with the use of chemical sprays and antibiotics, and the damage done to ecosystems, sustainable production systems are needed for the near future.