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[SEED SOVEREIGNTY]

How can organic agriculture contribute to the development and protection of the seed, - a case study of Nepal

Abstract

The seed system has changed a lot over the past decades with the control over the seeds lying more and more in the hands of a few large companies and less in the hands of the farmers. This has affected the genetic diversity as well as the farmers' rights. Nepal is a country with a high plant diversity. There is an increase in seeds imported to the country, especially hybrid seeds, which threatens the diversity and the seed sovereignty. Organic agriculture based on the four principles of health, ecology, fairness and care can help counteract this development and increase the seed sovereignty by being a natural driver of local seed development and the development and maintenance of seed diversity.

Keywords: seed sovereignty, organic agriculture, Nepal, principle of health, principle of ecology, principle of fairness, principle of care

Introduction

“Plant genetic resources are the biological basis of food security and, directly or indirectly, support the livelihoods of every person on Earth” (FAO, 1997)

As pointed out in the above quote by FAO, seeds are the heart of agriculture and the source of our foods. They carry the genetic information that supports agriculture and are thus vital for diversity, resilience and food security. Furthermore seeds are important in the area of economics, since the seed is a commodity that can be traded globally (Louwaar et al., 2011). Since ancient times the seed has had great cultural significance. Often being considered sacred, seeds are still at the heart of community rituals in many parts of the world (Farrelly, 2014). Agriculture started with the seed. Farmers domesticated the plants and have over thousands of years gradually created a variety of crops with a staggering diversity of colors, flavors, nutritional value, growth habits, pest resistance etc. Seeds have been saved and exchanged by farmers and developed in accordance to the local environment. This process of free exchange of seeds among farmers has made the passing of knowledge, traditions, customs and culture possible from one farmer to another for countless generations (Grain & PEAC, 2010). The last century this way of conserving and sharing seeds has changed in many parts of the world due to major changes in the seed system. In the first half of the 20th century, seeds were overwhelmingly in the hands of farmers and public-sector plant breeders. In the decades since then, the seed system has gradually moved the control of the seeds from the farmers and public breeders to a few large multinational chemical companies (Howard, 2009). This shift is mainly caused by technological advances such as hybridization and genetic modification as well as legal protections. This has increased the seed companies' potential to extract profits from agriculture and given a few large corporations the opportunity to acquire many small seed companies.

The development of the hybrid seed industry in the 1930s facilitated the emergence of a robust private seed industry with immense capital at its disposal which in turn began the shift towards a consolidation in the seed industry (Howard, 2009; Kloppenburg, 2014). In the early 1980s the international authorities began to grant patents for genetically engineered characteristics. The new patents meant that others could not use a GM plant - neither as seeds nor as a basis for further breeding - without paying license to the patent holder. The principle was enshrined in the TRIPS agreement on intellectual property rights (IPR) that is part of the conditions to which all countries wishing to join the World Trade Organization (WTO) must adapt. The commercialization of full patent-protected transgenic seeds further accelerated the consolidation in the seed market (Howard, 2009). Figure 1 visualizes the current pattern of the seed industry showing how a few corporations have acquired many small companies.

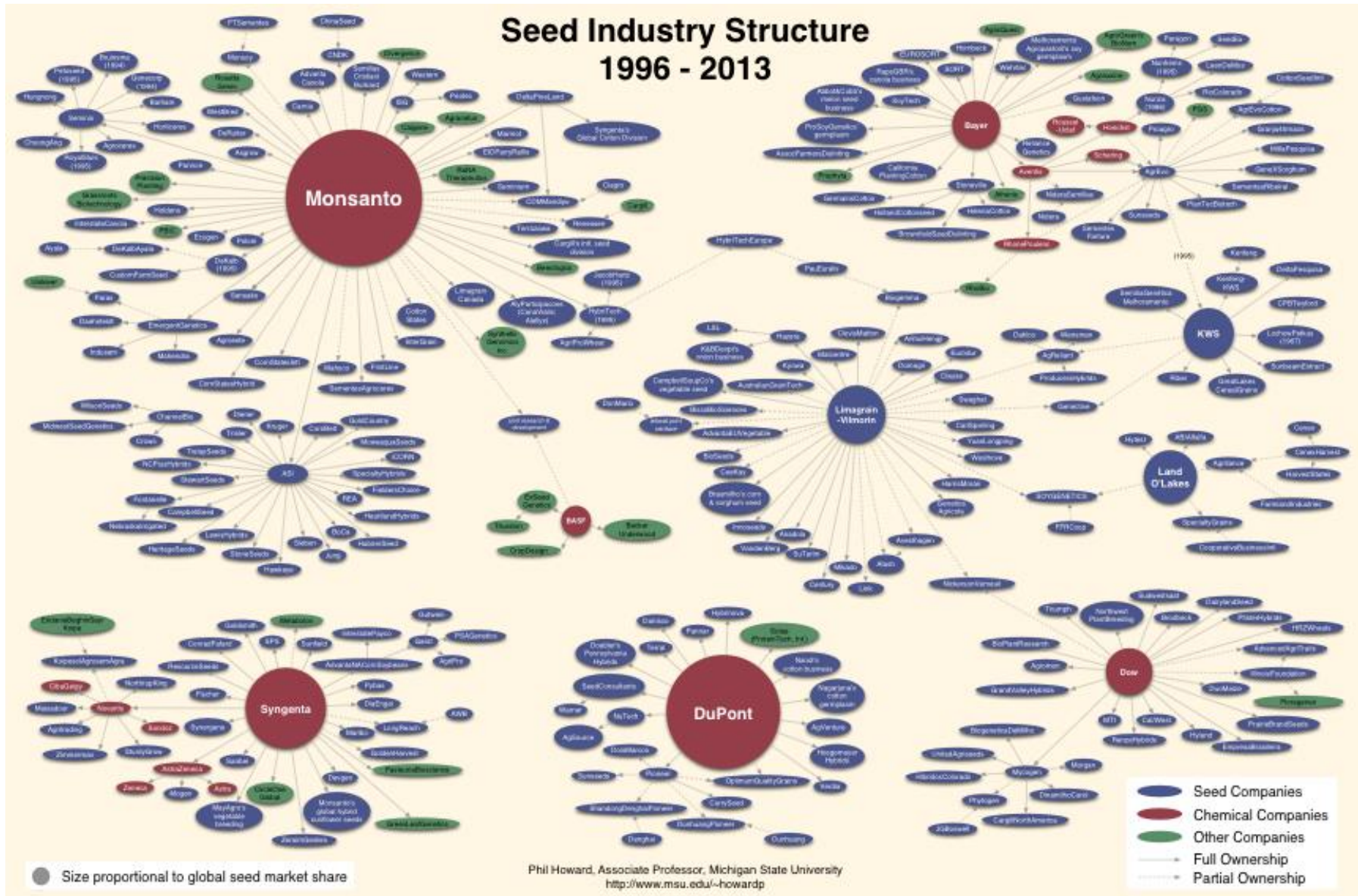


Figure 1 Seed industry structure, 1996-2013 (Howard, 2014)

According to ETC Group (2008) the top three seed companies, Monsanto, DuPont and Syngenta, owned 47 % of the global proprietary seed market in 2007. This development has reduced the competition among plant breeders and according to Howard (2009) the consolidation is associated with a number of impacts that constrain the opportunities for renewable agriculture. Among these he mentions declining rates of saving and replanting seeds, as a result of companies successfully convincing a growing percentage of farmers to purchase their products year after year, since the technology fee on the seeds usually only covers the use of a single harvest. The development has furthermore made a shift in both public and private research toward the most profitable proprietary crops and varieties, but away from the improvement of varieties that farmers can easily replant. This has caused an erosion of the seed diversity, as remaining companies eliminate less profitable lines from newly acquired subsidiaries. Cultural knowledge of how seeds can be saved and replanted may be lost if farmers do not maintain these practices (Howard, 2009). Since the 1900s, approximately 75 % of agricultural plant genetic diversity has been lost as farmers worldwide have left their multiple local varieties for genetically uniform, high-yielding varieties and more than 90 percent of crop varieties have disappeared from farmers' field (FAO, 2004).

The aim of this paper is to investigate the link between organic agriculture and seed sovereignty and to discuss if organic agriculture can enhance seed sovereignty in Nepal. This is done by;

- Giving a background of the situation in Nepal.
- Examining and clarifying the concept of seed sovereignty and the link to Nepal.
- Analyzing how organic agriculture and seed sovereignty are linked by looking at the four principles of organic agriculture and discussing how conscious organic agriculture based on the four principles can strengthen seed sovereignty in Nepal.

Agriculture and seed system in Nepal

Nepal is a landlocked country in South Asia with a population of approximately 28 million people (UN, 2012). It is a low-income country where agriculture is the single largest sector of the economy and thus very important in providing livelihoods to the great majority of the population. Agriculture contributes 36.1% of GDP and supports livelihood to 65% in rural areas (Gautam, 2008). Most rural households are engaged in subsistence farming and only 3% of the farms are classified as commercial farming operations. Up to the 1980s Nepal was exporting food, but in recent years Nepal is facing food deficiency and has become increasingly dependent on food imports to meet demands (Gautam, 2008; Govt. of Nepal et al., 2008). Approximately 21 % of the total land of Nepal is cultivated, with rice, maize, wheat, millet and potatoes as main crops (Gautam, 2008). There is little arable land that is not presently farmed which makes the expansion of agricultural areas difficult. A report from 2008 concluded that 41% of the population is undernourished, whilst 31% are under the poverty line (Govt. of Nepal et al., 2008). Due to the subsistence nature of agriculture most farming systems are mixed with a diverse variety of crops and livestock. Furthermore Nepal is a country with a great variation in climate, topography and ethnicity which means that there is vast range of different crops specially adapted to the many diverse environments (Gautam, 2008). Nepal is exposed to high risks from a variety of natural disasters like droughts, floods, landslides, windstorms, hailstorms, disease epidemics etc. and since the country lies in the Himalayas, the part of the world that is thought to be most sensitive to climate changes, these events are likely to increase in the future (Govt. of Nepal et al., 2008). Cropping systems consisting of various kinds of crops to increase the

resilience is used to cope with these natural disasters. The mixed cropping systems create a high diversity in plant species. The genetic variation in the crop varieties is also high due to a close proximity to many wild relatives in the nature. According to Regmi & Paudyal (2010) more than 6,000 vascular plant species are found in Nepal. Within these about 550 species and subspecies have food value, and some 200 are cultivated. The diversity is thus high in both species and varieties.

It is estimated that 95% of the seeds used in Nepal are open-pollinated variety (OPV) heirloom seeds, passed down for generations within family (CBS, 2004). But over the past decade more and more modern cultivars are being introduced, and especially commercial farmers in the lowlands have started using hybrid varieties, drawn by the potential of higher yields. As mentioned earlier the current number of commercial farms is low, but as Nepal urbanizes, the country is shifting from self-sufficient farming to commercial agriculture. According to Gautam (2008), this development is threatening the existing diversity of plant genetic resources.

Seed sovereignty

The erosion of seed diversity and the change in the seed system in many parts of the world has become a pivotal issue for many farmers and has started a public opposition against this development (Kloppenburg, 2014) There is a growing movement for people mobilizing and struggling against an agro-industrial system that undermines the seed sovereignty. According to Shiva (2012) Seed sovereignty *“includes the farmer’s rights to save, breed and exchange seeds, to have access to diverse open source seeds which can be saved – and which are not patented, genetically modified, owned or controlled by emerging seed giants. It is based on reclaiming seeds and biodiversity as commons and public good”*. Navdanya, a participatory research initiative, pioneered the movement for seed sovereignty in the response to the crisis of agricultural biodiversity (Navdanya, n.d.) and more and more movements are formed throughout the world.

In recent years a movement for seed sovereignty has also risen in Nepal. On September 13, 2011, United States Agency for International Development (USAID) announced a partnership with Monsanto and the Nepalese Ministry of Agriculture and Cooperatives for introducing and promoting hybrid maize seeds in Nepal to boost yields. They intended to subsidize the cost of hybrid seeds for 20,000 farmers in three commercial maize-producing districts (Acharya, 2013). Monsanto has been exporting hybrid maize seed to Nepal since 2004, but this large-scale potential import of seeds started widespread protests from students, environmentalists and social activists citing concerns over loss of local seeds, dependence on seed imports and environmental damage to the land and surrounding communities. The nationwide campaign ‘Stop Monsanto in Nepal’ organized a sit-in protest in front of the US embassy in Kathmandu and had a large campaign on the social medias trying to block Monsanto’s expansion in Nepal (Bhusal, 2012; Acharya, 2013) The pressure put on the government to annul its agreement with Monsanto proved to be effective and eventually resulted in the cancellation of the deal (Acharya, 2013). These protests propelled the debate on agricultural issues onto a national scale and made the many Nepalese people gather on a common desire for seed sovereignty.

Organic farming and seed sovereignty

Often organic farming is confused with traditional farming with no use of chemical input. This is however a mistake since traditional agriculture in developing countries is about doing as previous generations did,

even though it may not be the most appropriate course of action. Modern organic agriculture, on the other hand, is based on knowledge of biological processes and the interaction between plants and their environments - an insight which among other things enables farmers to grow crops in the best possible order and to supply crops with the nutrients they need, using organic fertilizers such as compost and manure. According to Morgera et al. (2012) organic agriculture *“is a system that emphasizes environmental protection and the use of natural farming techniques. It is concerned not only with the end-product, but with the entire system used to produce and deliver the agricultural product”*. It *“...excludes the use of artificial products such as genetically modified organisms (GMOs) and certain external agricultural inputs such as pesticides, veterinary drugs, additives and fertilizers. Organic farmers rely instead on natural farming methods and modern scientific ecological knowledge in order to maximize the long-term health and productivity of the ecosystem, enhance the quality of the products and protect the environment.”* It is a holistic approach that does not only take ecological aspects into account but also economic and social aspects. This is encompassed in four principles; principle of health, ecology, fairness and care, established by the International Federation of Organic Movements (IFOAM) which is set to inspire and develop the organic movement (IFOAM, n.d.). Each principle is articulated through a statement followed by an explanation. In this paper organic agriculture is defined through these principles. These principles are used in the analysis of how organic farming and seed sovereignty are linked as well as in the discussion of how organic farming can contribute to seed sovereignty in Nepal. The statement is included under each header, while both the statement and the explanation can be found in appendix 2.

Principle of Health

“Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible” (IFOAM, n.d.).

The principle stresses immunity, resilience and regeneration as key characteristics of health (IFOAM, n.d.). In the future with less stable climatic conditions, the adapted varieties are very important for resilience and there will be a need of diversified food crops to resist the increased risk of crop failure. Traditionally farmers have grown and saved a range of seed varieties to spread risk and guarantee a harvest. The high-yielding varieties being bred and sold through a few corporations may not perform as well in the face of unpredictable rains and temperatures, floods and droughts, which is making farmers, communities, and the entire global food system highly vulnerable to climate change. A great seed diversity and local knowledge about the crops is thus a vital tool for resilience towards these challenges.

The principle of health also emphasizes the intention of organic agriculture to produce *“high quality, nutritious food that contributes to preventive health care and well-being”* (IFOAM, n.d.). The shift from indigenous local crops grown for nutritional content, to just a few staple crops grown for yield has contributed to a loss of nutrients in diets and to global malnutrition (Farrelly, 2014) an issue which has also been problematized by the movement for seed sovereignty.

Principle of Ecology

“Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them” (IFOAM, n.d.).

It states that *“production is to be based on ecological processes, and recycling”* and *“inputs should be reduced by reuse, recycling and efficient management of materials and energy in order to maintain and*

improve environmental quality and conserve resources" (IFOAM, n.d.). This renewable agricultural system is not obtained through hybrid seeds where the F2 generation (the offspring of hybrid seeds) often does not give the same result as the parent generation because the genes in the next generation will segregate into many new combinations. Contamination of hybrid seeds to fields where seed saving is being practiced can thus influence the crop performance for the next generation on contaminated fields. The use of hybrid seeds requires farmers to purchase new seeds every season (Archarya, 2013). The use of seeds produced by agro-chemical companies can also pull farmers into a vicious cycle of dependency on pesticides, herbicides and other inputs from the company since these seeds often are developed so they have to be used with these inputs (Acharya, 2013). Because of patents and licenses preventing farmers from saving seeds from one growing season to the next, the farmers become dependent on the corporations for the most critical input in agriculture. Contamination of these licensed seeds to fields where they are not used makes the farmer vulnerable to costly and disruptive patent enforcement actions (Nargolwala, 2012). This is not renewable agriculture but agriculture highly dependent on input.

Locally available heirlooms of OPVs exhibit fairly consistent characteristics and produce seeds that will grow into plants more or less like their parent plants and are thus renewable sources of seeds. These seed types also have fair amount of resistance against local pests and insects because of the adaption to the local environment (Acharya, 2013). This local adaption is also encompassed in the principle of ecology where *"Organic farming, pastoral and wild harvest systems should fit the cycles and ecological balances in nature. These cycles are universal but their operation is site-specific. Organic management must be adapted to local conditions, ecology, culture and scale"* (IFOAM, n.d.). The formal seed industry primarily tends to produce high-yielding crops and more uniform varieties bred under high-input, chemical systems in conflict with organic principles (Louwaar et al., 2011) while the informal farmer seed systems generate and maintain less uniform varieties adapted to the local environment which is vital to the resilience against climate events, pests and diseases.

Maintenance of genetic and agricultural diversity is also a key characteristic in the principle of ecology in attaining ecological balance (IFOAM, n.d.). As previously mentioned the erosion of plant genetic diversity the last century has been enormous. Since we can never restore those species which have disappeared completely there is a need to act before the threat to diversity becomes too great. *In situ* and *ex situ* conservation is thus necessary to maintain a high level of plant genetic diversity (Gautam, 2008). The *in situ* diversity in the field is important in resilience and in producing a range of food crops that can provide sufficient nutrients to the population. Furthermore it is necessary with genetic diversity and the conservation of wild relatives in the surrounding ecosystem to maintain a genetic pool where you can find desirable traits for future breeding. Genetic material from crop wild relatives have been used for thousands of years to improve the quality and yield of crops and is still important in the development of plants tolerant and resilient towards different environments, pests and diseases. The diversity among wild relatives is very important to keep in regards of future breeding since we know that the climate changes will have severe impacts on the plant environment. The genetic pool in the crop wild relatives is thus likely to prove a critical resource in ensuring food security for the new millennium. In many countries industrialized agro-chemical agriculture has polluted the environment through the use of pesticides and over-fertilization which has had a major negative impact on the plant biodiversity in the surrounding environment. Organic agriculture with its avoidance of inputs such as chemical fertilizer and pesticides can help to preserve a high diversity in the surrounding environment.

Principle of Fairness

"Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities" (IFOAM, n.d.).

The principle of fairness stresses that organic agriculture should contribute to food sovereignty (IFOAM, n.d.). In the Declaration of Nyéléni food sovereignty is defined as *"the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems"* (Vía Campesina, 2007). Since the seed is the first link in the food chain it is necessary that food sovereignty encompasses seed sovereignty. The principle of fairness hereby becomes a protection of seed sovereignty.

In addition the principle of fairness emphasizes that fairness is characterized by *"equity, respect, justice and stewardship of the shared world, both among people and in their relations to other living beings"* (IFOAM, n.d.). Traditionally women have been seed keepers and seed breeders and they consequently play a critical role in their communities as the custodians of seeds. The seed saving and sharing can thus be an important factor in the empowerment of women.

Principle of Care

"Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment" (IFOAM, n.d.).

The principle of care stresses that scientific knowledge cannot stand alone, but *"practical experience, accumulated wisdom and traditional and indigenous knowledge offer valid solutions, tested by time"* (IFOAM, n.d.). The indigenous population has passed on knowledge about the local environment and the seeds being grown, saved and exchanged and has thus been breeding for traits fitting the local environment and the local needs. This knowledge is being ignored and lost with the use of modern seeds bred by the formal seed industry. The principle of care also encompasses the avoidance of unpredictable technologies *"such as genetic engineering"* (IFOAM, n.d.). By rejecting the use of GMOs the involvement of patents and major trade systems is being reduced.

According to the principle of care, decisions in organic farming *"should reflect the values and needs of all who might be affected, through transparent and participatory processes"* (IFOAM, n.d.). The emphasis on participatory processes is a way of building up social capital and strengthening communities. Organic farming is a knowledge-intensive production that requires extensive knowledge about the surrounding ecosystem. In order to take care of the surrounding environment it is necessary to collaborate with other members of the community. There is thus a social coherence around the agricultural practices and a network between different parts in the society. The organic movement and the seed sovereignty movement both work by mobilizing people and promoting communication between communities. The seed and its attendant political ecology is a potential vector for development of a shared consciousness the same way as the organic principles sets a stage for a shared consciousness. Within a social network and within practices of participatory agriculture, where the farmers build a pool of knowledge and skills, the empowerment of the farmers can be enhanced. These networks can create space for elaboration of participatory plant breeding, where the farmers evaluate and select material from their fields in order to breed for seeds better adapted to their region, to further enhance seed diversity and meet their different

needs. Furthermore these networks can be used to establish a decentralized and community-based seed distribution and local seed banks that ensure local seed supply.

How can conscious organic agriculture enhance seed sovereignty in Nepal?

As seen in the analysis the organic principles encompass the issues of seed sovereignty and can thus be seen as a relevant strategy to maintain seed sovereignty. Agriculture using hybrid seeds and other external inputs are getting more widespread in Nepal, but at the same time a few farms are adapting to organic agriculture (Si, 2013; Bhatta et al., 2009). The majority of the agriculture however still consists of traditional farming methods with minimal or no use of inputs. The Nepalese government and the Nepalese people are thus standing at a crossroad where they can decide which way they want to develop their agricultural system. Their neighboring countries China and India both have an industrialized commercial agricultural system and today 95 % of India's cotton seed is controlled by Monsanto (Shiva, 2014). Bhutan, the country East of Nepal, on the other hand has decided to make a transition to 100% ecological organic farming (IFOAM, 2014).

Nepal is a country in a food deficit and thereby needs to increase production to feed the population. This makes the industrial agriculture and the use of high-yielding hybrids very tempting. Supporters of conventional farming often argue that to raise the world food production one cannot avoid the use of chemical fertilizers, pesticides and high-performance GM crops. Several studies, however, show that going from traditional farming to conscious knowledge-intensive organic farming, can increase the production significantly (Halberg et al., 2006; Badgley et al., 2007).

Often development only looks at increasing yield and producing more food. But development also has to encompass other factors. This was demonstrated in Nepal by the opposition against Monsanto's partnership with USAID and the Nepalese government. The Nepalese people were not denying the existence of a food deficit in the country, but highlighting that factors such as farmer's rights and seed sovereignty also need to be included. An adoption of organic agriculture in Nepal can be a strategy towards seed sovereignty and a way to maintain the seed diversity. In many countries seed diversity and traditional knowledge is lost as farmers are encouraged or pressured to buy seeds. When the diversity is gone it is impossible to recover (FAO, 1997). The conservation of a high diversity is stressed by the principle of ecology. Nepal still has a high seed diversity and a high number of wild relatives to many of the crops being grown throughout the world, which makes it even more important to use an agricultural system that protects the surrounding environment in regards of future breeding and to be able to find varieties resilient towards the climate changes. Great crop diversity will increase the likelihood that a portion of seeds will germinate under difficult conditions, caused by the natural disasters, which are already a common phenomenon in Nepal and stand to increase in frequency and severity alongside the changes in climate. A diverse crop production is also essential for the Nepalese people in regards to provide nutritious food. With the high rate of malnutrition already seen in Nepal it is important that the agricultural production guarantees a diverse and nutritious production to ensure health to the community. If the attempt by Monsanto to export hybrid maize seeds had succeeded it could have had severe impacts on the population's health and nutritional status since more sources are indicating that the maize was aimed at supplying raw materials for the animal feed industry and that these varieties are very different from what Nepalese people are used to growing and eating (Bhattarai, 2011). Since the population relies on the food

being produced by the Nepalese agricultural sector this could potentially have impacted the health of the people on a large scale.

Organic agriculture can also be a way to empower the Nepalese people and create independency. The principle of ecology stresses that organic agriculture must be renewable. A seed renews itself over time as it grows into a crop, from which comes a new seed, but if the farmers start buying hybrid and GMO seeds farmers are required to buy seeds year after year. With the low incomes and returns and limited access to institutional credit in Nepal, the farmer's ability to buy seed for each planting season is greatly inhibited (Gautam, 2008) and the dependency for seeds as an external input could be disastrous for their economy. The farmers in Nepal, like in the rest of the world, have been the original breeders and their rights to control the seed must be kept. Traditionally women have been in charge of seed keeping and breeding. This tendency has also been found in Nepal, where a study of rural women of Nepal, showed that seed selection primarily is a female responsibility. In 60.4% of the cases, women alone decided what type of seed to use, while men decided in only 20.7% (Shiva et al., 2011). Nepal remains a largely male-dominated society, where Nepalese women lag behind men on many development indicators and only have a limited role in decision making (UNDP, 2010). The farmers control over the seed can thus be an important factor for the empowerment of the Nepalese women.

The organic principles build on a connection between the local context and the development of the agriculture. This is in regards both to the environment, the social relations and the economy. Organic agriculture can build up stocks of capital assets that promote the rural development and the community livelihood. Collaboration within the community and build-up of social capital makes the farmers able to pool their knowledge and increase their human capital. According to Morgera (2012) increased cooperation can result in more active participation in local government which can increase the empowerment of the farmers. Organic agriculture can strengthen *in situ* conservation and utilization of plant genetic resources through the diversified production and the maintenance of the surrounding environment. Furthermore the social capacity-building can promote and strengthen capacity for participatory plant breeding and the establishment of community seed banks to broaden the plant genetic diversity. In Nepal there has been a long term declining trend in public investment, particularly in agricultural support and productivity enhancing services such as seed development and research (Govt. of Nepal et al., 2008). Thus social networks of farmers and seed savers, and processes for them to share seed, knowledge and experiences can be of high value in Nepal.

As a final note it should be mentioned that agriculture sometimes is defined as organic when it meets a set of minimum standards in order to become certified. As mentioned earlier traditional farming without inputs is also by some mistakenly thought of as organic farming. In these cases the production is not necessarily build on IFOAMs principles and may lack some of the aspects included in these. Therefore, it should be stressed that the relationship between organic agriculture and seed sovereignty and the ability of organic agriculture to develop seed sovereignty in Nepal is examined in regards of an agricultural production that encompasses the four principles. It is important that organic agriculture is seen as a holistic approach where both social, ecological and economic aspects are involved in order to achieve sovereignty over the seed in Nepal and to preserve the diversity both *in situ* on the field and in the surrounding nature and the building of social capital required to build a network that can build an *ex situ* conservation of the seed.

Conclusion

For thousands of years generations of farmers across the globe have been selecting, exchanging and saving seeds. This has created a high agricultural diversity and crop varieties resilient towards many different challenges such as pests and diseases and adapted to different environments. The last century has seen a dramatic decrease in global seed diversity, mainly promoted by the changes in the seed industry. Nepal still contains a large plant genetic diversity but this is being threatened by the increasing use of hybrid and uniform high-yielding varieties grown in monoculture. An organic farming system build on the principles of health, ecology, fairness and care can contribute to seed sovereignty by being a diversified production with no reliance on input, and with seeds adapted to local conditions. It is a sustainable and self-reliant system that can stimulate the empowerment of the Nepalese farmers and contribute to seed sovereignty.

References

Cover photo: <http://milkwood.net/2012/09/18/seed-saving-101-workshop-occupying-the-seed/>

Acharya, Binod. 2013. "Seeds of Sovereignty." *República*, 12-25.

Badgley, Catherine, Jeremy Moghtader, Eileen Quintero, Emily Zakem, M. Jahi Chappell, Katia Aviles-Vazquez, Andrea Samulon, and Ivette Perfecto. 2007. "Organic Agriculture and the Global Food Supply." *Renewable Agriculture and Food Systems* 22 (02): 86-108.

Bhatta, Gopal Datt, Werner Doppler, and Krishna Bahadur KC. 2009. "Potentials of Organic Agriculture in Nepal." *Journal of Agriculture and Environment* 10: 1-14.

Bhattarai, Anil. 2011. "Monsanto is Not the Answer." *Kathmandu Post*, 10.25.2011

Bhusal, Manoj. 2012. "Interview Exclusive: Sabin Ninglekhu Limbo and "Stop Monsanto in Nepal" Movement." *Global South Development Magazine* 2 (1).

CBS (Central Bureau of Statistics). 2004. "Nepal Living Standards Survey 2002/2003, Statistical Report, National Planning Commission Secretariat, His Majesty's Government of Nepal." 2.

ETC Group. 2008. *Who Owns Nature? Corporate Power and the Final Frontier in the Commodification of Life*. Ottawa, CA, USA.

FAO. 1997. *The State of the World's Plant Genetic Resources for Food and Agriculture*. Rome.

FAO. 2004. "What is Agrobiodiversity?"

Farrelly, Michael. 2014. "Seeds for Life." *Mkulima, Farmer's World*, January, 5.

Gautam, J. C. 2008. "Country Report on the State of Nepal's Plant Genetic Resources for Food and Agriculture, Submitted to Commission of Genetic Resource for Food and Agriculture, FAO." .

Govt of Nepal, FAO, WFP, IFAD, Asia Development Bank, World Bank Interagency Rapid Assessment Mission. 2008. "Nepal - Initiative on Soaring Food Prices. Draft Report of Mission Findings and Recommendations." .

GRAIN & PEAC. 2010. *From Green to Gene Revolution: How Farmers Lost Control of the Seeds from Agricultural Modernisation*.

Halberg, Niels, Timothy B. Sulser, Henning Høgh-Jensen, Mark W. Rosegrant, and Marie Trydeman Knudsen. 2006. "The Impact of Organic Farming on Food Security in a Regional and Global Perspective." *Global Development of Organic Agriculture: Challenges and Prospects*: 277-322.

Hesseldahl, Peter. 2002. "Hvis Afgrøder Er Det?" *Teknologirådet*: 19.05.2014.

Howard, Philip H. 2009. "Visualizing Consolidation in the Global Seed Industry: 1996–2008." *Sustainability* 1 (4): 1266-1287.

- Howard, Philip H. "Seed Industry Structure, 1996-2013." 2014, <https://www.msu.edu/~howardp/seedindustry.html>.
- IFOAM. 2014. "The Thimphu Declaration Ecological Organic Agriculture in Mountain Agro-Ecosystems: Leading the Transformation." .
- IFOAM. N.d. "Principles of Organic Agriculture.", accessed 18.05, 2014, http://www.ifoam.org/sites/default/files/ifoam_poa.pdf.
- Kloppenborg, Jack. 2014. "Re-Purposing the Master's Tools: The Open Source Seed Initiative and the Struggle for Seed Sovereignty." *Journal of Peasant Studies* (ahead-of-print): 1-22.
- Louwaars, NP, Philippe Le Coent, and Tom Osborn. 2011. *Seed Systems and Plant Genetic Resources for Food and Agriculture* Food and Agriculture Organization of the United Nations (FAO).
- Morgera, Elisa, Carmen Bullón Caro, and Gracia Marín Durán. 2012. *Organic Agriculture and the Law*. Rome: FAO.
- Nargolwala, Christina L. 2012. *Renewable Agriculture: Transgenic Contamination and Patent Enforcement Threats*. Vol. 26 American Bar Association - LA English.
- Navdanya. "Seed Sovereignty." N.d, accessed 05/19, 2014, <http://www.navdanya.org/earth-democracy/seed-sovereignty>.
- Regmi, Bimal Raj and Apar Paudyal. 2010. "Climate Change and Agrobiodiversity in Nepal: Opportunities to Include Agrobiodiversity Maintenance to Support Nepal's National Adaptation Programme of Action (NAPA)." .
- Shiva, Vandana. 2012. "The Seed Emergency: The Threat to Food and Democracy."." *Al Jazeera English*.
- Shiva, Vandana. 2014. "The Seeds of Suicide: How Monsanto Destroys Farming." *Global Research*, 03.13.
- Shiva, Vandana, D. Barker, and C. Lockhart. 2011. "The GMO Emperor has no Clothes." *Florence, Italy and New Delhi, India: Navdanya International*.
- Si, Meng. 2013. "Organic Farming Takes Root in Nepal." *Chinadialogue*, 10.07.
- UN. 2012. *World Population 2012*: United Nations, Department of Economic and Social Affairs, Population Division.
- UNDP. 2010. *UNDP Nepal Annual Report 2010*.
- Vía Campesina. 2007. "Declaration of Nyéléni." *Nyéléni.Org*.

Appendix 1

Principles of Organic Agriculture

1. Principle of Health

Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.

This principle points out that the health of individuals and communities cannot be separated from the health of ecosystems - healthy soils produce healthy crops that foster the health of animals and people.

Health is the wholeness and integrity of living systems. It is not simply the absence of illness, but the maintenance of physical, mental, social and ecological well-being. Immunity, resilience and regeneration are key characteristics of health.

The role of Organic Agriculture, whether in farming, processing, distribution, or consumption, is to sustain and enhance the health of ecosystems and organisms from the smallest in the soil to human beings. In particular, organic agriculture is intended to produce high quality, nutritious food that contributes to preventive health care and well-being. In view of this it should avoid the use of fertilizers, pesticides, animal drugs and food additives that may have adverse health effects.

2. Principle of Ecology

Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.

This principle roots Organic Agriculture within living ecological systems. It states that production is to be based on ecological processes, and recycling. Nourishment and well-being are achieved through the ecology of the specific production environment. For example, in the case of crops this is the living soil; for animals it is the farm ecosystem; for fish and marine organisms, the aquatic environment.

Organic farming, pastoral and wild harvest systems should fit the cycles and ecological balances in nature. These cycles are universal but their operation is site-specific. Organic management must be adapted to local conditions, ecology, culture and scale. Inputs should be reduced by reuse, recycling and efficient management of materials and energy in order to maintain and improve environmental quality and conserve resources.

Organic Agriculture should attain ecological balance through the design of farming systems, establishment of habitats and maintenance of genetic and agricultural diversity. Those who produce, process, trade, or consume organic products should protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water.

3. Principle of Fairness

Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities

Fairness is characterized by equity, respect, justice and stewardship of the shared world, both among people and in their relations to other living beings.

This principle emphasizes that those involved in Organic Agriculture should conduct human relationships in a manner that ensures fairness at all levels and to all parties - farmers, workers, processors, distributors, traders and consumers. Organic Agriculture should provide everyone involved with a good quality of life, and contribute to food sovereignty and reduction of poverty. It aims to produce a sufficient supply of good quality food and other products.

This principle insists that animals should be provided with the conditions and opportunities of life that accord with their physiology, natural behavior and well-being.

Natural and environmental resources that are used for production and consumption should be managed in a way that is socially and ecologically just and should be held in trust for future generations. Fairness requires systems of production, distribution and trade that are open and equitable and account for real environmental and social costs.

4. Principle of Care

Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

Organic Agriculture is a living and dynamic system that responds to internal and external demands and conditions. Practitioners of Organic Agriculture can enhance efficiency and increase productivity, but this should not be at the risk of jeopardizing health and well-being. Consequently, new technologies need to be assessed and existing methods reviewed. Given the incomplete understanding of ecosystems and agriculture, care must be taken.

This principle states that precaution and responsibility are the key concerns in management, development and technology choices in Organic Agriculture. Science is necessary to ensure that Organic Agriculture is healthy, safe and ecologically sound. However, scientific knowledge alone is not sufficient. Practical experience, accumulated wisdom and traditional and indigenous knowledge offer valid solutions, tested by time. Organic Agriculture should prevent significant risks by adopting appropriate technologies and rejecting unpredictable ones, such as genetic engineering. Decisions should reflect the values and needs of all who might be affected, through transparent and participatory processes.