Factsheet
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Strengthening calves and piglets with medicinal plants

The potential of phytotherapy from a scientific perspective

FiBL

Healthy, happy offspring is a joy for all livestock keepers. Like all young animals, calves and piglets have to deal with their environment and the pathogens therein. However, their immune system is often not yet sufficiently developed to do so. This is why young animals in particular may fall ill frequently and severely from a number of different diseases. These often have to be treated using pharmaceuticals in order to maintain animal welfare and performance. A large proportion of antibiotics used in livestock husbandry is administered to calves and piglets. But it is precisely in these enterprises that prevention is better than treatment!

The use of medicinal plants can make a valuable contribution to the prevention and treatment of diseases in young livestock. At the same time, it can also be used as a complement to veterinary therapy to assist with recovery. The use of phytotherapy is explicitly stipulated in the Swiss Organic Farming Ordinance.

This factsheet presents the traditionally most frequently used and, from a scientific perspective, most promising medicinal plants and explains how they can be applied in practice. It also sets out simple measures that can often help to control pathogens at an early stage and reduce the animals' susceptibility to disease.

Content

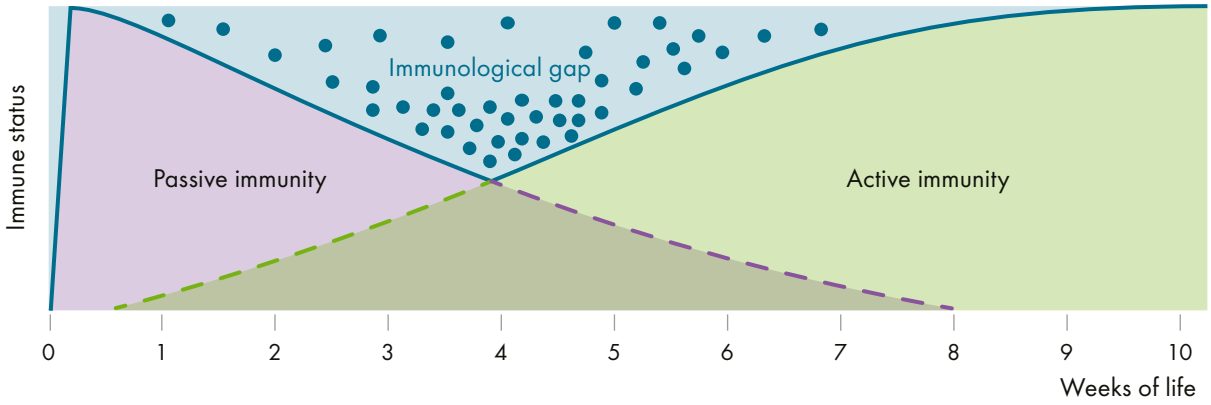
Diseases in young livestock and the use of medication

Even in non-intensive and organic husbandry systems, calves and piglets can and do contract life-threatening diseases. There are often many different factors that contribute to disease development:

- Unlike humans, calves and piglets are born with almost no immune protection. Only when they consume their first milk, the so-called beastings or colostrum, do they absorb antibodies from their mothers. An excellent supply of colostrum is therefore crucial for a good start to a healthy life.
- The young animals' immune system is not yet fully developed. While the maternal antibodies obtained from the colostrum continuously decrease, the young animal's immune system only slowly develops. This creates a "hole" in the immunity, the "immunological gap" (see Figure 1). It is during this time that the animals are particularly susceptible to disease.
- Painful procedures such as castration or disbudding, separation from the mother, re-housing or transports as well as intensive, inappropriate husbandry methods cause stress in animals. There is now a good body of research demonstrating that long-term stress weakens the immune system and thus leads to a general susceptibility to disease.
- Draughts as well as noxious gases and dust in the air of livestock housing irritate the respiratory tract and weaken its natural barriers against incoming microbes.
- High stocking densities, the co-housing of many different animals from different sources, wet or dirty litter as well as unhygienic drinkers and troughs favour the reproduction and spread of pathogens.
- In piglets, weaning from the sow's milk and switching to solid feed often triggers scouring (diarrhoea); digestive disorders can also occur in calves as a result of suboptimal drinker management.

These and many other factors lead to a general weakening of the animals – pathogens then have it easy. To successfully prevent these diseases takes more than to fine-tune individual management practices: the entire herd, management, feeding practices and husbandry system must be considered.

Figure 1: Immunological gap in calves and piglets



In the first days of life, the antibodies produced by the mother and passed on through the colostrum protect the newborn from pathogens. But this passive protection continuously decreases. The active immune defence, in which the young animals themselves produce cells and substances as part of the immune response in sufficient quantities, only builds up slowly. This gives rise to the "immunological gap", a period of several weeks during which the young animals are particularly susceptible to diseases.

Recognising "childhood illnesses" in calves and piglets

Diseases in young animals most frequently manifest where animal and pathogen come into close contact, i.e. in the area of the respiratory tract's and digestive tract's mucous membranes. The animals are often infected with not only one but several pathogens at the same time. Infections with any one particular type of pathogen can have different effects: they can go unnoticed, lead to more or less pronounced signs of illness, or they may be fatal. Infections are particularly problematic if they occur at a time when the young animal is highly stressed, such as during weaning, re-housing or transfer to a new farm. Table 1 lists major disease complexes in calves and piglets, as well as the causative pathogens and symptoms.

Table 1: Major infectious diseases of calves and piglets and their main causative pathogens

Disease complex	Pathogen			Symptoms
	Bacteria	Viruses	Parasites	
Calves				
Neonatal diarrhoea	*Escherichia coli*	*Bovine coronavirus, bovine rotavirus*	*Cryptosporidia*	Diarrhoea, dehydration, drop in body temperature, failing to suckle, fever, general weakness, inability to stand, shock
Pneumonia in calves/cattle	*Mannheimia haemolytica, Pasteurella multocida, Histophilus somni, Mycoplasma bovis*	Viruses causing *infectious bovine rhinotracheitis*[1], *parainfluenza virus type 3, bovine respiratory syncytial virus, bovine viral diarrhoea virus*[1]		Increased respiratory rate, loss of appetite, eye and nose discharge, rattled breathing, coughing, weakness, fever, not thriving
Piglets				
Diarrhoea in postweaning piglets	*Escherichia coli, Clostridium perfringens, Lawsonia intracellularis, Brachyspira spp., Salmonella spp., (Yersinia spp.*[2]*)*	*Rotavirus, coronavirus*[2]*, porcine circovirus type 2*	*Cryptosporidia*[2]*, coccidia,* gastrointestinal worms	Diarrhoea, dehydration, general weakness, not thriving, inability to stand, blue discolouration of ears and nasal disc, convulsions, shock
Respiratory infections	*Pasteurella multocida, Mycoplasma hyopneumoniae*[3]*, Actinobacillus pleuropneumoniae*[3]*, (Streptococcus suis), (Haemophilus parasuis)*	*Porcine reproductive and respiratory syndrome virus, porcine influenza virus, porcine circovirus type 2*		Coughing, sneezing, eye and nose discharge, increased respiratory rate, fever, not thriving

Animal diseases pursuant to the Swiss Epizootic Diseases Act, Article 1 (as of February 2022):

[1] Infectious bovine rhinotracheitis (IBR): notifiable epizootic disease to be eradicated; anyone keeping or caring for animals must report suspected cases to the herd veterinarian.

[2] Porcine epidemic diarrhoea (PED): notifiable epizootic disease to be monitored; veterinarians and laboratories must report cases and suspected signs of the disease to the cantonal veterinarian.

[3] Enzootic pneumonia (EP) in pigs: notifiable animal disease to be controlled; anyone keeping or caring for animals must report suspected cases to the herd veterinarian.

Strengthening health – preventing diseases

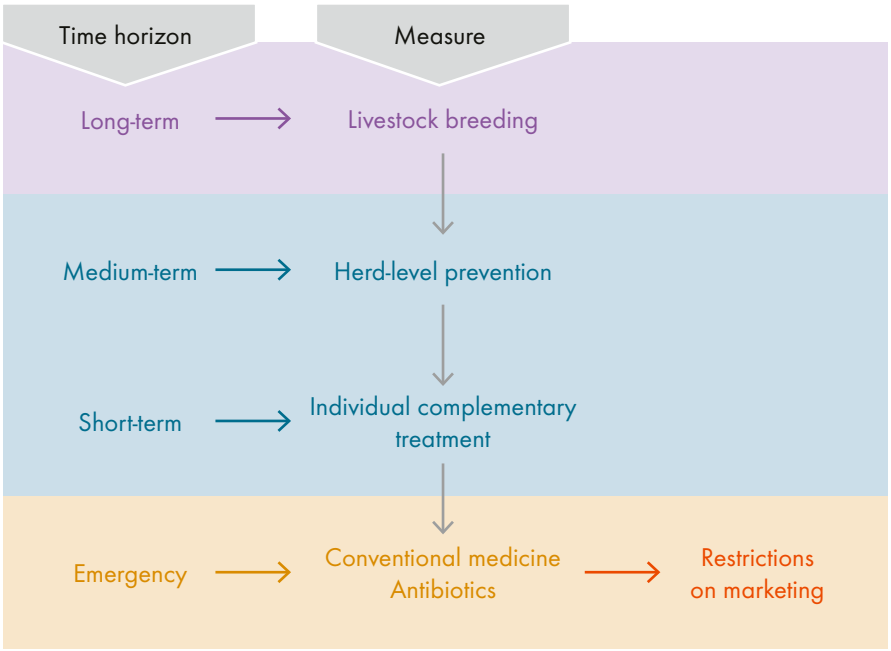
A number of measures, and often simple measures at that, can strengthen the health of young livestock, prevent diseases and reduce antibiotics use. In the long term, this effort pays off, resulting in reduced treatment costs, satisfactory performance and high animal welfare. The animal health services and the farms' herd veterinarians support farms in identifying individual risk factors and finding solutions.

Position of phytotherapy in the organic regulations

The Swiss Organic Farming Ordinance explicitly requires the use of phytotherapy (SR 910.18, Art. 16d, Para. 3a. fedlex.admin.ch):

The use of veterinary medicinal products in organic stockfarming shall comply with the following principles: Phytotherapeutic products [...] shall be used in preference to chemically-synthesised allopathic veterinary medicinal products or antibiotics, provided that their therapeutic effect is shown to be effective for the species of animal and the condition for which the treatment is intended.

Figure 2: The animal health cascade

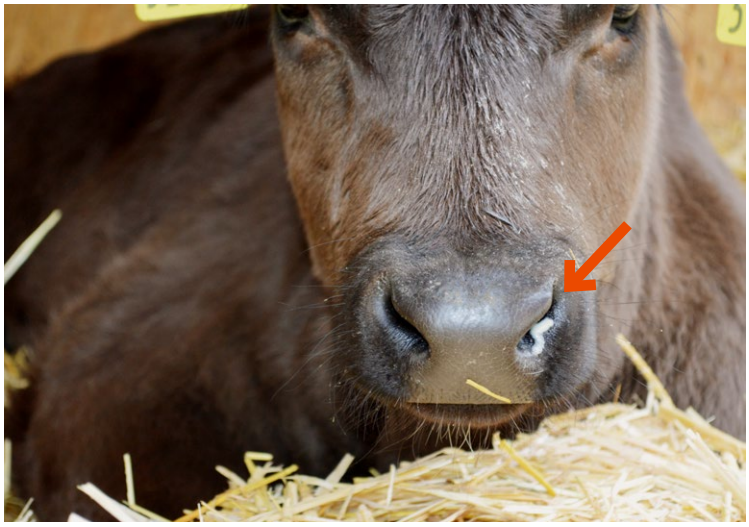


The animal health cascade outlines the holistic understanding of livestock health in organic farming. The greatest emphasis is to be placed on prevention. If an animal nevertheless falls ill, it should be treated using methods of complementary medicine, such as phytotherapy. Conventional medicine should be used only as a last resort or in emergencies.

Preventive measures to avoid diseases in calves and piglets

Calves

- Parturition in a clean and dry environment. Not in the sick bay!
- Ensure sufficient colostrum intake. The optimum is at least 2 litres in the first 2–3 hours after birth and another 2 litres within the next 6 hours. In any event, the calf should consume a total of at least 4 litres in the first 8 hours after birth.
- Check the navel. If there are recurrent infections on the farm, disinfect it externally.
- Keep small groups of 2–3 calves outdoors, protected from draughts and heat. Calf igloos with clean, dry, covered lying areas covered with a thick layer of bedding and sunny runs are ideal.
- Thoroughly clean calf pens/igloos before each restocking and let them dry in the sun for at least 2 days. UV light disinfects even under cloudy skies.
- Feed milk *ad libitum* or at least 8 litres of milk daily in the first month, then 10–12 litres divided into 3–4 feedings. This strengthens the calves' health, results in high daily weight gains and helps develop an efficient metabolism.
- Have your vet check the selenium, iron and vitamin E supply, administer if necessary and offer mineral feed for calves.
- Discuss vaccinations with your herd veterinarian: it may be useful to administer herd-specific maternity vaccinations for recurrent *rotavirus*, *coronavirus* or *E. coli* infections. Offer water and good, herb-rich hay *ad libitum*.
- An insulating calf blanket or calf jacket protects young calves from heat loss in winter. Ensure they do not get soaked, in which case they would be better off without it!
- Suckler-rearing on the calves' own mothers or foster cows has many advantages. Cow and calf are able to largely express their natural behaviour and fewer diseases tend to occur, as the calf gets its milk fresh, warm and containing appropriate immunoglobulins.



White or yellowish nasal discharge, along with coughing and an increased respiratory rate, is a sign of a respiratory infection.

Swiss calf health service *(Kälbergesundheitsdienst KGD)*

The KGD was established in 2017 with the aim of promoting calf health, animal welfare and economical calf rearing. The KGD advises and supports farmers and veterinarians in all matters relating to calf health by means of farm visits, upskilling, working groups and a telephone consultation service that is free of charge for members. As Bio Suisse is a collective member of the KDG, Bio Suisse farms benefit from a reduced price for individual memberships.

Online in German/French/Italian at kgd-ssv.ch; see "Animal health services" on page 23.

Swiss bovine health service *(Rindergesundheit Schweiz RGS)*

On 1 October 2021, the former "bovine health service" *(Rindergesundheitsdienst RGD)* became "Swiss bovine health" *(Rindergesundheit Schweiz RGS)*. The RGS operates throughout Switzerland from its two headquarters. The RGS offers services aimed at improving bovine health to veterinarians and farmers.

Online in German/French at rgs-ntgs.ch; see "Animal health services" on page 23.

Individual housing of calves – pros and cons

From a hygienic point of view, individual housing of newborn calves has an advantage: the calves do not immediately infect each other. However, individual housing is at odds with the animals' social needs. Numerous studies have shown that calves kept in pairs or groups are more social and intelligent and have better development and weight gain as compared with those kept singly. Keeping small groups of similarly aged calves in clean, freshly littered boxes or hutches with outdoor exercise in the fresh air is a worthwhile undertaking. Even better ethologically sound conditions can be achieved with suckler-rearing on the calves' own mothers or foster cows. For a successful system changeover, interested parties will find a lot of useful information in the FiBL technical guides "Mother-bonded and Fostered Calf Rearing in Dairy Farming" and "Artgerechte Kälbermast und Aufzucht von Mastremonten" (Species-appropriate calf rearing and rearing of weanlings for fattening; German/Italian only) (shop.fibl.org, items no. 1660 and 1019).

Piglets

- Wash sows with warm water before transferring them to the farrowing area or before birth in order to break chains of infection.
- For parturition and weaning, house sows only in uncontaminated, thoroughly cleaned, empty pens.
- Prevent PPDS (Postpartum Dysgalactia Syndrome): Reduce feed 2–3 days before parturition, feed plenty of silage or hay, give ground linseed, oat bran or vegetable oil as laxatives to prevent constipation and check milk flow regularly after birth.
- Discuss vaccinations with your herd veterinarian: it may be useful to administer herd-specific (maternal protection) vaccinations in case of recurrent infections.
- Check the navel and disinfect it externally in case of recurring infections on the farm.
- Ensure adequate iron supply: Administer iron pastes or iron injections (200 mg/piglet Fe+++) on days 3 and 15 after birth. Use a new injection needle for each litter! Additionally offer soil for rooting or access to natural soil.

Castration and disbudding – are there alternatives?

Amputations of body parts such as castration or disbudding drastically interfere with the animals' bodily integrity and health. They cause severe pain during the procedure and afterwards, sometimes becoming chronic, even if painkillers are administered. Moreover, the wounds may become infected. Therefore, every livestock keeper should carefully consider the necessity or otherwise of such procedures and assess possible alternatives. Immunocastration (permitted under Swiss organic standards; not permitted under the "Bud" label) or boar fattening are economically viable and ethologically sound alternatives to surgical castration of piglets. See also the FiBL technical guide on *"Ebermast im Biobetrieb"* (Boar fattening on organic farms; German only; shop.fibl.org, Item no. 1632). With adapted husbandry methods and careful handling it is possible to dispense with the budding of calves and goat kids. Advice on keeping horned cattle is available from Claudia Schneider at FiBL (email: claudia.schneider@fibl.org) or in the FiBL technical guide "Laufställe für horntragende Milchkühe" (Loose houses for horned dairy cows; German/French only) (shop.fibl.org, Item no. 1513).

You can tell if a piglet is dehydrated by gently pinching its upper eyelid with your fingers. If the pinched fold remains elevated more than a few seconds, the piglet is acutely dehydrated. The piglet requires fluid replacement.

An extended suckling period of 7 to 10 weeks reduces the risk of scouring in postweaning piglets. It allows for a smooth transition of intake from the mother's milk to plant-based solid feeds, making it easier for the digestive tract to adapt to the change in feed.

- Check the temperature in the farrowing and weaning pens: Piglet nest: 35–37 °C (newborns), 28–32 °C (suckling piglets), 25–27 °C (postweaning).
- Avoid draughts (e.g. seal exits with curtains).
- Always offer dry and clean bedding, especially in the piglet nest.
- Offer suckling piglets creep feed on the floor or in bowls, starting from the 7th to 10th day of life.
- Consider an extended suckling period (>42 days): piglets then undergo feed transition over a longer period of time and are already used to solid feed at weaning. This makes them more robust and less prone to illness.
- Wean piglets by litter or in small groups of less than 20 animals to reduce stress. After weaning: Offer kaolin clay or soil for rooting and best-quality silage; supplement ration with 1% of cider vinegar; ensure 6 % crude fibre content in the feed. This promotes the development of a healthy digestion.
- Check water supply: 0.5–0.7 l/min flow rate for postweaning piglets.
- Sick piglets or runts should be kept in a sick pen and not returned to the freshly weaned group, as they may transmit pathogens.

Pig health service *(Schweinegesundheitsdienst SGD)*

The SGD has been supporting and advising Swiss pig farmers on all matters relating to the health of their animals since 1965. It offers a variety of stock health programmes and services. It also carries out research projects.

Online in German/French at suisag.ch; see "Animal health services" on page 23.

Small ruminant advisory and health service *(Beratungs- und Gesundheitsdienst für Kleinwiederkäuer BGK)*

The BGK advises owners of deer, dairy sheep, New World camelids, sheep and goats in Switzerland and Liechtenstein regarding issues in the herd and on farm-specific questions on health, feeding and husbandry. In particular, a parasite monitoring programme is offered in cooperation with FiBL. Online in German/French/Italian at kleinwiederkäuer.ch; see "Animal health services" on page 23.

When is veterinary care required?

Not all diseases are conducive to treatments involving herbs or medicinal plants. Therefore, in certain situations, and especially in the following cases, a veterinarian should be consulted immediately:

- Highly severe, acute, life-threatening diseases
- Painful diseases
- Frequent illnesses in the herd
- Illnesses that continue for an unexpectedly long time
- Any suspected outbreak

Practical tip
A veterinarian should be consulted if the severity of the illness is such that you would consult a doctor if your children were concerned.

The problem with antibiotics

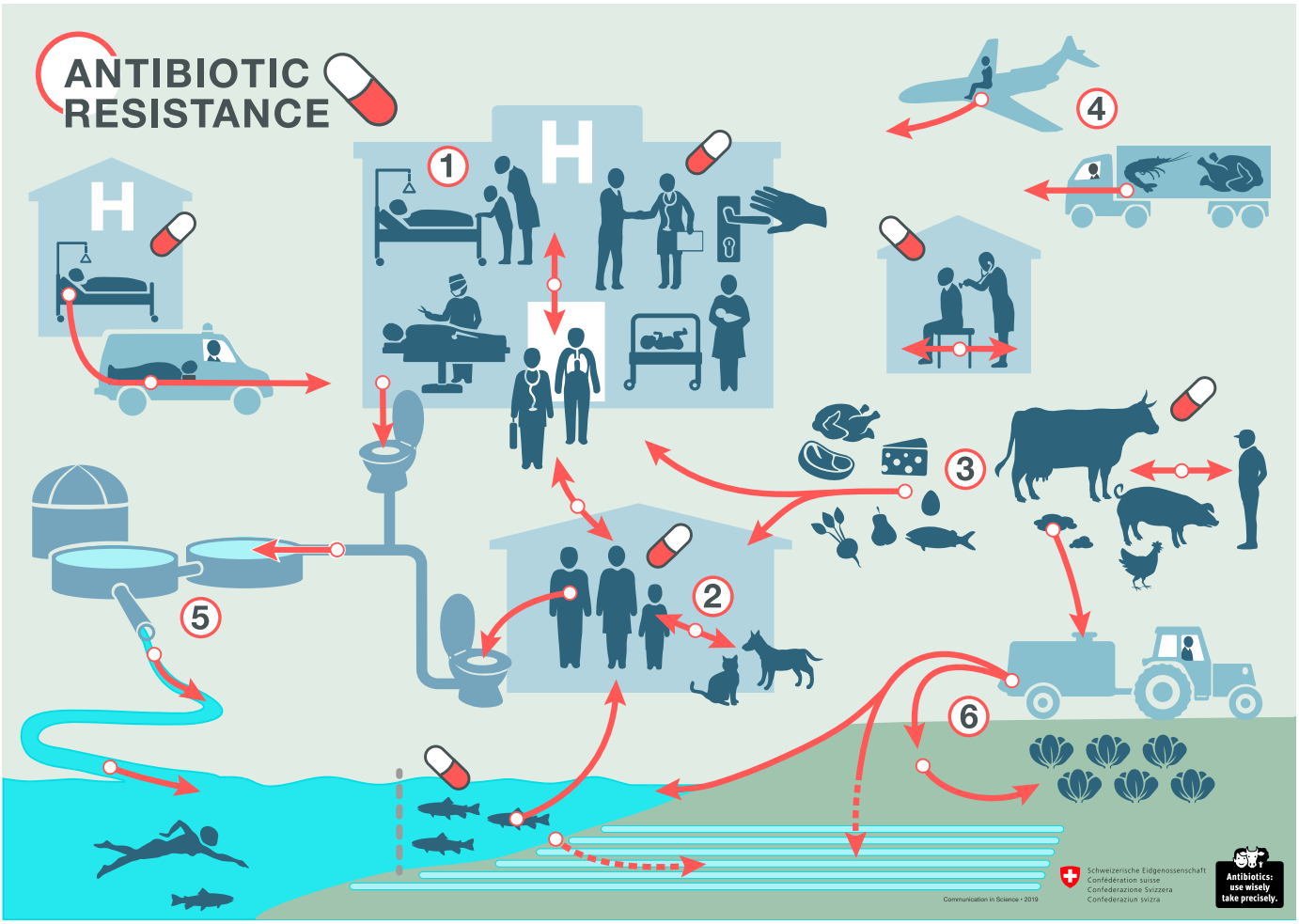
Since the discovery of antibiotics, the mortality rate in livestock suffering life-threatening bacterial infections has been greatly reduced. Antibiotics in their original form are natural substances produced by soil microorganisms. The treatment of gastrointestinal and respiratory diseases may include the administration of antibiotics, depending on the pathogen involved. In addition, veterinarians also prescribe anti-inflammatories or expectorants. The animal metabolises all these pharmaceuticals and excretes the metabolites into the environment via faeces or urine, where they can cause damage. Drug residues in meat or milk can cause health problems in humans. To avoid residues in the end product, it is essential to observe the required waiting period before slaughter or sale. In organic farming, double the waiting period must be observed before animal products such as meat, milk or eggs can be sold.

Development of resistant bacteria
There is another problem with regard to antibiotics: every use of antibiotics leads to the development of resistance mechanisms with which the bacteria protect themselves from being affected by the substances. Treatments that are administered too frequently, at incorrect dosages, or unnecessarily in humans and animals have led to the rapid development of antibiotics-resistant pathogens in recent years. As a result, antibiotics' effectiveness in the treatment of diseases has been eroded.

Resistance mechanisms and multi-resistant germs
Bacteria change the antibiotic attack site, pump the antibiotic out or use enzymes to break it down. These resistance mechanisms can also be exchanged between different species of bacteria. If a bacterium is resistant to several antibiotics, we speak of a multi-resistant germ. To make matters worse, multi-resistant germs can pass from animals to humans and vice versa. The World Health Organisation (WHO), the European Commission and the Swiss Expert Commission for Biosafety therefore classify antibiotic-resistant germs as one of the greatest current dangers to humankind.

Strategy on antibiotic resistance *(Strategie Antibiotikaresistenzen StAR)*
StAR aims to ensure the effectiveness of antibiotics. Antibiotics must be used with care. The Swiss Federal Food Safety and Veterinary Office FSVO provides therapy guidelines for the appropriate use of antibiotics in different animal species.
Online at blv.admin. ch > Tiere > Tierarzneimittel > Antibiotika > Strategie Antibiotikaresistenzen (StAR) Tier (German/French/Italian only; Strategy on antibiotic resistance (StAR) Animals)
In 2022, a supplement on complementary medicine was added to these therapy guidelines (German/French only).

Figure 3: Transmission pathways of antibiotic-resistant bacteria



(1) In healthcare facilities, resistant bacteria can be transmitted through contact between patients or between patients and their visitors, by nursing staff or through contaminated surfaces and medical devices (during a procedure).

(2) Resistant bacteria that appear after antibiotic treatment can be transferred from human to animal and *vice versa*.

(3) Resistant bacteria can also infect raw meat during slaughter and cause foodborne infections. Moreover, they can contaminate dairy products, eggs, fish and seafood as well as fruit and vegetables.

(4) Tourism and food imports constitute the fastest routes of transmission of resistant bacterial strains across national borders.

(5) Resistant bacteria can enter rivers, lakes and groundwater reserves, even though wastewater treatment plants eliminate them by 99 % before discharging the water into the natural environment.

(6) The application of livestock manure (slurry) to arable land can also lead to the spread of resistant bacteria, which can multiply on plants, seep into groundwater or enter rivers and lakes through run-off.

Figure used with permission of bag.admin.ch > Strategie & Politik > Nationale Gesundheitsstrategien > Strategie Antibiotikaresistenzen Bereich Mensch.

Phytotherapy in veterinary medicine

A look at the history

Herbal remedies are among the oldest therapeutics. There are indications that humans have been treating themselves with medicinal plants for more than 60,000 years. Animals have probably been self-medicating for even longer. This is likely based on a process that can be described as "biochemically mediated feedback of the body to olfactory and gustatory perceptions". Animals have been shown to be able to associate sensations that occur much later in time (e.g. satiation, abdominal pain, diminishing pain) with a prior taste or scent and to remember this association, sometimes for years.[1]

One of the oldest records of people treating their animals using plant-based remedies is a 3000-year-old collection of instructions for treating horses.[2] Well into the first half of the 20th century, the use of medicinal plants was a firm part of the curriculum for training veterinarians. In Europe as well as in Switzerland, traditional knowledge of the therapeutic and prophylactic uses of plants has been preserved primarily in the form of farmers' home remedies.[3,4] However, roughly for the past ten years, veterinarians' interest in the use of medicinal plants, i.e. phytotherapy, has once again been rekindled. In Switzerland, veterinarians can complete a recognised advanced training course at the *Schweizerische Medizinische Gesellschaft für Phytotherapie* (Swiss medical society for phytotherapy SMGP, smgp.ch) and thus obtain the *Fähigkeitsausweis Veterinärphytotherapie GST* (GST certificate of competence in veterinary phytotherapy) from the *Schweizerische Tierärztliche Vereinigung für Komplementär und Alternativmedizin* (Swiss veterinary association for complementary and alternative medicine, camvet.ch). A list of these veterinarians can be found here: smgp.ch.

Secondary phytochemicals as active compounds

While the effects of approved veterinary drugs are usually based on a single substance, medicinal plants and herbs always contain high levels of complex mixtures of substances known as secondary plant compounds. In contrast to the primary compounds (such as sugars, including starch and cellulose, proteins and fats), which function predominantly as building blocks or energy sources, secondary plant compounds serve specific tasks. These include, for example, protection against predation, defences against infections with bacteria, fungi or viruses, as well as communication and reproduction. While the number of basic building blocks in the form of primary compounds is in the range of a few thousand, the number of secondary compounds is estimated to be in the millions. Around 100,000 of these are known to date, and that number is constantly growing. Plants rich in secondary compounds include spices, stimulants, medicinal herbs, phytopharmaceuticals and poisonous plants, although from a scientific point of view there is overlap between these categories. The natural multisubstance nature of plants is the result of their millions of years of «experience» with infectious agents, for example. It is much more difficult for bacteria to develop resistance to the combinations of active compounds found in plants than to monosubstances. A further advantage plant-based active compounds offer over many chemically-synthesised active compounds is that they are completely biodegradable.

"Phytotherapy" refers to the prophylactic and therapeutic use of plants or parts of plants or their preparations, so-called herbal drugs. The following substances can be used for this purpose:

- Fresh plants
- Dried plants
- Essential oils
- Resins
- Starches
- Fats
- Waxes
- Mucilages
- Milky saps

Possible preparations include:

- Cold-water extracts
- Teas
- Boiled infusions
- Tinctures (alcoholic extracts)
- Oily and fatty extracts

The term phytotherapy does not cover isolated plant compounds (e.g. morphine, digitoxin, quinine, etc.) or pharmaceuticals used in homeopathy, anthroposophy or other therapeutic disciplines, although the distinctions here are blurred.

Table 2: The potential of herbs and medicinal plants

Opportunities	Limitations
• Mild effects, few side effects and good tolerance • As home remedies • For prophylaxis • Complementing conventional therapies • "Natural feed supplements" • Olfactory and gustatory enrichment for the animals • Environmentally friendly – metabolites are mostly fully biodegradable in the environment and do not impair groundwater quality • Tend to be inexpensive	• Often need to be administered multiple times a day over several days. • In many cases, their effect is less strong than that of chemically-synthesised counterparts. • Legal requirements must be met. • Cannot compensate for suboptimal husbandry or inconsistencies in management! • Severe, acute, life-threatening or painful conditions require conventional therapy.

Legal aspects of the use of herbs and medicinal plants in animals

From a legal standpoint, a single plant species can be considered in very different ways, making the legal situation regarding the use of phytotherapy in animals a very complex matter. Chamomile, for example, can be a forage species growing on the margins of pastures and meadows. If it is consumed by a grazing cow or contained in hay fed to an animal, it falls under agri-food laws and thus the farmer's own responsibility. However, if it is sold as a straight feed or as a component of a supplementary feed, it must meet certain assessment criteria under feed law. Chamomile must meet even stricter requirements if it is sold as a medicinal of pharmaceutical quality drug in drugstores or pharmacies. In this case, it must meet assessment criteria under pharmaceutical products legislation. Last but not least, chamomile or an extract thereof could be an animal care product, which in Switzerland is subject to chemical products legislation.

Reference points regarding legal distinctions

- The administration of plants grown or collected on the holding falls under the farmer's own responsibility. The medicinal plants listed in this leaflet, if used at the specified dosages, do not leave any residues hazardous to consumers in the animal products.
- In the case of straight or supplementary feeds approved for livestock, the manufacturer guarantees that these feedstuffs are safe for animals and consumers at the recommended dosages. On organic farms, however, only organically certified feed supplements may be used. Pure single herbs or herb mixtures of conventional quality may constitute up to 1 % of the total feed fed on organic farms.
- There are only two purely herbal veterinary drugs for farm animals in Switzerland (Stullmisan® and Reinigungstrank Natürlich). A few more can be imported from abroad via veterinarians. Only one purely herbal veterinary drug, i.e. Stullmisan® for the treatment of diarrhoea, is still authorised for young animals. However, Switzerland has recently extended its Complementary and Phytotherapeutic Products Ordinance to include veterinary drugs. This has simplified the authorisation process. In the long term, this may result in a once again somewhat wider range of herbal veterinary medicinal products becoming available.
- More than 60 different medicinal plants in pharmaceutical quality can be obtained from pharmacies or drugstores with a prescription issued by a veterinarian.

Insights from FiBL research

The modern use of medicinal plants for calves and piglets is grounded in various sources of knowledge:

- Historical literature in the field of veterinary medicine and agriculture often contains numerous recipes for medicinal plant use. However, it is not uncommon to find plants listed there the use of which must be strongly discouraged today due to their toxicity.
- Current empirical knowledge from farmers and veterinarians; the former is now well documented scientifically, especially in German-speaking Switzerland.
- Current scientific literature in the field of medicinal plant research (mainly laboratory research), which can be searched and assessed specifically with regard to the needs of young livestock diseases.
- Direct clinical research on medicinal plant use in calves and piglets.

Over the past 10 years, FiBL, in cooperation with other institutions, has conducted intensive research on the last three knowledge categories. The findings are presented in the following chapters.

Traditional farmer knowledge in Switzerland

Traditional empirical farmer knowledge regarding the use of medicinal plants in farm animals has the potential to serve as a basis for developing forward-looking strategies for livestock medicine. However, apart from Austria and Bavaria, there are no ethnoveterinary studies for Central Europe. Between 2011 and 2016 a project team consisting of FiBL researchers and external partners was able to review formulations of and indications for herbal remedies for farm animals used in a number of different Swiss cantons.[3,4,5,6,7] Selected interviewees were visited in person to document their experiential knowledge. During these visits, the scientists recorded detailed information on the plants used and on the processes employed to produce the final preparations. The researchers also collected, for each application, information on dosages, methods, frequencies and durations of administration, knowledge origins, frequencies of use and satisfaction with the therapies' results.

The studies recorded more than 1000 recipes for home remedies, each containing only a single plant species. A total of around 1700 indications were described for the recipes, primarily for use in cattle. The most frequently mentioned areas of application were skin lesions or wounds, diseases of the gastrointestinal tract and metabolic disorders.

The applications described were mainly applied externally or administered orally. Current phytopharmaceutical and clinical human medical research findings indicate that a substantial proportion of the recipes employed is useful.

> The five most frequently mentioned plants of the well over 100 documented species were chamomile, calendula, stinging nettle, comfrey and coffee. The "top 15" herbal remedies described also included bitter dock (*Rumex spp.*), spruce, linseed, thyme, common mallow (*Malva sylvestris/M. neglecta*), black tea and oak.

Wherever possible, the researchers recorded the daily doses by weighing the herbs. Using the customary method in veterinary medicine of converting dosages between livestock species of different weights, the "metabolic weight"[8], it was possible to derive dosage recommendations for calves and piglets (see Table 3 on page 14). The scientists then compared these values to those in Eugen Fröhner's book on veterinary pharmacology, the most renowned textbook of its kind in the German-speaking world around 1900[9]. The data can serve as a guide. This provides a framework within which users can gather their own experience.

Table 3: Medicinal plants: Indications and dosage for home remedies for livestock often used by farmers in German-speaking Switzerland

Plants				Indications for home remedies used in German-speaking Switzerland		
Plant species	**Plant part used**	**Legal status**	**No. of described uses in German-speaking Switzerland**[3,4,5,6,7]	**Respiratory tract**	**Gastro-intestinal tract**	**General strengthening**
Dock	Root	Nf	13		×	×
Stinging nettle	Herb	Nf/Fe/Ph	101		×	×
Oak	Bark	Fe/Ph	36		×	×
Fennel	Seed	Fe/Ph	19		×	
Spruce[d]	Branches/needles	Nf/Ph	62	×	×	×
Coffee	(Coffee beans)	Fe	72		×	×
Chamomile	Flower	Nf/Fe/Ph	180		×	×
Garlic[e]	Bulb	Fe/Ph	17			×
Caraway	Seed	Fe/Ph	12		×	
Linseed	Seed	Fe/Ph	65		×	×
Mallow	Herb	Nf/Fe/Ph	63		×	
Carrot	Root	Fe	2		×	
Peppermint	Herb	Fe/Ph	10		×	×
Sage	Herb	Fe/Ph	10	×	×	×
Black/Green tea	Leaf	Fe	33		×	
Echinacea[f]	Flowering plant in full	Ph	3			×
Thyme	Herb	Nf/Fe/Ph	41	×	×	
Silver fir	Branches/needles	Nf/Ph	20	×	×	×

Ph – Pharmaceuticals (may be prescribed by veterinarians, in which case no withdrawal period is required);
Fe – Feedstuffs; Nf – natural wild flora of meadows and forests in Switzerland

[a] All dosages are expressed as dried plant material. To convert to fresh substance (leaves, flowers, bulbs, roots): multiply the given figure times 5.

[b] Showing the mean value (median) and in brackets the 25/75% quartiles, i.e. the interquartile range representing the middle 50% of measurements in the data set that fall around the median.

[c] Dosages as given in the German-language textbook on veterinary pharmacology published in 1900.

Customary preparation			Dosage[a] piglets (10 kg) in g/animal and day; mean (25/75 % quartiles)[b]		Dosage[a] calf (60 kg) in g/animal and day; mean (25/75 % quartiles)[b]	
Fed directly	**Tea**	**Other**	**Dosage derived from Swiss home remedies**[3,4,5,6,7]	**Dosage derived from historic literature**[3]	**Dosage derived from Swiss home remedies**[3,4,5,6,7]	**Dosage derived from historic literature**[c]
×	×	Boiled infusion	5 (3–10)	–	15 (10–25)	–
×	×		5 (1–10)	–	10 (3–30)	–
×	×	Boiled infusion	3 (1–6)	1–3	10 (5–20)	5–10
	×		1	1–3	3 (2–5)	5–10
×		Ointment	Commercial product	–	Commercial product	–
×	×		2 (1–4)	–	7 (2–15)	–
×	×		1 (1–3)	1–2	5 (2–10)	5–10
×			3 (2–9)	–	12 (6–20)	–
×	×		2 (1–6)	1–3	5 (3–25)	5–10
×	×	Cold-water extracts	20 (10–30)	3–7	70 (30–110)	10–20
	×		10 (5–20)	3–7	40 (15–80)	20–50
×			9	–	24	–
×	×		4 (2–6)	1–2	8 (7–10)	5–10
×	×		1	1–3	1	5–10
	×		2 (1–4)	–	10 (5–15)	–
		Tincture/ extract	–	–	–	–
×	×	Inhalation	1 (1–2)	1–2	3 (2–8)	5–10
×			20 (12–30)	–	70 (50–100)	–

[d] In the ethnoveterinary projects, spruce was generally only applied externally. This does not allow for a dosage to be derived. However, a commercial product which is based on spruce needles is available for the treatment of diarrhoea.

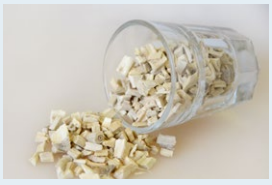
[e] We used garlic at a dosage of 0.3 g of garlic per kg piglet body weight, i.e. 3 g for a 10 kg piglet in a trial in which the piglet groups that received garlic showed a higher daily weight gain compared to the placebo groups.

[f] In a trial, we used an Echinacea extract (flowering whole plant including a small portion of root) at two different dosages. The dosage of 0.5 g dried Echinacea extract per calf and day proved to be the more promising one. This dosage also corresponds roughly to the dosage used for human medication.

Promising medicinal plants – findings of a systematic review

In 2014 and 2015, FiBL conducted an extensive review of the literature to identify medicinal plants that, from a scientific perspective, might be promising for use against diseases in young livestock. The researchers assembled the current scientific literature available worldwide on 30 medicinal plant species and reviewed it for proven effects documented for these plants. The most promising medicinal plant species for use in diseases of the respiratory and gastrointestinal tracts in young livestock are given in Table 4.[10]

Table 4: Promising medicinal plants and their effects from a scientific perspective

Gastrointestinal tract	Garlic (*Allium sativum* L.)  Effective against bacteria and parasites, enhances the effect of antibiotics, antidiarrheal, immunostimulant, anti-inflammatory	Peppermint (*Mentha x piperita* L.)  Effective against bacteria, enhances the effect of antibiotics, antispasmodic, antidiarrheal	Sage (*Salvia officinalis* L.)  Effective against bacteria and parasites, antidiarrheal, antispasmodic, immunostimulant
Respiratory tract	Purple coneflower (*Echinacea purpurea* (L.) MOENCH)  Effective against bacteria and viruses, immunostimulant, anti-inflammatory	Thyme (*Thymus vulgaris* L.)  Effective against bacteria, bronchial decongestant	Marsh mallow (*Althea officinalis* L.)  Cough suppressant
Immune system and inflammation	Purple coneflower (*Echinacea purpurea* (L.) MOENCH)  Immunostimulant, anti-inflammatory	Black tea /Green tea (*Camellia sinsensis* (L.) KUNTZE)  Immunostimulant, anti-inflammatory	Liquorice (*Glycyrrhiza glabra* L.)  Immunostimulant, anti-inflammatory

Two field trials at FiBL

Echinacea lowers scouring days in calves

Purple coneflower (Echinacea) is traditionally used in humans to strengthen the immune system and for recurrent respiratory infections. The effectiveness of Echinacea extracts is now well established. However, there is still a lack of data on their use in animals. Therefore, in a trial, FiBL researchers orally administered one of the following substances to three groups of calves twice a day for four weeks after birth:

- Echinacea extract at low dosage
- Echinacea extract at high dosage
- Placebo (dummy drug not containing any active ingredient)

Compounds contained in Echinacea stimulate the immune system.

The researchers recorded daily weight gains, milk intake, health parameters and the number of days of illness, as well as various immune and laboratory parameters. The calves in both Echinacea groups had slightly elevated body temperatures. This may indicate an increased immune response. In addition, the Echinacea calves in the low-dose group suffered 44 % fewer scouring days (7.5 versus 13.6 days) compared to the placebo group. This effect may be an indication of a local stimulation of the immune cells in the intestines as well as of the antibacterial and antiviral effect of Echinacea. However, the calves receiving the high Echinacea dosage derived no benefits from the higher dose, possibly because too high a dosage "overstimulates" and "fatigues" the calves' immune system. [11]

Practical tip

If you want to use Echinacea in young livestock, the recommendation is to administer a standardised alcoholic whole plant extract twice a day for 5–10 days. This is best done at the first signs of illness. We recommend the trialled lower dosage of 0.5 g drug equivalent Echinacea extract/calf/day as tested in the trial. However, such a preparation must be prescribed by a veterinarian.

Garlic improves weight gain in postweaning piglets

Around the world, garlic is used not only as a spice but also as a medicinal plant. It strengthens the immune system and also has an antibacterial effect and could thus prevent scouring in postweaning piglets, which is often caused by *E. coli* bacteria. In a field trial, FiBL researchers divided 600 weaned piglets into three groups and gave them each one of the following substances in their feed:

- 300 mg dried garlic powder/kg body weight.
- Placebo (dummy drug not containing any active ingredient)
- Colistin, a standard antibiotic

Garlic powder has antibacterial, immunostimulant and anti-inflammatory effects in the gastrointestinal tract and enhances the effect of antibiotics. It is therefore a useful therapeutic for diarrhoeal diseases and is readily ingested by piglets with their feed.

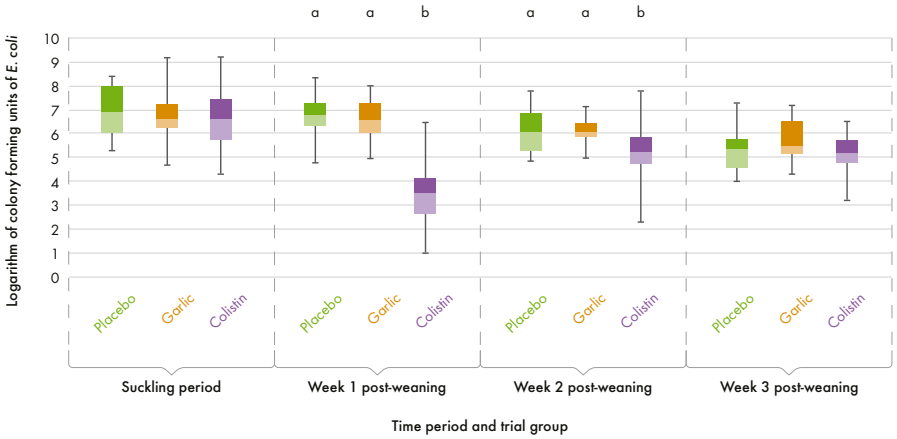
The researchers recorded weight gain, health, faecal bacterial load and scouring severity. The piglets receiving garlic showed increased daily gains and improved overall health compared to the placebo group. Daily gains were similar in the groups receiving garlic and antibiotics respectively (see Figure 4). However, due to severe scouring, one third of the garlic and placebo pens had to receive follow-up treatment with an antibiotic. But even the standard antibiotic colistin did not protect all piglets in the antibiotic group from scouring. Garlic had no effect on *E. coli* bacterial load in the faeces (see Figure 5). In summary, prophylactic garlic administration did not reduce the frequency of therapeutic antibiotic treatments compared to the placebo, but it did result in improved fattening performance.

Practical tip

A daily addition to the feed of 300 mg of garlic powder/kg body weight for postweaning piglets may be an effective alternative to the preventive use of antibiotics.[12] The preventive administration of an antimicrobial, anti-inflammatory, decongestant and generally diarrhoea-relieving herbal mixture of garlic, thyme, chamomile and common tormentil with the feed at the start of weaning may also be useful. Depending on the size of the piglet, 3–10 g per animal and day should be administered.

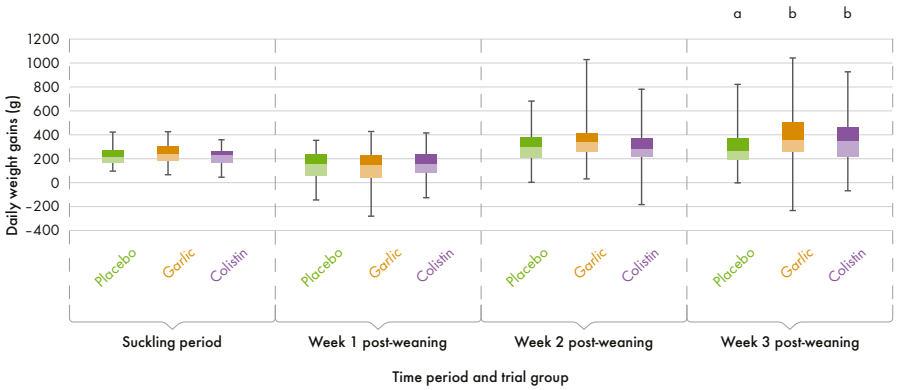
With good animal observation, antibiotics would only need to be administered in actual cases of moderate to severe scouring.

Figure 4: *E. coli* bacteria in faeces of piglets



The number of bacteria capable of reproduction is measured in colony-forming units (CFU). In contrast to the antibiotic used, garlic had no effect on the CFU of *E. coli*. Treatment with the antibiotic colistin was associated with a lower CFU of *E. coli* in the animals' faeces. Although the control group had received the antibiotic colistin in the first and second week post-weaning, the CFU of *E. coli* increased again in the second week. Different superscript letters indicate significant differences between groups.

Figure 5: Average daily weight gains by treatment group and week



The average daily gains in the 3rd week post-weaning did not differ between piglets that received garlic and the antibiotic colistin respectively. Animals in the control group treated with a dummy drug (placebo) showed lower daily weight gains than piglets receiving antibiotics or garlic. Different superscript letters indicate significant differences between groups.

Medicinal plant use in practice

Medicinal plants are ideally suited to preventing diseases, strengthening the animals' health, treating minor illnesses, and also as complementary therapy alongside other medical interventions, such as in addition to veterinary treatments.

Use the best quality product

Medicinal plants of the highest quality can be obtained by buying them as dried herb from a pharmacy or drugstore. These must first be prescribed by a veterinarian. These medicinal plants' Pharmacopoeia quality ensures that they contain all important main ingredients in sufficient quantities and that the threshold limits for pesticides and heavy metals are not exceeded. In contrast, if one buys chamomile or peppermint tea in food quality, they may contain lower quantities of the valuable compounds, due to processing and storage. Of course it is also possible to grow or collect medicinal plants and then feed these as fresh herb, dried herb or processed into ointments or tinctures. There are only a few herbal veterinary drugs on the market. However, more and more herbal feed supplements are being offered to support animal health. When buying these, make sure that they contain a high proportion of the medicinal plant(s) in question and that all ingredients are clearly indicated.

Storage

Medicinal plants or preparations thereof should generally be stored in a cool, dry and dark place. Dried herbs are best stored in well-sealed screw-top jars or tin cans. The herbs should be used up within a year or two, as the active compounds may degrade over time.

How to get the plant into the animal

- Feed herbs, fresh or dried, whole or crushed, ground or pelleted.
- Brew tea, let it steep covered, then mix it in with feed lukewarm including the herbs, sweeten with dextrose or honey if necessary; in case of scouring, always administer with a rehydration solution containing electrolytes. This may be either an organic commercial preparation or, at its simplest, the so-called WHO solution, which consists of 4 g table salt and 20 g organic dextrose dissolved in 1 litre of water.
- For piglets or weak animals, slowly administer lukewarm tea directly into the mouth using a large plastic syringe.
- Administer alcoholic, aqueous or oily extracts diluted with juice or water into the mouth.
- Roll into pills (e.g. using coconut oil, sugar + the herbs).
- Place or spray ready-made products into the mouth, as appropriate
- Externally: apply ointments, sprays, infusions directly onto the skin; use tea rinses.
- Spray essential oils onto the nasal disc/nasal bridge and spray into the ambient environment.
- Use steam inhalation (ideally in calf igloo or disperse using nebulisers).

An assortment of ointments from a medicine cabinet. For home use, preparations should be labelled with information on indications, ingredients, and the date they were prepared.

What is the correct dosage?

Today's dosage recommendations for medicinal plants for use in livestock are mostly based on traditional and experiential knowledge. In German-speaking Switzerland, dosages and dosage ranges based on ethnoveterinary research are also available (see Table 3 on page 14). Useful compilations of medicinal plant dosages can be found in the current specialist literature and on phytoarznei.ch, the freely accessible online database which has been developed by the University of Zurich's Institute of Veterinary Pharmacology in cooperation with the *Schweizerische Medizinische Gesellschaft für Phytotherapie* (Swiss medical society for phytotherapy) and FiBL and is regularly updated and expanded.

In general, the dosage of individual plants can be reduced if several plants are administered in combination. Moreover, if a medicinal plant is to be administered for just a short time, the dosage may be increased once or twice. An example would be the treatment of acute bloating in calves or piglets with a very strong tea of fennel, anise, caraway and chamomile. If there is no improvement within a few hours, call a veterinarian.

Pertinent recipes for practitioners

Basic recipe for alcoholic tincture prepared from dried plants

Shred dried herbs, crush seeds/fruits and place them into a clean container. Cover with 45–70 vol-% schnapps (mix at a ratio of 1:5 to 1:10) and leave to infuse at room temperature. Shake daily. Strain after 2–3 weeks and store in a dark glass bottle.

Digestive tincture for abdominal cramps, loss of appetite or bloating (recipe: H. Ayrle)

1 teaspoon caraway seeds (ground)
2 teaspoons chamomile flowers
1 teaspoon sage
1 teaspoon gentian root
1 teaspoon common tormentil
1 teaspoon peppermint
1 teaspoon fennel seed (crushed)
Add 80 ml 45-70 vol-% alcohol.
Dosage per calf: 1–2 tablespoons per day
Dosage per piglet: 1–2 teaspoons per day
Dilute with water, milk or juice and administer orally in small doses spread out across the day.

Calendula ointment (a common recipe from Swiss ethnoveterinary research)

- Leave approx. 20 g of dried or 100 g of fresh marigold flowers in 1 l of olive oil in a clean bottle or glass jar to infuse for 2 weeks in a dark place. It is important that all plant matter is covered with oil.
- After two weeks, strain out the flowers.
- Carefully heat the calendula-infused oil in a pot and, depending on the desired consistency, add in approx. 5–10 g beeswax/100 ml oil and whisk as it melts (wax melts above c. 60 °C). The oil must not boil.
- Fill the still warm ointment into jars or tubes.
- The ointment can be kept in the fridge for several months. Remove ointment only with clean fingers or a spoon.

Other plants that are suitable for ointments: chamomile, lavender, bitter dock, thyme, shepherd's purse, common daisy, comfrey. The oil infusions on which the ointment is based can also be produced from fresh plants, but care must be taken to ensure that the oil does not spoil. In order to preserve the ointment and enhance its effect, essential oils (e.g. lavender, lemongrass, oregano) or alcoholic tinctures can be added to the still warm ointment.

Case studies – the use of medicinal plants in practice

Scouring piglets

A pen of freshly weaned piglets falls ill with mild scouring. They are all still feeding, but the farmer does not want to wait for their condition to deteriorate.

Initial measures: Feed small amounts of feed several times a day, moisten feed to increase fluid intake, check nipple drinkers and pen temperature (ideally 25-27 °C), house very small or weak piglets separately.

Treatment with medicinal plants
Prepare a tea using the plants listed below. Mix the tea, including the herbal residue, into the feed twice a day for one week. Alternatively, dried herbs can be fed and chamomile, thyme and oregano can be fed fresh.
Per piglet and administration:
2 g chamomile flowers (dried)
5 g common tormentil or oak bark powder
2 g thyme or oregano herb (dried)
Pour 250 ml boiling water over the herbs and powder, cover and let infuse for 10 minutes; collect the condensation water and add it to the tea; let the tea cool down to drinking temperature (approx. 35 °C) and mix it into the feed together with the herbal residue and dextrose or electrolyte powder. For weak animals, the tea should be given directly into the mouth to ensure intake.

Result: Some animals will still need to be treated with antibiotics, but for the majority of the group, the tea will be sufficient.

Tannins as a treatment for diarrhoea in young livestock
Plant tannins have an antidiarrheal and astringent effect. They are found in descending potency in common tormentil, oak bark, spruce needles, black tea, lady's mantle and raspberry or blackberry leaves. These plants "tan" the intestinal surface by breaking down protein compounds in the mucous membrane. This leads to a decrease in water loss through the intestine.

In addition, tannins can bind pathogens such as bacteria. However, plants containing tannins should be administered for a maximum of one week to ensure that energy and nutrient absorption via the intestine does not become impaired. Furthermore, tannins should not be administered together with milk, as the milk proteins would erode their tanning potential.

Clean housing and hygienic feeding are prerequisites of good animal health.

Practical tip
Ideally, electrolyte powders (commercial preparations conformant with organic standards or WHO solution; see "How to get the plant into the animal" on page 19) should be mixed into teas used to treat scouring. This "medicinal plant/electrolyte tea" can then be provided in between milk feedings.

Calves with coughs

Two to three month old calves with a slight cough, eye and nose discharge; individual animals repeatedly have a slightly elevated body temperature. All calves are still drinking well and eating hay.

Initial measure: Improve ventilation while avoiding draughts.

Treatment with medicinal plants
Add an infusion of medicinal plants, sweetened with glucose and including the plant residue to some compound feed and feed this twice a day for one week.
Recipe per calf and administration:
10 g fennel seeds (freshly mortared)
10 g aniseed (freshly mortared)
10 g thyme
Pour 250 ml boiling water over the herbs, cover and let infuse for 10 minutes, collect the condensation water and add it to the tea; let the tea cool down to drinking temperature (approx. 35 °C) and mix it into the feed together with the herbal residue. The tea may also be added directly to the milk.

Result: After three days, a clear improvement is evident; follow-up treatment is not required.

Weak, scouring lambs

Three days after birth, two twin lambs are not drinking properly, lie down a lot, have cool ears and legs and already show slight scouring.

Initial measures: Separately house the ewe and her lambs in a quiet, clean, protected pen, install a heat lamp, ensure that the ewe gets sufficient energy and check the udder daily.

Treatment with medicinal plants
Administer a tea made with the following medicinal plants twice a day for one week:
Per lamb and administration:
2 g chamomile flowers (dried)
2.5 g green or black tea leaves (dried)
2 g ginger root powder (or chop up 10 g fresh ginger root)
Pour 250 ml boiling water over the herbs and root, cover and let infuse for 10 minutes, collect the condensation water and add it to the tea; let the tea cool down to drinking temperature (approx. 35 °C) and mix with electrolyte powder in a lamb feeding bottle.

Result: After two days the lambs should be much better. If not, consult the vet!

Young calves tend to enjoy teas and readily drink from a feeding bottle.

Further information

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Research Institute of Organic Agriculture FiBL, Frick, Switzerland

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FiBL Focus Podcast
German-language podcast aired on 1 April 2022: *Knoblauch – nicht für den Schweinebraten sondern in den Schweinebauch* (Garlic – in the pig, not on the pork), fibl.org > Infothek > Podcast

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suisag.ch

Veterinarians who have obtained the GST certificate of competence in veterinary phytotherapy
smgp.ch

Medicinal plants database
phytoarznei.ch

For veterinarians
Specialisation in the field of veterinary phytotherapy
camvet.ch

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