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# Animal health management concepts and practices in livestock production under organic farming specifications

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■ **The principles of animal health management emphasised by organic farmers, and which are at the heart of the organic specification, are: naturalness, animal welfare and reduced chemical inputs. Thus, the use of allopathic medicinal treatments for animals is generally rarer in organic than in conventional agriculture. This is made possible in particular by the husbandry practices imposed by the specifications, which can be accompanied by innovations in the farming system.**

## Introduction

Organic Agriculture (OA) is a method of production and processing that is based on a number of European and French regulations, which change frequently (Box 1). The main principles of the present regulations include respect for natural equilibrium, the exclusion of the use of synthetic chemical products and genetically modified organisms (GMOs) and the limitation of the use of inputs. With regard to livestock farming more specifically, the practices adopted must meet the behavioural needs of each species and consider two major principles, namely the link to the soil and respect for animal welfare. Two key concepts summarise the vision of animal health and welfare in OA. The concept of naturalness goes beyond ensuring the needs of the animal. Vaarst and Alrøe (2012) propose to consider the animal as a being that can live a richer life with opportunities to express more of their natural behaviour (e.g. to play and behave socially), to be able to have enriching experiences and to have access to food and to an environment that are considered natural for the species (Vaarst and Alrøe, 2012) The concept of naturalness thus includes: the rejection of chemicals, the promotion of agroecological principles and the respect for the integrity of the individual (Verhoog *et al.*, 2003). Naturalness in a farming system is not synonymous with living in nature. In organic farming systems, humans have a moral obligation to ensure animal welfare (Vaarst and Alrøe, 2012), so the concept of naturalness and welfare are closely linked. The second key concept in OA is that of human intervention in animal care, i.e. intervening when necessary and through animal welfare friendly care practices (Vaarst and Alrøe, 2012). In order to reconcile animal welfare with the exclusion of the use of synthetic chemicals, the regulations recommend basing animal health management on disease prevention and paying particular attention to the housing conditions and husbandry practices of animals of suitable breeds and/or strains. Beyond prevention, the management of sick animals remains a priority to respect their welfare, but must meet certain requirements (see details in Box 1).

**Box 1.** ***The regulatory framework for organic agriculture and its main requirements for animal health management.***

Since 1er January 2009, organic agriculture has been governed by two European regulations: the "framework" regulation **(EC) n°834/2007 of 28 June 2007** on organic production and labelling of organic products, which lays down the main principles on which the organic production methods are based (in particular its article 14, which specifies the rules applicable to animal production) and its "implementation" regulation **(EC) n°889/2008 of 5 September 2008**. The latter lays down the concrete rules to be applied, in particular its articles 23 and 24 concerning "Prophylaxis and veterinary treatments" and its annexes which contain the positive list of authorised inputs. On 1 January 2022, a new Regulation (EU) No 2018/848 entered into effect. Supplemented by two secondary acts ((EU) 2020/427 and (EU) 2020/464), it lays down the concrete rules to be applied in the field, which have been little changed in terms of animal health.

The regulations recommend that animal health management should focus on disease prevention, through breed and strain selection and husbandry conditions (prolonged lactation, hygiene, moderate housing densities and access to the outdoors, management). The main constraints on the use of treatments are as follows:

- In case of sick or injured animals, phytotherapy, homeopathy, trace elements, minerals (listed in annex V of the ECR n° 889/2008) and vitamins (listed in annex VI of the ECR n°889/2008) are to be used preferably.

- Allopathic chemical treatments are only possible for curative purposes and their number is limited (from 1 to 3 per year depending on the animal's life span, excluding compulsory treatments and vaccines), under the responsibility of a veterinarian. Only antiparasitic drugs are not restricted to a define number.

- The waiting period after an allopathic treatment to be able to sell animal products is doubled compared to the legal waiting period for this medicine. If the legal waiting period is zero, the farmer must still apply a minimum waiting period of 48 hours in OA

- Hormones and growth promoters (hormonal or not, including antibiotics, coccidiostatics and other artificial growth-promoting drugs) are prohibited.

- In France, the INAO (National Institute for Origin and Quality) ensures the uniform application of the European regulation on organic production and, when European law is in question, the CNAB (National Committee for Organic Farming) is competent to interpret the texts. Thus, the INAO (2021) reading guide specifies, among other things, the definition of veterinary treatment (any curative or preventive treatment undertaken against a specific disease), the counting of treatments on the same animal (if the management of a disease requires several veterinary treatments spread out over time, only one treatment is counted) and the status of certain specific inputs (antiseptics, cod liver oil, analgesics...).

In recent years, there has been a significant increase in consumer demand for organic products and in the number of farmers converting to OA (Agence Bio, 2022a and 2022b), although there have been periods of discrepancy between demand and supply. As far as French consumers are concerned, the more natural character of OA-labelled products is an element put forward by a third of them (Agence Bio, 2022b). A reduction in the use of medicines, through better management of animal health, is also one of the motivations for OA expressed by some farmers (Duval *et al.*, 2017).

Thus, the animal health management in organic livestock farming takes place within a framework of a singular conception of animal health by the farmers and of technical limitations linked to the organic specifications. Moreover, understanding the technical particularities of organic systems is not so easy. Indeed, scientific research specifically on the technical characteristics of organic farming (studies of the technical, economic and health performance of organic systems, or comparisons with conventional systems) is quite rare. Biotechnical studies are usually based on farming practices promoted in OA but carried out on conventional farms. They do not reflect the specific production conditions of OA and are therefore not necessarily relevant to assess their effectiveness under organic conditions. Thus, in this review, we favour biotechnical references produced in organic systems, even if they are rare. On the other hand, work in the human and social sciences has focused more specifically on organic farmers, in order to describe their characteristics and the way in which they think about and practise this type of agriculture. These studies aim to understand how organic farmers differ from conventional ones and, more broadly, how they spearhead an alternative vision of agricultural development (e.g. Cabaret and Nicourt, 2011; Bellon and Penvern, 2014). In this article, we first discuss the sociotechnical particularities of health management by farmers, and then, in a second step, the animal health status and the biotechnical particularities of animal health management in organic systems. It should be noted that there is more knowledge available in the literature on ruminant production than on monogastric production; this explains the fact that it is taken as a reference and used to illustrate the ideas that we develop in this article.

## 1. Socio-technical aspects of health management by organic farmers

This section first presents the conceptions that organic farmers have of animal health and how best to manage it, and then the way in which these farmers position themselves with respect to various external stakehold-

ers (advisors, veterinarians, technical group leaders…). It is worth noting that these different sociological studies are unevenly applied to the different sectors: organic monogastric farms are under-represented in sociological studies. A large proportion of the bibliographical references apply to the ruminant productions.

## ■ 1.1 Common features and variability of animal health concepts among organic farmers

Many studies have highlighted particular ways of thinking about animal health in OA. For example, Cabaret and Nicourt (2011) described two models for comparing the concepts of health between conventional and organic farmers: on the one hand, an ontological and additive model for conventional farmers, who see disease as the result of external bio-aggressors, as opposed to the functional and subtractive model of organic farmers, in which disease is seen as an imbalance in the animal's environment; this imbalance must then be compensated for by readjusting farming practices. This second model is part of a holistic, multifactorial approach to health, called the "global approach" by many animal health advisors (Le Bris *et al.,* 2018).

For example, Duval *et al* (2017) showed that animal health management strategies of dairy organic farmers were aimed at promoting herd health rather than targeted management of diseased animals. Farmers reported working on the forage system, animal genetics, housing conditions, health monitoring and quality of animal care to improve herd health. There is also an interest in so-called "alternative" approaches to animal health among organic farmers: either preventive through feeding (e.g. the Obsalim® method, see Box 2) or therapeutic (mainly phyto- and aromatherapy, homeopathy and osteopathy), which they most often combine, creating a multitude of treatment combinations (Hellec and Manoli, 2018). As the appropriation of these techniques is lengthy, with few scientific references available or specialised support on these issues, they operate by trial and error and therefore rely heavily on their experience (Cabaret and Nicourt, 2009; Nicourt *et al.,* 2009).

However, these conceptions of health specific to organic farmers should be discussed in the light of other studies that have more specifically addressed the links between representations and practices within a given animal production. Nicourt *et al.* (2009) described two main types of organic farmers in sheep meat production, which are distinguished by their conceptions of health, their practices and their relationship to advice: *i)* "autonomous", isolated farmers, whose aim is to achieve this health equilibrium through very broad practices favouring the most natural environment possible, in conditions approaching wild life, and allowing them to have more resistant animals; *ii)* "creative" farmers who rely more on alternative medicines to correct health disorders, while having hygiene and husbandry practices that reduce health risks; moreover, these farmers regularly experiment with new preventive and/or alternative approaches.

More recently, a study in organic beef and dairy sheep production (Joly, 2018) identified three types of farmers that illustrate well the main principles of animal health management in OA presented by Vaarst and Alrøe (2012): *i)* farmers for whom a healthy animal is defined as an animal with a low level of disorders; they rely on good husbandry practices (e.g. balanced diet, free-range calving) to prevent health disorders; *ii)* farmers for whom a healthy animal is an animal with a satisfactory level of performance; they then rely more on preventive practices to manage health: vaccines, alternative medicines, hygiene; *iii)* between these two clearly identifiable types, a third group of farmers with intermediate practices and conceptions emerges.

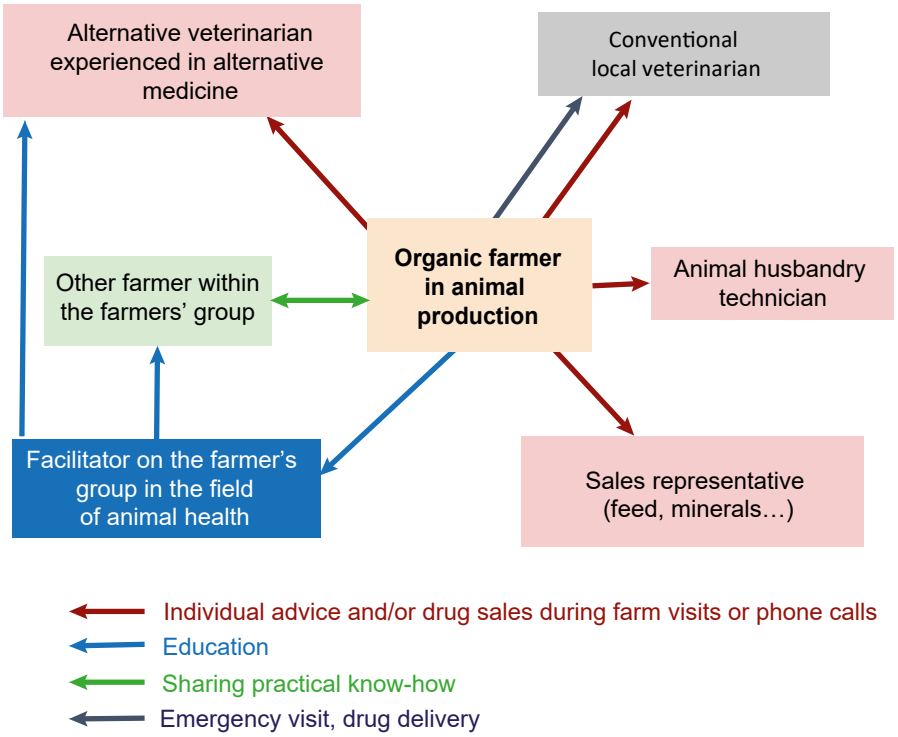
## ■ 1.2. Animal health support for organic farmers

These views of animal health result in a need for appropriate support to

**Box 2.** ***The Obsalim alternative observation method (Manoli and Hellec, 2017;Michaud* et al., *2019).***

Among the alternative approaches to animal health used in OA, the Obsalim® method proposes to detect and solve feed-related health problems in ruminants. This method, based on close observation of animals, was developed empirically by a French veterinarian. He developed a system of correspondence between clinical signs observable on dairy cows (then other species and other production orientations) and dietary disturbances. This method has spread very quickly among farmers at the national level, and is very present in training courses for farmers on husbandry techniques and conversion to OA. This success can be explained by the effectiveness of the training system that has been set up (individual and group use) and by the practical effectiveness that farmers recognise in it (for the management of feed and the choice of diets). The originality of this method is that it provides tools for observing animals and herds, with a set of cards describing the main symptoms to be observed. It also proposes a system (hair rallies) for networking farmers to encourage them to discuss their observations on their herd and those of others. It is above all this opportunity to develop one's ability to observe animals that is appreciated by the farmers. For some, this brings them back to a more sensitive dimension of their work, more meaningful. This method has not been scientifically validated, but a study comparing it to a more conventional approach to dietary diagnosis concluded that it was similarly effective (Michaud *et al.,* 2019).

**Figure 1.** ***The organic farmers' animal health advisory network.***




clarify the choices to be made in terms of the management of the farming system and the care given to the animals. Figure 1 summarises the advisory network of organic farmers regarding animal health.

In general, local rural veterinarians, described as "firemen", are not considered by organic farmers as privileged advisors (Duval *et al.,* 2017). Some veterinarians are trying to move beyond the role of emergency doctor to become a partner in animal health monitoring (Duval *et al.,* 2016; Benoit, 2021). However, they have difficulties in establishing themselves as key partners in the definition of herd health management strategies for organic dairy farmers and are sometimes even considered incompetent by these farmers to have this role (Vaarst *et al.,* 2006; Duval *et al.,* 2017), even in countries where the role of the veterinarian on farms is formally defined in national organic regulation (Skjølstrup *et al.,* 2021). This is partly due to the specific context of OA, which veterinarians seem to be unfamiliar with, both in terms of regulations and the specific expectations of organic farmers (holistic approach to health, alternative medicines). Furthermore, moving towards an advisory role requires the development of different forms of collaboration with farmers, based on new economic models for rural veterinarians (Benoit, 2021). Receiving advice independent of the drug sales is indeed a strong concern of organic farmers (Duval *et al.,* 2017). Thus, some farmers' groups work with veterinarians who provide herd health advice without selling medicines, for example through agreements between farmers' groups and independent veterinarians (Ruault *et al.,* 2016). Furthermore, although the majority of rural veterinarians have long ignored the demand of farmers for alternative medicines, initiatives have recently been developed, such as the creation of a continuing education programme by veterinary French schools on the subject of phytotherapy.

The mismatch between the advice of conventional local veterinarians and the needs of organic farmers has pushed the latter towards more decision-making autonomy, especially in the choice of their animal health advisors. According to Hellec and Manoli (2018) and Hellec *et al.* (2021), farmers who use alternative medicines rely on several types of advisors to help them in the daily management of their herd's health: the conventional local veterinarian for conventional interventions on the herd, but also alternative veterinarians, recognised for their expertise on alternative medicines and intervening mainly during days of continuing education. In addition to the different types of veterinarians, other people work with farmers on organic farming: animal husbandry technicians (dairy or reproduction advisors), or sales representative (feed, plant-based or mineral products) (Manoli *et al.,* 2018) and facilitators of farmer's group in the field of animal health. In some areas, farmers' "animal health" groups have been formed to address the lack of advice on alternative medicines. These groups are most often formed by livestock advisory organisations specialised in organic farming or grassland-based systems (such as CIVAM, GAB, Chambers of Agriculture…) but not specialised in animal health. It is at the request of their members that specific farmers' groups on animal health have been formed. The facilitators of these groups are then considered by the farmers as particularly important advisors. The advice provided is collective in nature, and combines training in small groups (ranging from 5 to 12 people) during which technical content is often provided by external speakers, and time for discussion between farmers, aimed at sharing practical know-how in the specific context of each one. This sharing of experiences between farmers, although it does not make it possible to validate the effects of a particular practice on

animal health, given that health is multifactorial, has long been described as a very common way of disseminating innovations in agriculture (Darré *et al.,* 2004). This sharing of experiences responds to a desire for autonomy in decision-making to manage the animal health of their herds, as well as a need for very practical solutions to manage animal health (Manoli *et al.,* 2020). Such discussion between farmers also exist in other contexts: for example, the "stable schools" in Denmark, training and sharing practical know-how sessions between farmers that also take place on the farm of one of the participants (Vaarst *et al.,* 2007). Farmers' interest in these advisory methods during training sessions is not specific to organic farmers; it has been confirmed more widely for conventional farmers (Manoli *et al.,* 2020), even though it has existed for a longer time in OA and grassland-based systems (e.g. livestock advisory organisations such as GAB and CIVAM).

To conclude on this illustration of conceptions and practices, it should be noted that these conclusions are difficult to extrapolate to the case of the monogastric productions: the pig and poultry farms are in fact characterised by a lower density of farms in a given territory and a more integrated food chain. It would also be interesting to study the particularities of the conceptions of farmers in these farming systems with regard to animal health and advisory network of farmers.

## 2. Biotechnical aspects of health management by organic farmers

In this section, we first present a comparative overview of the health situation on organic and conventional farms. These studies were most often conducted on dairy farms. We then examine the extent to which the main requirements of the specifications, taken individually or integrated within an organic farming system, can have an impact on animal health.

### ■ 2.1. Animal health status in organic farms

The herd health status and the main health disorders in OA do not appear to be fundamentally different from what is described in conventional farming. However, organic farmers' concerns may be more critical, as the use of treatments appears to be more restrictive.

In dairy cattle production, the published scientific data comparing the health status of organic and conventional herds is numerous and robust. They were summarised by Sundrum (2001) and we provide here more recent additions (Table 1). The frequency of health disorders in organic cows appears to be somewhat better than in conventional cows. However, the comparison is not so straightforward when looking at clinically expressed diseases, as organic farmers are less likely to detect and treat diseased animal with allopathic medicines (Ruegg, 2009). This is mainly true for mastitis where few differences are observed. In contrast, for metabolic diseases, the frequency is often much lower in organic farming, as for example for ketosis, which is reduced by 50 to 75% according to the studies.

This better health status of dairy cows in OA results in a lower use of

**Table 1.** ***Comparison of the frequency of production diseases in organic and conventional dairy herds.***

| Country, Number of organic farms/ Conv farms | Somatic cell count | Clinical mastitis | Clinical ketosis | Clinical hypocalcaemia | Retained placenta | Reference |
|---|---|---|---|---|---|---|
| Sweden 82/99 | Organic = Conv | Organic < Conv | Organic< Conv | – | Organic < Conv | Bennedsgaard *et al.* (2003) |
| Sweden 20/20 | Organic = Conv | Organic = Conv | – | – | – | Fall and Emanuelson (2009) |
| Norway 149/159 | Organic = Conv | Organic < Conv | Organic< Conv | Organic = Conv | Organic < Conv | Valle *et al.* (2007) |
| Norway 31/93 | Organic = Conv | Organic < Conv | Organic< Conv | Organic < Conv | – | Hardeng and Edge (2001) |
| USA 30/30 | Organic = Conv | Bio = Conv | – | – | – | Sato *et al.* (2005) |
| France 2668/68 291 | Organic >= Conv | Organic = Conv | | | | Le Mezec *et al.* (2016) |

allopathic medicines. A study comparing the drug expenditure of 58 organic farmers with 234 conventional farmers in the Rhône-Alpes region (Sulpice *et al.,* 2017) showed that the use of allopathic drugs in OA is reduced by 34%. This is true for all therapeutic families (antibiotics, anti-inflammatories, hormone treatments, rehydrating fluids). This reduction is more pronounced for antiparasitic drugs (–60%) and less for vaccines (–10%). On the other hand, the use of aromatherapy is more important (+73%).

In pig and poultry production, there are fewer comparative studies between conventional and organic farms (see for review; Kijlstra and Eijck, 2006). In France, an epidemiological survey of 85 batches of organic broilers (Souillard *et al.,* 2019) showed that only 37% had health disorders, with digestive disorders in three quarters of cases (75% unspecified enteritis, 16% necrotic enteritis and 8% coccidiosis). Faced with this type of disorders, farmers have used alternative medicine as a priority, with 63% of farmers using it exclusively, while 18% have preferred allopathic treatments (antibiotics, anticoccidial). In organic pig production, whether pigs are kept in buildings or in the open air, they show a low frequency of health and welfare disorders (Leeb *et al.,* 2019; Delsart *et al.,* 2020). The main health disorders are similar to those encountered in conventional farms: respiratory disorders in post-weaning and fattening (Leeb *et al.,* 2019) and diarrhoea in post-weaning, which can lead to a high mortality rate due to dehydration (Leeb *et al.,* 2014). In farrowing, the multifactorial problem of neonatal mortality of piglets is amplified by less secure farrowing conditions (possible crushing of piglets and more complicated monitoring) (Delsart *et al.,* 2020). When pigs have access to a range, some health management difficulties remain, on the one hand, parasitism and, on the other hand, the health risk due to poorer biosecurity (Delsart *et al.,* 2020). There is a lack of information on the health status in France, as organic pig production remains very limited (1.8% of sows; Source: Agence BIO/OC, Agreste/SAA 2020).

Beyond these small differences between organic and conventional farming, it is interesting to note that the frequency of health disorders on organic farms are very different between countries. These differences can be illustrated (Table 2) through a study in 192 dairy farms in Germany, Spain, France and Sweden (Krieger *et al.,* 2017). For all diseases, the frequency was on average lower in Sweden, while the farm characteristics were not particularly favourable to cow health (higher production level, use of tied-up barns for some herds). It should also be noted that the animal health status on some farms is very poor (e.g. more than 20% dead calves or more than 30% lame cows; Table 2) despite the fact that their practices comply with OA specifications. This has led to questions from upstream and downstream stakeholders on the appropriateness of requiring a minimum animal health status to be achieved in order to maintain OA certification (Krieger *et al.,* 2020).

## ■ 2.2 Contribution of the organic specification to animal health

Some practices, imposed or recommended by the OA specifications for reasons of health or biodiversity preservation, have been widely adopted by organic farmers and have had positive impacts on the preservation of animal health.

The requirements for animal **housing** are, in some productions, very different

**Table 2.** ***Frequency of production diseases in 192 organic dairy farms in 4 European countries according to*Krieger et al. *(2017). SCC: milk somatic cell count***

| | | France | Germany | Spain | Sweden |
|---|---|---|---|---|---|
| Calf mortality (% mortality in the first month) | Median | 5.7 | 1.4 | nd | 1.1 |
| | Mini-maxi | 0-30.0 | 0-19.2 | nd | 0-5.4 |
| Subclinical mastitis (% SCC > 100,000 cells/mL) | Median | 55.5 | 53.6 | 57.5 | 44.1 |
| | Mini-maxi | 26.1-87.5 | 24.8-73.5 | 37.0-94.2 | 18.9-80.6 |
| Prevalence of lameness (%) | Median | 25.0 | 20.4 | 10.0 | 4.3 |
| | Mini-maxi | 0-51.4 | 0-79.2 | 0-27.3 | 0-25.4 |

SCC: milk somatic cell count.

from those in conventional farming and have a real impact on animal health. For example, in organic pig production, the space per animal in indoor housing systems is double that of conventional one and access to the outdoors is now mandatory. Most studies conclude that the frequency of lung lesions observed at the slaughterhouse is divided by 3 for organic pigs compared to conventional ones, in relation to the improvement of air quality (for review, Delsart *et al.,* 2020). The freedom of movement of sows at the end of gestation and in farrowing pens, even if it sometimes increases piglet mortality (Goumon *et al.,* 2022), facilitates nesting and farrowing (Delsart *et al.,* 2020), which makes it possible to dispense with the use of prohibited prostaglandins.

The OA specifications recommend disease prevention through the use of **suitable genetic types** (Box 1). The breed types used in organic farming are obviously more diverse than in conventional farming. This can be illustrated by data on cattle breeding (Le Mezec *et al.,* 2016): herds with the exclusive Prim'Holstein breed represent 53% in conventional farms and only 22% in organic farms. The latter favour minor dairy breeds and also crossbreeding (10% of inseminations in dairy crossbreeding). However, these choices of racial diversity do not necessarily lead to better resistance to disease. Indeed, knowledge of genetic differences between breeds is not available in France, where genetic breeding values are calculated within each breed population. They have been approached in studies whose objective is to produce estimates of the heterosis effect. For example, in dairy production, Dezetter *et al.* (2015) showed that genetic resistance to mastitis was higher in the Montbeliarde breed than in the Normande breed, with the Prim'Holstein breed being intermediate. Moreover, the heterosis effect[1] for health traits is weak and not always favourable (Dezetter *et al.,* 2019). One way to improve the choice of genetic types would be to have a more diversified genetic offer in purebred cows, which would allow farmers to choose animals that meet their expectations. Regardless of the type of production, breeders are demanding the integration of new criteria into selection schemes (robustness, natural immunity, valorisation of roughage, docility, maternal qualities, feed efficiency, animal temperament) that can contribute to animal health (Experton, 2015). However, the adaptation of genetic types to OA is still in its early stages regardless of the type of production.

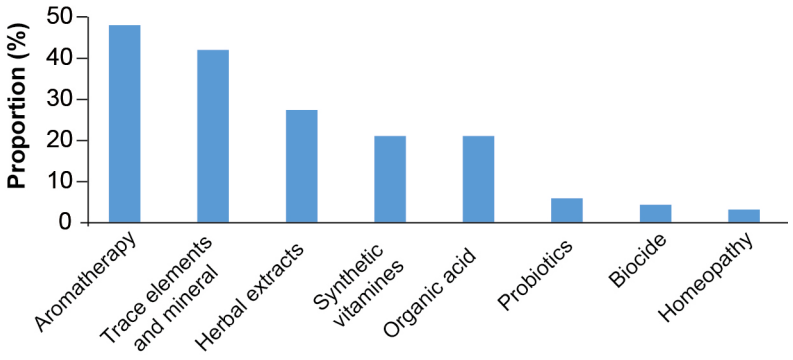
**The provision of roughage** to pigs, imposed by the OA specifications, has particularly interesting effects on herd health. In growing pigs, it helps to reduce the frequency of gastric ulcers (Holinger *et al.,* 2018). For pregnant sows, the satiating effect of this intake makes it possible to compensate for the frustration linked to their died restrictions and to reduce hierarchical pressures within the herd. The consumption of fibre in the farrowing pen is generally favourable to the health of sows (Meunier-Salaun *et al.,* 2001). Furthermore, the improved intake capacity due to the high forage bulkiness increases feed intake, milk production and ultimately piglet survival. In ruminants, organic feeding systems are generally based on grazing. This is beneficial to the cattle health, by reducing the frequency of production diseases. However, in addition to this dominant favourable effect, grazing presents specific risks (plant toxicity, grass tetany, fly and tick infestation, etc.) that farmers must learn to manage (Bareille *et al.,* 2019).

**The duration of milk feeding in young animals** imposed by the OA specifications is longer than in the conventional system. This seems to contribute to their better health. In pig production, weaning is a period at risk of diarrhoea in piglets (Leeb *et al.,* 2015). Weaning at 40 days, the minimum suckling time required by the OA specification, may be particularly risky as this corresponds to the time of decline of passive immunity by maternal antibodies before the final establishment of the piglet's own immunity. However, few studies have shown the effect of such a late weaning. In the INRAE Porganic experimental set-up[2], it was decided to wean the piglets a little later, at 49 days, in order to ensure a better digestive maturity. Combined with a low-protein second-age feed, it prevented diarrhoea (Ferchaud *et al.,* 2022). In dairy cattle production, the specifications require a minimum of 3 months of calf feeding, preferably with maternal milk. Here again, some farmers have opted for an even longer suckling period. Thus, over the last ten years, an innovative technique of rearing dairy calves with suckler cows has been spreading within the professional networks formed around intensive grazing. This technique allows for a much longer suckling period. It consists of giving a cow, taken from the dairy herd, two to three calves, which she feeds and raises for 4 to 8 months, largely on pasture. This technique is very favourable to the health and welfare of the calves

1 The heterosis effect is the difference between the average performance of the population from the first generation crossbreeding and the average performance of the two parental purebred populations.

2 For more information, visit https://www.inrae.fr/actualites/porganic-dispositif-experimental-inrae-recherches-production-porcine-biologique-region-nouvelle-aquitaine

**Figure 2.** ***Proportion of 85 organic broiler batches using so-called alternative treatments according to the French study by Souillard* et al. *(2019).***




(Constancis *et al.,* 2021). It also aims to reduce the laboriousness of the farmer's work while improving the roughage autonomy of the farm (Coquil *et al.,* 2017).

**Alternative medicines** are recommended to treat sick or injured animals (Box 1). These practices play an important role in the animal health management of organic farms. A survey of 100 organic ruminant farmers showed that 68% used homeopathy and 65% used aromatherapy (Experton *et al.,* 2021). In the study by Souillard *et al.* (2019), organic broiler farmers used a variety of non-allopathic treatments (Figure 2). It should be noted, however, that these treatments are mobilised in a preventive manner (79% of uses against only 21% for curative purpose), to avoid digestive problems, but also to promote ossification and growth.

In addition to the questions that these alternative treatment practices raise in terms of quality, safety and marketing, the question of their efficacy is very important (Rostang *et al.,* 2022 in this special issue), which requires the use of different adapted and robust methods to evaluate their bioactivities according to the needs of the farms. A proposal for methodologies to assess the effects of plant extracts on chicken immunity is presented in this special issue (Travel and Guilloteau, 2022; this issue). However, part of the favourable effect felt by farmers may come from the early detection of behavioural changes in the animals that go with the implementation of these alternative methods (Hellec *et al.,* 2021).

Unfortunately, there are still some situations where the farming conditions and the requirements of the OA specifications complicate the management of animal health. This is the case with pig production, where the management of iron intake and castration at a young age are tricky steps. On the one hand, it has been shown that iron supplementation is necessary to maintain haemoglobinemia and health in piglets reared in buildings or outdoors, and that a single intramuscular injection of iron (limit of one allopathic treatment for a piglet) could be suboptimal to prevent anaemia in piglets (Delsart *et al.,* 2020; Prunier *et al.,* 2022). It is therefore necessary to find alternative oral solutions to iron injection, to ensure sufficient, natural and progressive iron intake in newborn piglets, while keeping the possibility of allopathic treatment for another disorder during the life of the fattening pig. On the other hand, castration, which is recommended because of the late age at slaughter, also implies the use of allopathic chemical treatments for pain management; alternative practices are therefore expected.

## Conclusion

In conclusion, the study of the practices and concepts of organic livestock farmers shows that, overall, these farmers are making efforts to move towards more naturalness in the management and design of their livestock systems. These technical orientations have resulted in specific advisory systems in the field of animal health in organic farming. Furthermore, a comparison of the animal health status of organic and conventional farms shows that, overall, the health of organic herds is better, even if the comparison is always tricky because of the different intervention thresholds between conventional and organic farmers.

At the end of this review, the particularities of organic farmers in the field of innovation are noteworthy. The innovations developed and tested *in situ* by organic farmers have always been numerous, originating in the specifications and values promoted by organic stakeholders. This makes this type of agriculture a fertile ground for technical innovations (Bellon and Penvern, 2014), which paradoxically have received little attention from researchers. Thus, biotechnical research on these systems and/or on the practices of interest to organic farmers has always been limited, as it is often considered too marginal.

Research specific to OA is conducted in order to better analyse this minor production system and to account for the values held by organic farmers and stakeholders. They allow us to highlight

different types of innovations, which, at a time of agroecological transition, show a possible path for this transition. For example, the diversification of the sources of advice mobilised by organic farmers to support them in more gentle and preventive medicine shows an older and stronger support in organic networks for discussion between peers. The practical and situated knowledge that is promoted in these discussion groups is important to develop for agroecology. These types of advice are developing and are currently gaining ground in conventional animal health advice networks (Manoli *et al.,* 2020). In this respect, organic farming, in the field of animal health, can be seen as a niche of technological innovations that have emerged in a particular socio-technical scheme (Geels and Schot, 2007) and are spreading widely in the dominant scheme, where more and more systemic innovations are required (e.g. more integrated animal health management,Fortun-Lamothe *et al.,* 2022in this special issue) for the agroecological transition. In One Health approaches, these issues of moving towards more systemic animal health management are also strongly present (Zinsstag *et al.,* 2011). Although the technical specificity of organic farming systems is therefore difficult to define, it is all the more important to develop research on OA: firstly, to support this farming model, for which the question of scaling-up is a topical issue (cf. INRAE's Metabio metaprogramme on scaling-up of OA), and secondly, because of the potential for disseminating innovations that this represents.

## Références


Agence Bio, 2022a. Les chiffres 2021 du secteur Bio. Dossier de presse, Juin 2022. https://www.agencebio.org/wp-content/uploads/2022/06/DP-final_AGENCE-BIO-10-juin-2022.pdf.

Agence Bio, 2022b. Baromètre de consommation et perception des produits biologiques en France. Etude n°2100912, Janvier 2022, 152 p. https://www.agencebio.org/wp-content/uploads/2022/03/Barometre-de-consommation-et-de-perception-des-produits-bio-Edition-2022_VF.pdf.

Bareille N., Haurat M., Delaby L., Michel L., Guatteo R., 2019. Quels sont les avantages et risques du pâturage vis-à-vis de la santé des bovins ? Fourrages, 238, 125-131.

Bellon S., Penvern S., 2014. Organic farming, prototype for sustainable agriculture. Springer Édition, 489p. https://doi.org/10.1007/978-94-007-7927-3

Bennedsgaard T.W., Thamsborg S.M., Vaarst M., Enevoldsen C., 2003. Eleven years of organic dairy production in Denmark: herd health and production related to time of conversion and compared to conventional production. Livest. Prod. Sci., 80, 121-131. https://doi.org/10.1016/S0301-6226(02)00312-3

Benoit L., 2021. Vers une médecine vétérinaire préventive ? Une étude à l'échelle des cabinets vétérinaires. Mémoire de master 2 Agroécologie, Connaissances, Territoires et Sociétés. 83p.

Cabaret J., Nicourt C., 2009. Les problèmes sanitaires en élevage biologique : réalités, conceptions et pratiques. In : Numéro spécial, Élevage bio. Guyomard H., Coudurier B., Herpin P. (Eds). INRA Prod. Anim., 22, 235-244. https://doi.org/10.20870/productions-animales.2009.22.3.3350

Cabaret J., Nicourt C., 2011. La maladie animale entre visions ontologique et fonctionnelle : jachère des croyances ou culture de l'interdisciplinarité en élevage biologique. Présenté au : Colloque SFER/RMT « Les transversabilités de l'Agriculture Biologique », Strasbourg, FRA (23-06-2011 – 24-06-2011) [en ligne]. Disponible sur http://prodinra.inra.fr/record/45534

Coquil X., Brunet L., Hellec F., Pailler I., 2017. Conception d'une conduite de génisses laitières sous vaches nourrices : une intensification écologique des systèmes d'élevage herbager ? Fourrages, 231, 213-222.

Constancis C., Ravinet N., Bernard M., Lehebel A., Brisseau N., Chartier C., 2021. Rearing system with nurse cows and risk factors for Cryptosporidium infection in organic dairy calves. Prev. Vet. Med., 190. https://doi.org/10.1016/j.prevetmed.2021.105321

Darré J.P., Mathieu A., Lasseur J., 2004. Le sens des pratiques. Conceptions d'agriculteurs et modèles scientifiques, éd. INRA.

Delsart M., Pol F., Dufour B., Rose N., Fablet C., 2020. Pig farming in alternative systems: strengths and challenges in terms of animal welfare, biosecurity, animal health and pork safety. Agriculture, 10, 261. https://doi.org/10.3390/agriculture10070261

Dezetter C., Leclerc H., Mattalia S., Barbat A., Boichard D., Ducrocq V., 2015. Inbreeding and cross-breeding parameters for production and fertility traits in Holstein, Montbéliarde, and Normande cows. J. Dairy Sci., 98, 4904-4913. https://doi.org/10.3168/jds.2014-8386

Dezetter C., Boichard D., Bareille N., Grimard B., Le Mezec P., Ducrocq V., 2019. Le croisement entre races bovines laitières : intérêts et limites pour des ateliers en race pure Prim'Holstein ? INRA Prod. Anim., 32, 359-378. https://doi.org/10.20870/productions-animales.2019.32.3.2575

Duval J.E., Bareille N., Fourichon C., Madouasse A., Vaarst M., 2016. Perceptions of French private veterinary practitioners' on their role in organic dairy farms and opportunities to improve their advisory services for organic dairy farmers. Prev. Vet. Med., 133, 10-21. https://doi.org/10.1016/j.prevetmed.2016.09.008

Duval J.E., Bareille N., Fourichon C., Madouasse A., Vaarst M., 2017. How can veterinarians be interesting partners for organic dairy farmers? French farmers' point of views. Prev. Vet. Med., 146, 16-26. https://doi.org/10.1016/j.prevetmed.2017.07.013

Experton C., 2015. Répondre à des pratiques et attentes diversifiées en élevage biologique. AlterAgri, Janvier-Février, 15-18. https://abiodoc.docressources.fr/doc_num.php?explnum_id=2406

Experton C., Mouchard T., Gasqui P., Vourc'h G., Cluzet C., Manoli C., Ruault C., Linclau O., Girerd C., Roussel P., Bouy M., 2021. OTOVEIL - Analyse des processus techniques et organisationnels qui mènent à des situations d'équilibre sanitaire dans les élevages bio. Innov. Agro., INRAE, 82, 283-300.

Fall N., Emanuelson U., 2009. Milk yield, udder health and reproductive performance in Swedish organic and conventional dairy herds. J. Dairy Res., 76, 402-10. https://doi.org/10.1017/S0022029909990045

Fortun-Lamothe L., Collin A., Combes S., Ferchaud S., Germain K., Guilloteau L., Gunia M., LeFloc'h N., Manoli C., Montagne L., Savietto D., 2022. Principes, cadre d'analyse et leviers d'action à l'échelle de l'élevage pour une gestion intégrée de la santé chez les animaux monogastriques. In : Rationaliser l'usage des médicaments en élevage. Baéza É., Bareille N., Ducrot C. (Éds). INRAE Prod. Anim., 35, 307-326. https://doi.org/10.20870/productions-animales.2022.35.4.7225

Geels F.W., Schot J., 2007. Typology of sociotechnical transition pathways. Research Policy, 36, 399-417. https://doi.org/10.1016/j.respol.2007.01.003

Goumon S., Illmann G., Mousten VA., Baxter E., Edwars S.A., 2022. Review of temporary carting of farrowing and lactating sows. Front. Vet. Sci., 9:811810. https://doi.org/10.3389/frvets.2022.811810022

Hardeng F., Edge V.L., 2001. Mastitis, ketosis and milk fever in 31 organic and 93 conventional Norwegian dairy herds. J. Dairy Sci., 84, 2673-2679. https://doi.org/10.3168/jds.S0022-0302(01)74721-2

Hellec F., Manoli C., 2018. Soigner autrement ses animaux : la construction par les éleveurs de nouvelles approches thérapeutiques. Écon. Rurale, 363, 7-22. https://doi.org/10.4000/economierurale.5384

Hellec F., Manoli C., Joybert M., 2021. Alternative medicines on the farm: a study of dairy farmers' experiences in France. Front. Vet. Sci., 8. https://doi.org/10.3389/fvets.2021.563957

Holinger M., Früh B., Stoll P., Kreuzer M., Hillmann E., 2018. Grass silage for growing-finishing pigs in addition to straw bedding: Effects on behaviour and gastric health Livest. Sci., 218, 50-57. https://doi.org/10.1016/j.livsci.2018.10.012

INAO, 2021. Guide de lecture du RCE n° 834/2007 et du RCE n° 889/2008. Version de mai 2021 https://www.inao.gouv.fr/Les-signes-officiels-de-la-qualite-et-de-l-origine-SIQO/Agriculture-Biologique

Joly J., 2018. Pratiques sanitaires d'élevages de Ruminants. Contribution à l'identification de déterminants sociotechniques de l'équilibre sanitaire en agriculture biologique. MFE Ingénieur École Supérieure d'Agriculture, Angers, France.

Kijlstra A., Eijck I.A.J.M., 2006. Animal health in organic livestock production systems: a review. N.J.A.S., 54, 77-94. https://doi.org/10.1016/S1573-5214(06)80005-9

Krieger M., Sjöström K., Blanco-Penedo I., Madouasse A., Duval J. E., Bareille N., Fourichon C., Sundrum A., Emanuelson U., 2017. Prevalence of production disease related indicators in organic dairy herds in four European countries. Livest. Sci., 198, 104-108. https://doi.org/10.1016/j.livsci.2017.02.015

Krieger M., Jones P.J., Blanco-Penedo I., Duval J.E., Emanuelson U., Hoischen-Taubner S., Sjöström K., Sundrum A., 2020. Improving animal health on organic dairy farms: stakeholder views on policy options. Sustainability, 12, 3001. https://doi.org/10.3390/su12073001

Le Bris T., Gasqui P., Experton C., Cluzet C., Vourc'h G., Manoli C., 2018. Vers une objectivation de l'équilibre sanitaire des troupeaux : ce que nous apportent les données collectées en élevages de ruminants en agriculture biologique. Rencontres Recherche Ruminants, Paris, France, décembre 2018. http://www.journees3r.fr/spip.php?article4658

Leeb C., Hegelund L., Edwards S., Mejer H., Roepstorff A., Rousing T., Sundrum A., Bonde M., 2014, Animal health, welfare and production problems in organic weaner pigs. Org. Agr., 4, 123-133. https://doi.org/10.1007/s13165-013-0054-y

Leeb C., Rudolph G., Bochicchio D., Edwards S., Früh B., Holinger M., Holmes D., Illmann G., Knop D., Prunier A., Rousing T., Winckler C., Dippel S., 2019. Effects of three husbandry systems on health, welfare and productivity of organic pigs. Animal, 13, 2025-2033. https://doi.org/10.1017/S1751731119000041

Le Mezec P., Guerrier J., Roinsard A., 2016. Les élevages de bovins bio en France : choix de conduite, génétique et résultats techniques. Conférence au sommet de l'élevage "L'élevage bovin biologique en France : des éclairages de la recherche et des références. https://www.abiodoc.com/sites/default/files/gen_ab_biothemas_2016.pdf

Manoli C., Hellec F., 2017. Recréer des liens entre l'alimentation et la santé du troupeau : usages et diffusion de la méthode Obsalim® en élevage laitier bovin. Fourrages, 231, 203-212.

Manoli C., Ruault C., Lebris T., Douine C., Hellec F., 2018. Animal health management on organic farm: influence of extension services and animal health professionals. The International Society for Economics and Social Sciences of Animal Health (ISESSAH), 14-15 May 2018, Montpellier, France. https://www.isessah.com/publications

Manoli C., Martin G., Defois J., Morin A., Roussel P., 2020. Quelles attentes en formation exprimées par les éleveurs et les conseillers en productions porcines et bovin lait pour une gestion intégrée de la santé animale ? Rencontres Rech. Rum., Paris, France, 2-3 décembre 2020. http://www.journees3r.fr/spip.php?article4948

Meunier-Salaun M.C., Edwards S.A., Robert S., 2001. Effect of dietary fibre on the behaviour and health of the restricted-fed sow. Anim. Feed Sci. Technol., 90, 53-69. https://doi.org/10.1016/S0377-8401(01)00196-1

Michaud A., Cremilleux M., Beaure G., Védrine A., Rigolot C., 2019. Un diagnostic d'alimentation de ruminants « qui parle aux éleveurs ». Comparaison avec un protocole classique. Fourrages, 240, 321-328.

Nicourt C., Benoit M., Laignel G., Cabaret J., 2009. Approches sanitaires comparées d'éleveurs ovins allaitants biologiques et conventionnels. Innov. Agro., INRAE, 4, 49-60.

Prunier A., Leblanc-Maridor M., Pauwels M., Jaillardon L., Belloc C., Merlot E., 2022. Evaluation of the potential benefits of iron supplementation in organic pig farming. Open Research Europe 2:11 https://doi.org/10.12688/openreseurope.14367.2)

Rostang A., Belloc C., Leblanc Maridor M., Pouliquen H., 2022. La pharmacie vétérinaire – un enjeu majeur pour un élevage durable. In : Rationaliser l'usage des médicaments en élevage. Baéza É., Bareille N., Ducrot C. (Éds). INRAE Prod. Anim., 35, 245-256. https://doi.org/10.20870/productions-animales.2022.35.4.7181

Ruault C., Bouy M., Experton C., Patout O., Koechlin H., Sergent O., 2016. Groupes d'éleveurs en santé animale et partage des savoirs entre éleveurs biologiques et conventionnels. Innov. Agro., 51, 89-103.

Ruegg P., 2009. Management of mastitis in organic and conventional dairy farms. J. Anim. Sci., 87 (Suppl. 1), 43-55. https://doi.org/10.2527/jas.2008-1217

Sato K., Bartlett P.C., Erskine R.J., Kaneene J.B., 2005. A comparison of production and management between Wisconsin organic and conventional dairy herds. Livest. Prod. Sci., 93, 105-115. https://doi.org/10.1016/j.livprodsci.2004.09.007

Skjølstrup N.K., Lastein D.B., Jensen C.S., Vaarst M., 2021. The antimicrobial landscape as outlined by Danish dairy farmers. J. Dairy Sci., 104, 11147-11164. https://doi.org/10.3168/jds.2021-20552

Souillard R., Répérant J.M., Experton C., Huneau-Salaun A., Coton J., Balaine L., Le Bouquin S., 2019. Husbandry practices, health, and welfare status of organic broilers in France. Animals, 9, 97. https://doi.org/10.3390/ani9030097

Sulpice P., Gay E., Dumas P.L., Fauriat A., Frenois D., 2017. Exposition aux antibiotiques dans les troupeaux bovins : variabilité de l'indicateur ALEA et recherche de facteurs explicatifs, Recueil des Journées Nationales SNGTV, mai 2017, 629-638.

Sundrum A., 2001. Organic livestock farming, A critical review. Livest. Prod. Sci., 67, 207-215. https://doi.org/10.1016/S0301-6226(00)00188-3

Travel A., Guilloteau L., 2022. Méthodologies pour choisir et caractériser les extraits de plantes et évaluer leurs activités biologiques sur les défenses naturelles et le bien-être des poulets. In : Rationaliser l'usage des médicaments en élevage. Baéza É., Bareille N., Ducrot C. (Éds). INRAE Prod. Anim., 35, 369-390. https://doi.org/10.20870/productions-animales.2022.35.4.7337

Vaarst M., Alrøe H.F, 2012. Concepts of Animal Health and Welfare in Organic Livestock Systems. J. Agric. Environ. Ethics, 25, 333-347. https://doi.org/10.1007/s10806-011-9314-6

Vaarst M., Bennedsgaard T.W., Klaas I., Nissen T.B., Thamsborg S.M., Østergaard S., 2006. Development and daily management of an explicit strategy of nonuse of antimicrobial drugs in twelve Danish organic dairy herds. J. Dairy Sci., 89, 1842-1853. https://doi.org/10.3168/jds.S0022-0302(06)72253-6

Vaarst M., Nissen T.B., Ostergaard S., Klaas I.C., Bennedsgaard T.W., Christensen J., 2007. Danish stable schools for experiential common learning in groups of organic dairy farmers. J. Dairy Sci., 90, 2543-2554. https://doi.org/10.3168/jds.2006-607

Valle P.S., Lien G., Flaten O., Koesling M., Ebbesvik M., 2007. Herd health and health management in organic versus conventional dairy herds in Norway. Livest. Sci., 112, 123-132. https://doi.org/10.1016/j.livsci.2007.02.005

Verhoog H., Matze M., van Bueren E.L., Baars T., 2003. The role of the concept of the natural (naturalness) in organic farming. J. Agric. Environ. Ethics., 16, 29-49. https://doi.org/10.1023/A:1021714632012.

Zinsstag J., Schelling E., Waltner-Toews D., Tanner M., 2011. From "one medicine" to "one health" and systemic approaches to health and well-being. Prev. Vet. Med., 101, 148-156, (https://doi.org/10.1016/j.prevetmed.2010.07.003.)

## Abstract

In order to contribute to the development of Organic Agriculture (OA) in France, this article provides elements for the understanding of its regulatory framework and particularities. First of all, the analysis of sociotechnical literature shows that organic farmers have a specific view of animal health which is based on a preventive and holistic approach to animal health, according to which health management is primarily based on levers related to the management of the farming system. Farmers surround themselves with a diversity of actors to accompany them in the management of health at the farm level, which goes beyond the classical advice of the veterinarian. Then, another particularity is that the health status of the herds seems to be better in OA than in conventional agriculture. Indeed, comparative studies show a lower frequency of treatment of clinically expressed diseases in OA, without it being clear whether this is due to a lower level of medication used by farmers. Finally, a focus is made on certain rearing practices, imposed or recommended by the specifications for reasons of health or biodiversity preservation. These practices have been widely adopted by organic farmers and have had positive impacts on animal health. These particularities have been addressed in the literature unequally depending on the animal production sector. Therefore, in this review, more detailed elements are given on ruminants, and some specific contributions are made concerning pig and poultry productions.

## Résumé

### *Conceptions et pratiques de gestion de la santé des animaux en productions animales sous cahier des charges de l'agriculture biologique*

*Afin de contribuer au développement continu de l'Agriculture Biologique (AB) en France, cet article apporte des éléments de compréhension de son cadre réglementaire et de ses particularités. Tout d'abord, l'analyse sociotechnique montre que les conceptions de la santé animale, portées par les éleveurs et les accompagnants techniques spécialisées, sont basées sur une approche préventive et holistique de la santé animale, selon laquelle la gestion de la santé passe avant tout par des leviers liés à la conduite du système d'élevage. Les éleveurs s'entourent d'une diversité d'acteurs pour les accompagner dans cette gestion globale de la santé, qui dépasse le conseil classique du vétérinaire. Ensuite, une autre particularité est que l'état sanitaire des troupeaux semble meilleur en AB qu'en agriculture conventionnelle. En effet, les études comparatives relèvent une fréquence de traitement des maladies exprimées cliniquement plus faible en AB, sans que l'on puisse clairement élucider si cela est dû à une moindre prise en charge médicamenteuse des malades par les éleveurs. Enfin, un focus zootechnique est réalisé sur certaines pratiques d'élevage imposées ou recommandées par le cahier des charges pour des raisons de préservation de la santé ou de la biodiversité. Ces pratiques ont été largement adoptées par les éleveurs en AB et ont eu des impacts positifs sur la préservation de la santé des animaux. Ces particularités ont été traitées dans la littérature de façon inégale selon les filières. Des développements plus importants sont donc faits dans cette synthèse sur les espèces de Ruminants, et des apports plus ponctuels sur les productions porcines et avicoles.*

BAREILLE N., DUVAL J., EXPERTON C., FERCHAUD S., HELLEC F., MANOLI C., 2022. Animal health management concepts and practices in livestock production under organic farming specifications. In: Special Issue, Streamlining the use of veterinary drugs in livestock. Baéza E. (Ed). INRAE Prod. Anim., 357e-368e.
https://doi.org/10.20870/productions-animales.2022.35.4.7368