Strategic nutritional management for organic livestock and poultry farming-A review


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Received: 08-04-2015 Accepted: 12-12-2015 DOI: 10.18805/ar.v37i1.9263

ABSTRACT
Organic livestock farming promotes the use of organic and biodegradable inputs from the ecosystem in terms of animal nutrition, animal health, animal housing and breeding. It is getting popular in many countries including India due to increased consumers’ demand of organic products and environmental concerns. Sound managemental aspect of organic livestock farming stands upon the nutritional management of the animals for better performance and animal health. Animal nutrition plays a key role to prevent infections, to provide wellbeing to the animals through better immunity and to improve animal production. Thus, roles of nutritionists and veterinarians are more important in organic system than conventional system which needs improved nutritional management and efficient surveillances of diseases and organisms that are economically important.

Key words: Animal nutrition, Organic livestock farming, Organic products.

Organic animal husbandry is a system of livestock production that promotes the use of organic and biodegradable inputs from the ecosystem in terms of animal nutrition, animal health, animal housing and breeding. It deliberately avoids the use of synthetic inputs such as drugs, feed additives, synthetic fertilizers and genetically engineered breeding inputs. The principal goal of organic production is to develop enterprises that are sustainable and harmonious with the environment. Organic farming starts with production of on-farm agriculture and horticulture products (Mcsheeny, 1977) and now also got popularized in livestock sector as and is well supported by giant leap in various research activities carried out on organic livestock farming (Chandrashekar, 2010, Tsiplakou et al., 2010, Bernues et al., 2011, Gomiero et al, 2011, Mena et al, 2012 and Gabriel et al., 2013)

Organic livestock farming system is getting popular in many countries including India due to increased consumers’ demand of organic products and environmental concerns due to increased demand for consumer’s organic products, concerns about risk of chemical drug residues, environmental effects and improved food quality in pasture based organic livestock farming have perhaps led consumers to organic food (Thamsborg et al. 1999 and Sundrum 2001).

Nutritional management plays a bigger role to control and prevent many economically important diseases, better health and enhanced performance of animals in sustainable organic animal farming as compared to conventional farming systems. However, the process of conversion from conventional to organic farming faces several problems mainly due to inadequate technical knowledge and value-added activities at farm or regional level with poorly organized marketing (Nardone et al 2004).

The comparison between conventional and organic livestock farming: Organic livestock production differs from conventional systems in many respects like animals are allowed a larger housing area including outdoor access, and fed organic feeds. There is a restricted use of antibiotics, prolonged waiting times before delivery of products after medical treatments and preventive medical treatments are not allowed. Practice of following longer weaning periods in pigs, no tail, teeth or beak clippings and slower growing breeds are used especially in broilers.

In India, Agricultural Processed Foods Export Development Authority (APEDA) under Ministry of Commerce is the controlling body for organic certification for export. The survey on ‘Rising demand of organic products in metropolitan cities’ is based on 1,500 lead retailers cited that health and environment grounds are the main reasons for purchasing organic products by customer. According to the survey, patterns of monthly spending give a good picture of consumer behavior. For instance, Mumbai rise in demand the most at 65% on organic products followed by Delhi-NCR at 61%, Bangalore at 58%, Ahmedabad at 55%, Hyderabad at 52%, Chandigarh at 51% and Indore at 50% (ASSOCHAM, 2010). Currently, most of the organic farmers in India are still in the transition phase and hence their costs
are still high. As these farmers continue with organic farming, the production costs are expected to reduce, making India as one of the most important producers of organic food (Rawat, 2012).

Source of animals for organic livestock farming: Mammalian livestock (e.g., cattle, sheep, hogs, goats, and rabbits) raised for meat production must be under fully organic management beginning no later than the third trimester of gestation. For example, bred cows from conventional sources must be under fully organic management at least 3 months prior to calving in order for the offspring to be considered organic. Bred ewes and does must be under fully organic management at least 50 days before the birth of offspring in order for those offspring to be eligible. Livestock used as breeding stock may be obtained from a nonorganic operation. They must be managed organically, and while they may be used to produce organic offspring, the breeding animals themselves may not be sold as organic slaughter stock. Poultry chicks from conventional sources are allowed for the production of organic meat and eggs only if they are rose organically beginning the second day of life (i.e., as “day-old chicks”). Older birds grown under conventional management are allowed only as breeder stock for the production of hatching eggs. Livestock and livestock products that are removed from an organic operation and subsequently managed on a nonorganic operation may be not sold, labeled, or rep-presented as organically produced. For instance, dry dairy cows may not be kept on a nonorganic farm and then reintroduced into an organic herd for lactation (NPOP, 2005).

Norms for feeds and feeding in organic livestock farming in India

(a) Principles: The livestock should be fed 100% organically grown feed of good quality. All feed shall come from the farm itself or be produced within the region. The diet shall be offered to the animals in a form allowing them to execute their natural feeding behavior and digestive needs. Coloring agents shall not be used in organic livestock production (NPOP, 2005).

(b) Standards: The certification programme shall draw up standards for feed and feed ingredients. The prevailing part (at least more than 50%) of the feed shall come from the farm unit itself or shall be produced in co-operation with other organic farms in the region. The certification programme shall allow exceptions with regard to local conditions under a set of time limit for implementation. (NPOP, 2005).

List of prohibitory products not to be added to the feed given to farm animals: Synthetic growth promoters or stimulants, synthetic appetizers, preservatives, except when used as a processing aid, artificial coloring agents, urea, farm animal by-products (e.g. abattoir waste) to ruminants, droppings, dung or other manure (all types of excreta) even if technologically processed, feed subjected to solvent (e.g. hexane), extraction (soya and rape seed meal) or the addition of other chemical agents, Pure amino acids and genetically engineered organisms or products thereof.

Vitamins, trace elements and supplements shall be used from natural origin when available in appropriate quantity and quality. The certification programme shall define conditions for use of vitamins and minerals from synthesized or unnatural sources.

In emergencies the certification programme shall allow the use of milk from nonorganic farming systems or dairy based milk substitutes so long as they do not contain antibiotics or synthetic additives for young ones (NPOP, 2005).

Managemental aspects of organic livestock farming: There are main three managemental aspects in organic livestock farming like housing, feeding and animal health. Housing consists of factors like sufficient free movement, sufficient fresh air and natural daylight according to the needs of the animals, protection against excessive sunlight, temperatures, rain and wind according to the needs of the animals, enough lying and/or resting area according to the needs of the animal, ample access to fresh water and feed according to the needs of the animals, adequate facilities for expressing behavior in accordance with the biological and ethological needs of the species and no compounds used for construction materials or production equipment shall be used which might detrimentally affect human or animal health (NPOP, 2005).

While good nutrition aims to achieve adequate yields, it has an enormous effect on animal health and is therefore very important in disease prevention. (Lampkin 1990) points out that cow with a high production level due to emphasis on concentrates in their diet have a shorter productive life. In organic systems, crop rotation and a variety of plant species in the pasture help to achieve diet diversity.

Organic crop production

Only land that has been free of prohibited substances (e.g. synthetic pesticides and fertilizers) for three years can be certified for organic production. The actual conversion from conventional agriculture to full organic production, however, can take from three to five years, depending on the crop(s), soil fertility and the transitioning approach.

(i) Cultivar selection and planting stock: All seeds (including cover crop seed) and other planting stock (rhizomes, shoots, cuttings, tubers, and transplants) must be certified organic and either purchased from a reputable dealer or produced organically on the farm.
(ii) Production methods: The emphasis of organic production is on biodiversity and the use of natural means of plant fertilization, soil-building, and pest management. In fact, organic agriculture has been referred to as “good farming practice without using synthetic chemicals” (ATTRA, 2004). Planting cover crops, cultivating, composting, irrigating, and using animal and green manures are also employed in organic systems. Mulching materials can include natural materials (e.g. wood chips) or allowable synthetic materials (e.g. newspaper). Plastic mulch is permitted in organic production if it is removed at the end of the harvest season.

(iii) Pest management: Organic farmers state that managing insect pests, plant diseases, and weeds are the greatest challenges in organic farming. Simply substituting conventional pesticides with organically approved chemicals is expensive and less efficacious than using cultural management strategies that minimize pest pressure in concert with organically approved controls.

(iv) Harvest and storage: Products grown organically and harvested during the transition period cannot be marketed as organic. Harvest equipment, storage areas, and packaging materials must comply with NOP standards. Growers with split operations must either use separate equipment and facilities for these operations or decontamination protocol must be followed before use in the organic end of the enterprise. Packaging materials must be protected against potential contamination from prohibited substances.

Commonly used feed and fodder in organic livestock farming

(i) Pasture species: Lucerne paddocks for finishing, selected mixed herb ‘medicinal’ paddocks as a tonic for sick or weak animals.


(iii) Grasses: Commonly used pasture grasses include Sudan grass, Napier grass, Guinea grass, Para grass.

(iv) Legumes: Commonly used pasture legumes include Cowpea (lobia), Cluster beans (guar), Peas (matar), Bengal gram (chana), Horse gram, Dew beans (moth), Lentil (masoori dal), Berseem, Lucerne (alfalfa).

(v) Non-Legumes: Sorghum (jiwar), Pearl mellet (bajra), Barley (jau), Maize (makai), Ragi (madua).

(vi) Herbs: Possible herb species are chicory, plantain, yarrow, burnet, caraway, sage, and parsley. Chicory is a particularly productive and drought tolerant, deep-rooted herb.

(vii) Tree Leaves: Commonly used tree leaves include Neem (Azadirachta indica), Pipal (Ficus religiosa), Babul (Acacia nilotica), Subabal (Leucaena leucocephala), Mulberry (Morus Niagra) etc.

Feeding for internal parasitic Control

Gastrointestinal parasitic infection is probably one of the most economic and production losses in livestock worldwide (Coop and Holmes, 1996 and Waller, 2006). Nematode infections decrease feed intake, utilization of feed, body weight gain, milk production and reproductive performance.

1. Feeding

(i) Feeding by pass protein: Many research studies have reported that protein supplementation either in the form of by-pass protein or higher dietary protein improves resilience and expression of immunity to gastrointestinal parasites (Coop and Holmes 1996; Coop and Kyriazakis 2001). Protein supplementation in the form of rumen undegradable protein has been shown to increase the resistance of sheep to Haemonchus contortus (Wallace et al 1996).

(ii) Minerals: Zinc plays an important role to build up a successful immune response against gastrointestinal nematodes. Iron had presumably no direct effect on parasitic control; however, iron supplementation improves host performance because it restores iron status in the body which is lost through blood during gastrointestinal parasitic infections (Koski and Scott 2003). In certain areas deficient in Mo in soil and pasture, supplementation of Mo equivalent to feeding a diet containing 4-8 mg/kg DM in sheep reduces worm burden (McClure et al 1999).

(iii) Vitamins: (Vellema et al., 1996) noted that vitamin B12 deficient lambs had higher faecal egg counts than vitamin B12 supplemented one after natural infection with gastrointestinal nematodes.

(iv) Feed additives fungus: Feeding of fungi such as Duddingtonia flagrans, Harposporrium anguillulae and Arthrobotrys spp. as a feed additive during the time when the parasite infestation is expected to high have the potential to control gastrointestinal parasite in the pasture (Waller and Larsen, 1993; Thamsborg et al., 1999 and Terril et al., 2004).

2. Pasture management

Some legume forages such as sulla (Hedysarum coronarium), sainfoin (Onobrychis vicifolia), birdsfoot trefoil (Lotus corniculatus), maku (Lotus pedunculatus) and Serecea lesperdea reduce parasitic infections as measured by reduced parasitic egg excretion, egg hatching, total worm burden and rate of larval development of parasites specific to different parts of gastrointestinal tract (Min and Hart, 2003; Ramirez-Restrepo et al., 2005a). (Min et al., 2003) noted that Angora goats grazing on Lesperdea cuneata (5.2% condensed tannins/kg DM) had a reduction of 76% in total worm burdens, 94% Haemonchus, 100% Teladorsaga sp and Trichostrongylus. (Tzamaloukas et al., 2005) noted that lambs grazing chicory (Cichoriumintybus) had the lowest adult worm burdens compared to those grazing on grass/clover.
3. Grazing management

Mixed grazing of a pasture by different species such as cattle and sheep (but not sheep and goat) together may reduce the infection as a very little cross infection of parasites occurs between animal species. There are even certain species of worms that affect only a particular ruminant species. Alternate grazing of two or more ruminant species has been shown to be of value in controlling some species of parasites (Thamsborg et al., 1999).

(i) Rotational grazing: A successful approach could be adopted in which pastures are subdivided and the animals are intensively grazed for short period at higher stocking density when the forage is at the young, active growing stage. Svensson et al., 2000 reported that 27% of organic farmers follow rotational grazing as compared to 3% in conventional farming as a control measures for nematode infections.

(ii) Stocking rate management: Stocking rate management is practiced by many organic farmers to control parasite infection (Thamsborg et al., 1999). Low stocking as compared to high stocking rate reduced nematode infection in heifer and steers grazing in wet marginal grasslands (Kristensen et al., 2006).

(iii) Strategic grazing: Young animals are most susceptible to parasitic infestation than mature animals due to less immunity to parasites at that time. Therefore, the access of clean ungrazed pasture first to young animals such as lamb, calf or kid may reduce the risk of parasite infection (Thamsborg et al., 1999).

Feeding for immunity to infectious disease

(i) Minerals: Trace minerals that have been identified as important for normal immune function and disease resistance are zinc, manganese, selenium and copper in many field conditions (Galyean et al., 1999). Cu supplementation (20 ppm) has shown to reduce severity of udder infection challenged with Escherichia coli than control (6.5 ppm) in dairy heifer (Scaletti et al., 2003).

(ii) Vitamins: Carotenoids (beta-carotene and lycopene), vitamin A, E and C are naturally-occurring antioxidant nutrients that scavenge detrimental free radicals produced through normal cellular activity and from various stressors (Bendich, 1993). The antioxidant function of these micronutrients could enhance immunity by maintaining the functional and structural integrity of important immune cells.

(iii) Probiotics: A number of studies support the use of probiotics (lactic acid bacteria, such as lactobacilli and bifidobacteria, and yeast culture such as saccharomyces spp, and other beneficial bacteria) to prevent and treat many infectious diseases, particularly of the intestine such as diarrhea in young animals besides many other health benefits and animal performance. Besides the health benefits of probiotics, it improves growth rate and feed conversion efficiency in calves (Ramaswami et al., 2005), microbial protein flow (Hassan et al., 1996) and DM intake (Putnam et al., 1997) particularly in poor managemental conditions.

(iv) Prebiotics: Prebiotics have shown promise in the prevention and control of exogenous and endogenous intestinal infections and good health of the animals (Grizard and Barthomeuf, 1999).

Feeding to prevent metabolic disease

(i) Acidosis: Processing of grains increases starch availability and promotes in acidosis (Owens et al., 1998). Sometimes, rumen acidosis is associated with alfalfa hay that is too low in ADF and NDF. (NRC, 1989) recommends that the dry matter of dairy cow diets should contain at least 25% neutral detergent fiber (NDF) and that three quarters of the NDF should come from forages.

(ii) Milk fever: The feeding of a diet high in cations especially in K and Na in dry period tends to increase incidence of milk fever (Goff et al., 2004). Whereas, feeding cows with diet relatively high in anion, primarily Cl and SO₄ may help to prevent milk fever. A ratio between 1: 1 and 2: 1 of Ca to P would appear to be most satisfactory, providing the overall levels of each element are within the normally accepted range.

(iii) Pasture bloat: Lotus corniculatus (Birdsfoot trefoil) is less likely to cause bloat than alfalfa and many types of clovers, because it reduces the rate of digestion considerably in the rumen. Also, grasses do not usually cause bloat, because the protein content is lower than legumes.

(iv) Important considerations for feeding organic poultry: Synthetic amino acids or vitamins are not allowed in organic poultry feed, which can result in a nutritional imbalance leading to increased disease susceptibility and behavioural problems like cannibalism and feather picking (Damme, 2000; Berg, 2001). The largest component of any of the organic poultry diet is the cereal (maize). Home grown protein sources like peas, beans and rape seed can be utilized. In this regard, peas offer more scope towards organic feed formulation and may be included between 250 and 300g /kg for table chicken and 150 to 20g/kg for laying hens. Oily fish meal can be used in organic rations and it had higher essential amino acid content as compared to full fat Soya. Its use in poultry rations is limited permit because it is costly as well as organic products were found fishy taints. Sprouted grains are a good source of vitamins and can be used to replace synthetic amino acids. Limestone and phosphate rock can be employed as mineral source for organic ration. For layers, limestone grit and oyster shell will provide calcium for egg production. Hence, a balance ration is factor for sound and healthy birds. Over feeding must be avoided. Use of synthetic amino acids for poultry diet in organic production system should be
avoided. Requirement of essential amino acids can be fulfilled through feeding of organic soya bean, skim milk powder, potato protein, maize gluten etc. (Chander, 2009). The birds must have continuous access and supply of quality water without any antibiotic and bacteriological residues. The water should be regularly tested for ground water finding contamination.

**Tropical organic livestock farming**

The role of livestock in many tropical countries is to contribute to the ecological and environmental sustainability of these systems, e.g., in nutrient recycling (Hermansen 2003; Powell et al. 2004). Tropical smallholder livestock keepers represent about 20% of the world population (McDermott et al. 2010), and livestock play a significant role in household food and income (Funesti-Monzote 2008; Descheemaeker et al. 2010), serving cultural and traditional purposes, as well as supplying the household members and local communities with products like meat, milk, eggs, skin, and bones (Wilson 2009; Powell et al. 2004; Devendra and Thomas 2002), and finally providing draft power (Powell et al. 2004; Descheemaeker et al. 2010).

**Challenges against organic livestock farming in India:**

The countries with the most producers are India (677,257), Uganda (187,893) and Mexico (128,862). Yet animal products are still a small share of the organic market, compared to fruits, cereals and herbs, and, in terms of exports, are almost negligible in developing countries (Willer and Kilcher 2011). While many tropical countries are making concerted efforts to boost organic production, especially of high value commercial crops, with considerable success, some serious problems are still restricting growth in organic farming. Some of these potential obstacles, especially when exporting livestock products, are lack of knowledge, small farms, problems in livestock feeding, sanitary regulations, traceability, disease, lack of training and certification facilities.

**CONCLUSION**

Demand for organic livestock products is growing as literacy is on the rise and the media are making consumers more aware of and concerned about animal welfare issues and healthy foods. Organic farming is more profitable than conventional farming. A good accomplishment in organic livestock farming system stands upon the nutritional management of the animals for better performance and animal health. Nutrition plays a key role to prevent infections, to provide wellbeing to the animals through better immunity and to improve animal production. Bioactive plant secondary metabolites in forages and as feed supplements could have the potential to improve future organic livestock farming. Roles of nutritionists and veterinarians are more important in organic system than conventional system which needs improved nutritional management and efficient surveillances of diseases and organisms that are economically important. Many nutritional technologies emerged out in the area of prevention and treatment of infections, boosting immunity and enhancing production to solve the situations faced in organic livestock production entail more systematic research.

**REFERENCES**


