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# Interventions in feeding systems and management of dairy animals- food security strategy in livestock sector

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**Abstract**
As the global population is constantly increasing humanity faces enormous challenges to feed the growing population. Dairy foods play an important role in providing nutrient and energy dense sources of calories. This article reviews the interventions that can be applied by the farmers to the existing feeding and management systems of dairy cattle to increase their productivity. Productivity of animals can be increased by feeding them with supplements, feed additives and also by minimising the production losses by corrective managemental practices. Feeding of 50 g fenugreek per Kg increases the milk production by 0.67 litres per day. Feeding of 50 g asparagus root increases the milk production by 12.72 per cent in 2 months. Feeding of 1.5 kg fresh azolla, 1 Kg maize per 100 Kg body weight and 15 g yeast increases milk production per day by 1.30, 1.0 and 0.5 litres respectively. Managemental practices such as deworming increases the milk production by 33 per cent, spray cooling of cows in summer months to reduce the heat stress increases milk production by 0.7 litres per day. Prevention and control of mastitis is an important mangemental aspect which can prevent large volumes of milk from being wasted. Application of these interventions which are locally available and inexpensive increases milk production thereby contributing to food security.

**Keywords:** Feeding, increase, interventions, milk production, management

## Introduction
Dairying provides a regular source of income, nutritious food, generates on- and off-farm employment, provides financial stability and social standing and hence dairy development is a sustainable, equitable and powerful tool for achieving economic growth, food security and poverty reduction.

India is the highest milk producer in the world with an annual milk production of 176.3 million MT (2017-18) (NDDB, 2018) [1]. Per capita availability of milk in India is 375 g per day. India accounts for 19 per cent of the world milk production and consists of about 57 per cent of world buffalo and 16 per cent of world cattle population. Milk production in india is by the mass population of cows. The average productivity of in milk cattle and buffalo in the country is about 4.65 Kg per day (2015-16) which is far below as compared to the productivity levels of in-milk animals in dairy developed nations.

In developing countries, dairy animals are fed poor quality feed with low digestibility and low nutritive value, fibrous feeds – mainly crop residues and low quality pasture which are deficient in nitrogen, minerals and vitamins and this is one of the major factors limiting dairy production. The other factors affecting the productivity of animals are under feeding, various diseases, stress, seasonal variation etc.

Milk production is a high energy consuming process and so use of supplements (energy rich and protein) becomes an important aspect in dairy farming. This article reviews the interventions that can be applied to the existing feeding and managemental practices to increase the milk quantity and enhance the quality of milk.

## I. Feeding Interventions
A wide variety of feed additives are available which can be used pre partum and post partum. Beyond appropriate feeding management, the administration of some additives such as plant extracts, enzymes, glucose precursors, probiotics, choline and vitamin E may be helpful in ameliorating nutrient utilization and availability with a consequent improvement of milk yield. Feed additives can be classified as biological additives (yeast cultures), natural additives (medicinal plants and its seeds) and chemical additives (buffers such as sodium acetate and sodium succinate)

**1. Galactogogues**

Galactogogues are medications that aid in initiating, maintaining, and augmenting of adequate milk production. Herbal galactogogues act through interactions with dopamine receptors by exerting an influence through adreno-hypothalamo-hypophyseo-gonadal axis resulting in enhanced prolactin concentration and thereby augmenting milk production. Locally available galactogogues are fenugreek (Vendhayam) and asparagus (Thanneervittan).

**A) Fenugreek:** Fenugreek has a positive effect on the lactation performance of ruminants. Diocin is a natural saponin found in Fenugreek and has a structural similarity to estrogen. Feeding 50 grams of Ground Fenugreek seeds per Kg to early lactating ruminants resulted in a significant increase in milk production of 0.67 kg per day (Degirmencioglu *et al*, 2016) [2]

**B) *Asparagus*:** Roots contains saccharine and mucilagenous substances in large proportion. It helps in improving digestibility, increases milk after calving, helps in mammary gland development, hastens letting down time, stimulates lactiferous tissues and keeps udder and teats in smooth condition. Feeding 50 g powder of shatavari roots mixed with concentrates once in a day for a period of 60 days increased the milk production in cows by 12.72 per cent (Tanwar *et al*, 2008) [3]

**2. Hydroponic fodders**

Hydroponics is growing of a plant without soil. It is also called sprouted grain/fodder. It needs a short period to grow and develops in a green house under controlled environment. Hydroponic fodders are rich in crude protein, organic matter, ether extract, nitrogen free extracts and β-carotene as compared to the common non-leguminous fodders. Hydroponic fodder increases milk yield by 10.07 per cent in dairy cows. This is a best alternative technology to use for dairy animals with low cost materials.

**A) Azolla:** Azolla is a free floating, rapidly growing aquatic fern on water surface. It floats on the surface of water by means of numerous, small, closely overlapping scale-like leaves, with their roots hanging in the water. They form a symbiotic relationship with the cyanobacterium *Anabaena azollae*, which fixes atmospheric nitrogen, giving the plant access to this essential nutrient. Azolla is very rich in proteins, essential amino acids, vitamins (vitamin A, vitamin B12, Beta Carotene), growth promoter intermediaries and minerals including calcium, phosphorous, potassium, ferrous, copper, magnesium. The main character influencing the value of azolla as its feed is its amino acid composition. Feeding of cows with 1.5 Kg fresh green azolla (*azolla pinnata*) with roughages and concentrates for a period of 2 months increased the milk production by 1.30 litres per day (Meena *et al*, 2017) [4]

**3. Maize**

Maize is a locally available cereal. The type of carbohydrate and nitrogen included in the ration influences milk production. Maize starch differs from other cereal starches such as barley and wheat in its degradation; 60 per cent of maize starch being degraded in the rumen compared with 90 per cent of barley and wheat starch. Escape of 20-40 per cent maize starch from rumen fermentation followed by its absorption in the lower tract increases milk production. Feeding of cows with 1 Kg crushed maize per 100 Kg Body Weight increases milk production by 0.8-1.1 Litres per day (Kamal *et al*, 2008) [5]. Feeding of finger millet straw supplemented with maize grain also increases milk production by 1 litre per day (Chandrasekharaiah *et al*, 2004) [6].

**4. Yeast**

Yeast (*Saccharomyces cervisiae)* supplementation in diets of ruminants increases utilization of poor quality roughages, grains and by-product based diets. Live yeast supplementation increases milk yield, milk protein, fibre digestion and stabilization of rumen pH in dairy cattle. Increase in milk production is attributed to an increase in NDF digestibility and more VFA production thus allowing higher energy availability for milk yield. Effect of yeast supplementation is more pronounced in animals under stress conditions. Feeding of 15 grams of yeast per day for a period of 60 days increased the milk production in cows by half a litre per day (Anjum *et al*, 2018) [7].

**II. Managemental Interventions**

**1. Deworming**

Parasitic infections negatively affect the economics of raising cattle. The economic impact of parasitism is commonly calculated by comparing production in parasitised cattle with production of those that have had their parasite burden removed with an antihelminthic drugs (Bert and Louis, 2006) [8]. Economic losses due to internal parasitism in cattle which affect the overall health can be highly significant. They result in weakness, diarrhoea, anaemia and reduced productivity in cows. Parasites compete for nutrition with the cows and this results in decreased milk production. Regular deworming of cows can result in increase of milk yield upto 33 per cent by one month, ultimately supporting sustainable milk production.

**2. Heat Stress**

Elevated temperature and humidity negatively affects feed intake which in turn affects milk production. Heat stress also affects the quality of milk. Further heat stress also alters the levels of Prolactin, glucocorticoids, Growth hormone, Thyroid hormones, Progesterone, Estrogen. Effect of heat stress is dependant on the breed. Holsteins are particularly affected by increased temperatures. Spray cooling of cows during hot summer months can alleviate heat stress and prevent production losses due to high temperatures. Direct sprinkling of water on cows conducts away surface heat and enables animals to vaporize more moisture from the skin, thereby allowing the cows to utilize the resulting latent heat of vaporization for body cooling. In effect, this phenomenon alleviates the thermal-induced compensations of decreased feed intake, hormonal alterations, and other factors that result in lowered milk yield so that the energy used for cooling processes may be spared for production functions. Spray cooling of cows incresed daily milk production by 0.7 litres (Igono *et al*, 1985) [9].

**3. Stress**

Stress decreases prolactin levels resuling in lactation problems, affects LH levels resulting in reproductive problems and causes problems with milk ejection by affecting Catecholamines. Alleviation of stress can result in increased milk production. In addition to the physiological stress (Lactogenesis) experienced by dairy animals an additional

stress due to rough handling, poor environmental conditions and poor housing conditions will surely affect milk production. As hormone action is completely dependent on emotion and stress, control of stress is the primary factor in improving lactogenesis. Stress on dairy animals can be controlled by minimising rough handling of cows, reducing transportation and providing adequate feed and water.

**4. Mastitis control**

Mastitis is the inflammation of parenchyma of mammary glands. It is characterized by physical, chemical and, usually, bacteriological changes in milk, and pathological changes in glandular tissues. Mastitis is a global problem as it adversely affects animal health, quality of milk and the economics of milk production. Mastitis is the most widespread infectious disease in dairy cattle, and, from an economic aspect, the most damaging . Risk factors for mastitis are high milk yield, age, pendulous udder and teat, environmental factors such as improper ventilation, high temperature, seasonal variations and faulty milking practices.

Mastitis occurs in two forms- clinical and subclinical. Clinical mastitis is characterized by abnormal milk and swelling or pain in the udder and may be accompanied by systemic signs such as elevated rectal temperature, lethargy and anorexia (Harmon, 1994) [10]. Signs of mastitis in sub-clinical form are not apparent and can only be detected by bacteriological examination and somatic cell counts (SCC) of the milk. Under field conditions, determination of SCC in milk is usually done using the California Mastitis Test (CMT). CMT scores are directly related to average SCC. CMT is very inexpensive test with real-time results.

There are many factors acting simultaneously, and the disease generally involves interplay between managemental practice and infectious agents, but with other factors, such as genetics, udder shape or climate. Mastitis pathogens are categorized as contagious or environmental. Contagious pathogens live and multiply on and in the cow's mammary gland and are spread from cow to cow, primarily during milking. Environmental mastitis can be defined broadly as those intra-mammary infections (IMI) caused by pathogens whose primary reservoir is the environment in which the cow lives. *Staphylococcus aureus* is most commonly found in mastitic milk.

**Prevention and Control**

1. Milking of animals in a hygienic environment. Small scale farmers must have a hygienic place to milk the animals.
2. Use of milkers' gloves
3. Postmilking teat disinfection- To remove any contagious mastitis-causing pathogens that may have been deposited on the teat surface - including any present just inside the opened teat canal. Most commonly used is Potassium Permanganate
4. Not allowing cows to sit immediately after milking by feeding the cows after milking
5. Dry cow therapy- Antibiotics are administered towards the end of lactation and may remain in the udder in concentrations high enough to kill pathogenic bacteria for 20-70 days
6. Vitamin E and Selenium additives in feed- Can be supplied in the form of mineral mixture

**Conclusion**

Fenugreek, asparagus, azolla, maize and yeast are locally available and inexpensive. Addition of these to the ration of dairy cows results in an increased milk production per day without incurring heavy cost to the farmers and provides economical benefit to farmers. Managemental interventions mentioned in this article can be easily adopted. Deworming of cows with the appropriate dewormer according to the physiological status of the cow is highly recommended. Steps to prevent mastitis results in increased milk production and enhances milk quality along with an increased income for the farmers. The above mentioned feeding and mangemental interventions can be adopted at the farmers level and this will ensure food safety and food security in dairy sector.

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