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Prospects of Dairy Farming in India: A Review

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A B S T R A C T

Dairy farming is one of the leading component of agricultural activities in almost all parts of the world including India. India is the world's largest producer of dairy products by volume and has the world's largest dairy animal population. The country accounts for more than 13% of world's total milk production and is also the world's largest consumer of dairy products, consuming almost all of its own milk production. Dairy farming has been regarded as one of the activities that could contribute to alleviating the poverty and unemployment especially in the drought prone and rainfed areas. Dairy production in India, which has seen great increase over the period, has grown into a thriving enterprise; due to the policy decisions related to systematic breeding, improved feeding and superior health care management. These positives notwithstanding, the sector is confronting some of the major constraints that hinder inclusive development of the dairy farming in the country. Apart from low productivity of the animals, there are many other problems like, large human and livestock population and its pressure on available resources like land, degraded pasture lands, shortage of feed ingredients and fodders, which need to be targeted. Adoption of advance technology like genomic selection, use of sexed semen with improved AI practices at ground level which ultimately help to set new benchmark in overall indian milk productivity as well as increase individual animal productivity that in the end help small and marginal farmers upliftment of their income and in future indian dairy industry will reach new horizon.

Introduction

Dairy farming has played greater role in rural economy. Milk has become major source of revenue generation in rural India. Milk and different kind of dairy products are important components of our modern diets. India is the world's largest producer and consumer of milk and has the world's largest dairy herd, comprised of water buffalo and indigenous and crossbred cattle. Annual growth in milk production and consumption has been a robust 4.2 percent since 2000, and India has also emerged as a small net exporter of dairy products. As per 19th livestock census India possesses largest number of livestock in the world and ranks first in buffalo population (108.7 million) and second in cattle population (190.9 million) (GoI, 2014). It contributes nearly about one fourth of world's total bovine population. India enjoying as highest producers of milk at global level with

achievement of around 155.5 million tonnes during 2015-16 with per capita availability of 337 g/day (GoI, 2017). Dairy farming is a central source of livelihood for over 100 million people. Many of these small-scale livestock keepers have no access to land, and the number of rural landless households is likely to be increase due to further subdivision of land holdings. For smallholder and landless farmers, livestock are becoming an increasingly important source of income. These activities have contributed to the food basket, nutrition security and household income of the farmers and play a significant role in generating gainful employment in the rural areas.

Indian Dairy Farming: Present Status

Livestock production and agriculture are intrinsically linked, each being dependent on the other, and both crucial for overall food security. Since 1970, India's milk production has grown by an average of nearly 4% per year and in 2006 India became the largest milk producing country in the world (Muhammad *et al*, 2009). At national level, nearly 36% of the milk production is contributed by Indigenous Buffaloes followed by 26% by crossbred cattle.

The Indigenous cattle contribute 12% of the total milk production in the country, whereas non-descript cattle contribute 9% milk production and non-descript buffaloes contribute 13% milk production (GoI, 2017). Each year buffalo milk production rises by 4% and that of cow milk by 1.2% (Brouwers, 2006). India enjoying as highest producers of milk at global level with achievement of around 155.5 million tonnes during 2015-16. The per capita availability of milk has reached a level of 337 grams per day during the year 2015-16, which is more than the world average of 299 grams per day in 2015.

In spite of India's position as the highest producer of milk, the average annual milk yield from cattle and buffalo is only 1214 kg as against the world average of 2104 kg per lactation (Hegde, 2006). There is large population of milk producing animals; however, the average milk production per animal is very low as compared to other countries. In India Animal Husbandry and Dairy sector plays an important role in the national economy and in the socio-economic development of the country. According to estimates of the Central Statistics Office (CSO), the value of output of livestock sector at current prices was about 5,91,691 crore during 2015-16 which is about 28.5% of the value of output from agricultural and allied sector. At constant prices the value of output from livestock is about 29% of the value of the output from total agriculture and allied sector.

The Indian dairy industry has come a long way over the years from a milk production of 17 million tons in 1951 to 187.7 million tons in 2019 (NDDB, 2020).

Though India ranked first in milk production average yield rate per animal is very low as compared to other countries. In the year 2015-16 average milk yield of indigenous buffalo and cattle was 5.76 kg/day and 3.41 kg/day respectively (GoI, 2017). There is a need to develop breeding policy to overcome such challenge.

Constraints in Dairy farming in India

Constraints are the circumstances or the causes which forbid the course of action. There are several constraints in adopting the recommended dairy production technologies with varying degree of seriousness in increasing milk production. On one hand these constraints adversely affected the adoption of recommended dairy production

technologies by the farmers while on the other hand block the flow of new technology from research scientists to extension agents and in turn to dairy farmers. Constraints related to animal breeding are like non availability of AI (Artificial Insemination) and PD (Pregnancy Diagnosis) services at their doorstep perceived as the major constraint followed by Lack of availability of staff round the clock for AI and lack of awareness about scientific breeding practices, missing heat, Poor results of AI, High Incidence of repeat breeding in cross bred cows, inability to get their animals to the A.I. centers due to high cost and labour involvement and Non availability of breeding bulls of improved breeds locally. Farmers are slowly becoming aware of worth of their labour and time. So farmers started demanding the essential production services at their doorstep which can very well thought over by policy makers to make these services more accessible with subsidized cost recovery approach in stipulated time frame. Lack of awareness, missing heat and poor results of AI are the other rated constraints which can be overcome by improving overall efficiency of staff and AI technicians and also by organizing extension educational activities to create awareness among the dairy farmers about scientific breeding practices and their importance in improving the overall dairy production. Further, providing incentives to AI workers and staff for achieving more targets with better conception rate can be thought over by various service delivery agencies.

Constraints related to animal health care are like inadequate knowledge on diseases of cattle and their control as most important constraint followed by high cost of veterinary medicines, inadequate supply of quality medicines to veterinary institutions, inaccessibility of veterinarians due to more span of control, inadequate laboratory facilities and distant location of veterinary institutions. Poor acceptance rate by the small farmers for majority of the technologies was attributed to the lack of extension facilities, unavailability of inputs and the time and labour involved under small farm situations. This might be because of more emphasis on sick animal treatment by state animal husbandry department. This clearly indicates the need to accelerate the efforts in delivering extension services such as creating awareness among the dairy farmers. Further provision of adequate quality medicines and other infrastructure along with recruitment of required technical staff can help to overcome such constraints.

Economics of Dairy Farming

Dairy farming in India is part of a integrated farming system characterised by crop–livestock interactions (Singh 2004; Kumar and van Dam 2013). The by-products from several of the crops (crop residues, hay and straw) are used as input for dairy production, in addition to other inputs for which they have to directly incur costs (cattle feed, veterinary medicines, and artificial insemination). Animal dung and urine are used as inputs (biofertilizers and biopesticides) by farmers for improving soil fertility. To arrive at the economics of livestock farming, it is important to have realistic estimates of the cost of producing biofertilizers and the economic value of biopesticides.

Under intensive dairy farming, milk yield and revenue are high, but the input costs are also high as farmers have to grow green fodder, use expensive cattle feed to increase the milk yield.. In traditional dairy farming milk yield and revenue are low, but the input costs are also low, with animals grazing in the wild and farmers depending on natural grasses and crop residues as fodder for animals, using small amounts of cattle feed. Family members perform the domestic labour for animal

rearing. This could be due to the unique situation with respect to land and biomass availability. While the arable land availability is low, biomass is available round the year. The opportunity cost and the direct cost of using these inputs for dairy farming are negligible (Kumar and Singh 2008). The low land availability also creates surplus family labour that can be gainfully employed for animal rearing; for this the market value of labour should not be considered.

A sizeable portion of total produce was retained by the dairy farmers 37% in Bihar, 27% in West Bengal, and 21% in Uttar Pradesh and Delhi (northern region in the study). Higher the amount of milk production per capita, lower the proportion of milk used domestically as found in states such as Gujarat and Punjab. This means that for traditional dairy farming by smallholders, it is all the more important to get the real economic value of the milk consumed by the household, and the actual economic cost of all inputs, including labour.

Precision dairy farming

Precision dairy farming means " the use of information technologies for assessment of fine scale animal and physical resource variability aimed at improved management strategies for optimizing economic, social, and environmental farm performance" (Eastwood *et al.,* 2004) with objectives of Maximizing individual animal potential, Detecting diseases earlier and minimizing the use of medication through preventive health measures (Schulze *et al.,* 2007). A precision dairy farming technology allows dairy producers to make more timely and informed decisions, resulting in better productivity and profitability.

The list of precision dairy farming technologies used for animal status monitoring and management continues to grow. Because of rapid development of new technologies and supporting applications, precision dairy farming technologies are increasingly more feasible. Many precision dairy farming technologies already being utilized by dairy producers are: Electronic (radio frequency) identification systems and associated management software, Automatic body condition scoring, Automatic recording devices (rumen temperature, pressure, pH) by electronic rumen bolus, Robotic milking systems - daily milk yield recording, milk component monitoring (such as fat, protein), daily body weight gain measurement, Robotic calf feeding systems, Pedometers for heat detection, for health monitoring i.e. measuring lying time and standing bouts, milk analyzer, parturition sensors, milk conductivity indicators. Benefits of precision dairy farming technologies include increased efficiency, through large-scale mechanization and economics of scale, reduced costs, improved quality and food safety through better animal identification and traceability, minimized environmental impacts, improved animal health and well-being through improved health monitoring and individual care. It gives more timely and informed decision.

Future strategies

More food is required to meet the growing needs of the world. The high investment intensity will need to go into dairy farming and it will be necessary to increase the productivity of the animals as well as increase the farm size to make it viable for the farmer and also change the state of mind to make dairying as a profession of subsistence.

Increase milk production

Bestowed with the highest bovine population in the world, India exhibits tremendous

potential to further strengthen its position in the world dairy market. Livestock in general and dairying in particular plays a vital role in the in the national economy and also in the socio-economic development of millions of rural households. Livestock can significantly contribute to pathways out of poverty, since demand for livestock products will increase substantially in the years to come. According to one projection, the demand for milk production in India will be more than double until 2020 (Delago et al, 1999).

Employment generation at rural level

Dairy sector is the major source of income for an estimated 27.6 million people (Naidu and Kondaiah, 2004). Among these, 65 to 70% are small, marginal and land-less farmers. Thus, the dairy sector is regarded by many as one of the most pro-poor sectors with any positive development translating into increased income and employment to millions across the country.

Public private partnerships

With the advent of better technology and penetration of organized retail into the Indian markets, the dairy industry in India has been able to bring in the ethnic as well as exotic product offerings to the markets. Transforming public private partnerships (PPPs) in the Indian dairy sector may serve as a major step towards the growth and prosperity of people to grass root levels and economy of India on the whole.

Promoting export of A2 Milk

The DAHD has been advised the dairy industry to market A2 milk separately, because all indigenous breeds of cows and buffaloes produce milk that contains A2 protein while exotic breeds of cattle and buffalo produce milk with A1 casein. With the help of enzymes A1 casein can be cleaved to release an amino acid called BCM-7. BCM-7 (Beta Casomorphin-7) may trigger a host of diseases: diabetes, heart disease, autism, multiple sclerosis, inflammatory bowel disease etc. Therefore, it is considered that for the benefit of consumers and the farmers rearing indigenous cattle, the organized sector should take initiative to market A2 milk. international market A2 milk fatches good prices so ultimately our farmers are benefited

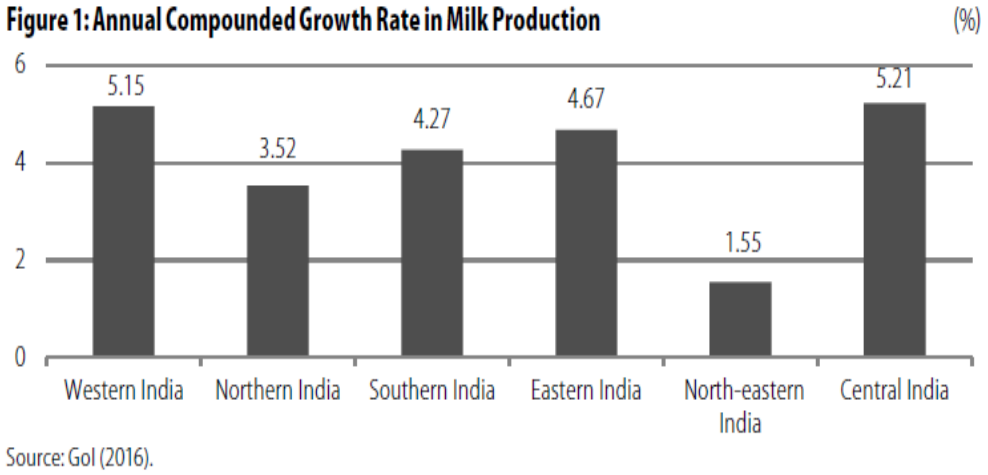
Breeding Management and introduction of genomic selection for Increasing Productivity

India has a very large population of cattle and buffaloes with average milk yield per annum per milch cattle being 917 kg. There is need to reduce the population size and improve productivity. Nearly 80 percent of breedable female stock is not bred properly. There is shortage of facilities to produce good quality semen and artificial insemination for breeding indigenous animals and crossbreeding. It is estimated that for the breedable population of cattle and buffaloes, India needs 66,000 proven bulls (Khanna, 2016).

Breeding of dairy cattle has travelled a long way from initial days of daughter-dam comparisons to recent advances in genomic selection. A brief historical perspective of employing molecular information for selection of dairy animals beginning from genetic markers to marker assisted selection to whole genome selection procedures. The need for introduction of whole genomic selection procedures and a proposed road map for their introduction to achieve higher genetic progress in the indigenous cattle and buffalo populations in the country

With the development of scientific knowledge, it will be possible to modify the

existing breeding programmes and achieve higher genetic gains. The successful implementation of genomic selection will increase the genetic gain maximum by 50% through reducing generation interval both on sire to sire and sire to dam paths, increasing accuracy of breeding value of sires and dams and increasing selection intensity by increasing candidates to be selected



Nutrition management for increasing productivity

In India, the livestock feed resources are inadequate in quality and quantity. The land under permanent pastures and grasslands is about 3.6 percent of the geographical area and the fodder cultivation is limited to 4.86 percent of the cultivable land. Production of quality seeds for fodder varieties is a prime need. The role of the feed industry is vital to maintain feed supply to intensive dairy farms. Against an annual requirement of over 120 MMT of feed, facilities exist for about 8 MMT (Khanna, 2016). Opportunities exist for installation of plants to manufacture cattle feeds, mineral mixture, total mixed rations, bypass protein and bypass fat feeds.

Sexed Semen Technology

India is unique in its appreciation of the cow culturally with less than 40% of India's cows productive. Cow is considered sacred and slaughter is illegal. This coupled with high milk demand renders the male calf not productive and thus non-required and are often castrated early in life and mostly left unattended. Progressive farmers are widely using ABS sexed semen, ensuring over 90% female progenies, resulting in more heifers and less male calves which does not have much value in the market

Adaptation of such advance technology like genomic selection, use of sexed semen with improved AI practices at ground level which ultimately help to set new benchmark in overall indian milk productivity as well as increase individual animal productivity and in future indian dairy industry will reach new horizon

A number of suggestions to the future development of India's dairy industry also have been proposed by Karmakar & Banerjee (2006)

Production Cost Reduction: In order to increase the competitiveness of Indian dairy industry, efforts should be made to reduce cost of production. This can be achieved

through increasing productivity of animals, improve animal health care and breeding facilities and management of dairy animals. The Government and dairy industry will need to play a vital role in this direction.

Strategy and Infrastructure Development: Indian dairy industry should further develop proper dairy production, processing and marketing infrastructure, which is capable of meeting international quality requirements. A comprehensive strategy for producing quality and safe dairy products should also be formulated with suitable legal backup.

Focus on Specialty Products: Dairy industry in India is unique with regard to the availability of buffalo milk. In this case, India can focus on buffalo milk based specialty products, such as Mozzarella cheese, in order to meet the needs of the target consumers.

In conclusion india's dairy sector is unique. There is consistent increase in milk production, consistent expansion of the consumer market. Organized sector processes a marginal 20 percent of milk produced and has wide options. India mostly remained traditional in their approach to dairy farming activities, which is mainly due to their social, economical and ecological compulsions. Livestock plays a central role in the natural resource based livelihood for the vast majority of the population, which is mostly confined to rural areas. The fourfold increase in milk production between 1963 and 2003, with more than half of the milk being produced by buffaloes, was largely due to integrated interventions involving the synergistic action from the government, researchers, non-governmental organizations and farmers. A review of dairy development in the country presents encouraging trends in terms of milk production, per capita availability of milk, sources of milk production and also accessibility of milk. However, in order to meet the challenges ahead, it calls for an integration of interventions at the level of farmers associating nutrition, health, reproduction and management. It needs to upgrade farm size, reduce livestock population, and use technologies in genomics, semen sexing, artificial insemination, reproduction and cloning, nutrition, feeds, fodders and above all animal management. This would not only bring more economic benefits to small holder farmers and improve dairy production, but also would pave way for better integration of the traditional and industrialized systems of dairy farming.

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