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## A Study on the Emerging Trends of Indian Dairy Industries

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### **Abstract**

The livestock animals industry contributes right around 4 percent to India's GDP, with the dairy sector making up the larger part. It is in this manner amazing that this sector ought to be to a great extent unorganized. As a growing economy, India has seen fast development as of late and the dairy industry, specifically, is one which should be brought into center. With the Union Budget 2018-19 giving an uncommon spotlight on the rural sector, we can dare to dream that there will be greater development as far as supply chain management and presentation of innovation. The sector for what it's worth at present faces a few difficulties, for example, inaccessibility of nutritious feed, poor storerooms and absence of innovative help, to give some examples. Despite the fact that India is the biggest maker of milk on the planet, the industry itself is to a great extent unorganized, with just 18-20 percent of the absolute milk delivered being channelized in an organized way. The initial step to countering this is move the concentration to littler dairy farms, which now and then need veterinary offices and fundamental nutritious feed. With an expansion in the spending intensity of the populace, the interest for milk and other worth included dairy products is just set to increment in the coming years. So as to fulfil the rising need, there should be a checked move from the unorganized to the organized sector. Additionally, consumers these days hold more noteworthy purchasing power as well as wellbeing cognizant with respect to what they consume. There is hence a need to give sound dairy products which can be promptly consumed. This makes an open door for boutique dairy farms to set up nearby tasks giving crisp cow, bison or goats milk to consumers. Far beyond with individuals having less time nowadays, the interest for premium worth included products, for example, pro-biotic yogurt, cheddar, wellbeing shakes and so forth are on the ascent. These products have a higher edge as well as have a higher timeframe of realistic usability which makes the supply chain simpler and savvy. Hence, the present study has been focused on the emerging trends in Indian Dairy industries and the study based on secondary sources of data.

**Keywords:** Technological Support, Buying Power, Value-Added Products, Rising Demand and Organized and Unorganized Sector.

### **Introduction**

Over the range of three decades, India has changed from a nation of intense milk deficiency to the world's driving milk maker, with production surpassing 100 million tons in 2006. This wonderful achievement is ascribed to a Government activity known as Operation Flood (1970–1996) and its extraordinary spotlight on dairy development exercises. In that

activity, rural milk shed zones were connected to urban markets through the development of a system of town cooperatives for getting and marketing milk. Also, milk production and productivity were improved by guaranteeing the accessibility of veterinary administrations, Artificial Insemination (AI), feed and farmer training. The venture satisfied, advancing production additions of 4–5 percent for every annum. In any case, that growth has drooped to fewer than 3 percent as of late, raising reason for concern. The log jam is ascribed to the decrease in interest in the dairy sector since the finish of the Operation Flood activity. Focal and state government distribution for dairy development has reduced in the previous two five-year plans.

India has demonstrated huge change from being a milk-shortage country with just 17 billion liter of milk production during the 1950s, to the biggest milk-creating nation on the planet with about 160 billion liters in 2016-17. Representing over 25% of the all out worldwide milk production, the dairy industry in India not just assumes a crucial job in the national economy, yet in addition in the socioeconomic development of a large number of rural family units. The expanding request from the thriving white collar class has to a great extent added to the expanded production in the nation. A portion of the components that have been proactive in keeping up this incorporate passageway of various private players and different government activities towards the development of the industry like new age cooperatives. With the nation's populace growing at a disturbing rate and the larger part being vegan, India has additionally turned into the world's biggest consumer of milk. In 2016-17, the absolute milk consumption in India arrived at a volume of 154 million metric ton.

As per IMARC Group, the milk consumption in India is anticipated to outperform the production in the coming a long time by virtue of various factors, for example, firming economic growth, expanding populace, growing per capita consumption of milk, and rising urbanization and advancement of the dairy industry. The milk consumption in India is relied upon to increment at 6% year on year, stretching around 234 million metric ton before the finish of 2025. In spite of its immense livestock animals and having managed to accomplish various UNO position in milk production over the world, the Indian dairy industry falls a long ways behind its worldwide partners as far as milk productivity per cattle, mechanical progression, market organisation and thriving of dairy farmers. This can be credited to a few elements which influence the milk productivity of cows as well as confine the general growth and development of the Indian dairy industry.

### **Research Objectives**

The present study aimed with following objectives:

1. To know about the emerging situation of Indian Dairy Industries and rising demand in International Market.
2. To study trends in Indian Dairy Industry.
3. To narrate innovations and advancements in the Indian Dairy Industry.
4. To study about bloom of Indian Dairy Industry and its market restraints and challenges.

### Operational Definitions

Dairy farming is a class of horticultural, or an animal cultivation, attempt, for long haul production of milk, typically from dairy cows yet in addition from goats, sheep and camels, which might be either handled nearby or shipped to a dairy industrial facility for preparing and inevitable retail deal. Most dairy farms sell the male calves conceived by their cows, more often than not for veal production, or reproducing relying upon nature of the bull calf, as opposed to raising non-milk-delivering stock. Numerous dairy farms likewise grow their own feed, normally including corn, and feed. This is sustained legitimately to the bovines, or is put away as silage for use throughout the winter season.

Dairy farming is the reproducing and upkeep of animals for their milk production. In western culture this is normally the cow, yet it tends to be goats and different animals. The dairy industry forms the milk to create products like drinking milk, cheddar, yogurt and margarine.

### Reviews of Related Literature

**Lipismita Samal, A. K. Pattanaik<sup>1</sup> (2013-14)** has done an examination on, "Dairy Production in India - Existing Scenario and Future Prospects", it found that the dairy production in India, which has seen extraordinary increment over the post-autonomy period, has grown into a flourishing undertaking; on account of the strategy choices identified with deliberate reproducing, improved sustaining and better medicinal services management over the period. These positives in any case, the framework is standing up to a portion of the significant requirements that upset comprehensive development of the dairy sector in the nation. Aside from low productivity of the animals, there are numerous different issues like, huge human and livestock populace and its weight ashore, corrupted field lands, deficiency of feed fixings and foods, which should be focused on. While the farming sector is seeing a sort of stagnation or a decrease in growth rate in zones where the green unrest prior brought another day break for human endurance against yearning and lack of healthy sustenance, the dairy sector is indicating a superior guarantee.

**Ravi Jadawala and Dr. Satish Patel<sup>2</sup> (2017)**, has done an investigation on "Difficulties of Indian Dairy Industry-In the parts of Cattle Farms". The investigation abridges India is without a doubt the biggest milk creating nation of world. India has most noteworthy populace of dairy animals and bison. Since Indian autonomy dairy industry is indicating unfaltering and vigorous growth pace of 3 percent. Sector has seen enormous improvement in supply chain and milk preparing offices. Regardless of strong growth, cattle farms has not embraced modernization and cattle farms are confronting numerous difficulties. In this article they have talked about various

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<sup>2</sup> Ravi Jadawala (M.Phil. Scholar) Dr. Satish Patel, Asst Professor, Dept. of Rural Management, Faculty of Management and Technology at Gujarat Vidhyapith, Indian Journal of Applied Research 7(10), October 2017.

difficulties of Indian dairy industry and we have attempted to break down difficulties through structures like SWOT investigation and Potter Five power model. Indian is one of the most elevated milk creating nations then additionally per capita milk production in Indian is a lot of low contrast with other milk delivering area. India can't fulfil its local milk need. The normal milk production per cow and wild ox every year in India is excessively low. The expense of milk in India is excessively high. Indian cattle farm is taking a shot at low proficiency. Because of absence of information, absence of legitimate medicinal history the mortality of cattle is excessively high. Cattle farmer likewise face issue in keeping up immunization and wellbeing history of his animals. Other significant difficulties of dairy industry are wasteful supply chain and customary method for raising cattle. For the restoration of industry now it become important to embrace modernization in cattle farms, Increase the utilization of innovation and moving towards organized method for cattle raising.

### **Emerging Situation of Indian Dairy Industry**

The dairy sector in India developed at a pace of 6.4 percent every year over the most recent four years against the worldwide growth rate 1.7 percent and the point is to improve milk productivity per animal further, Minister of Fisheries, Animal Husbandry and Dairying Giriraj Singh said on Thursday. Regardless of being positioned number one in milk production, the per animal productivity is 1,806 kg a year, though the world normal is 2,310 kg. Innovations received under Rashtriya Gokul Mission, for example, incipient organism move innovation, formation of office for sex arranged semen production and genomics determination would improve the productivity, he said while initiating a workshop quality milk production here. He said around 80 million rural Indian family units are occupied with milk production with extremely high extent being landless, little and peripheral farmers.

The Indian dairy market is among the biggest and quickest growing markets on the planet. India is additionally perceived to be the least cost milk maker on the planet. One of the significant explanations for this would be, not normal for enormous scale dairy farms in Europe, milk production and selling are vital to the occupation of more than 600 million individuals in rural India with a group size of 1-3 milch animals. The dairy sector has moved toward becoming among the most noteworthy gross worth sectors in agribusiness with more significant expenses and correspondingly higher estimation of milk production. With the globalization of the dairy industry, there has been a change in outlook of universal dairy markets from being supply headed to request driven. This deficiency has expanded the interest for fares of Indian dairy products. As per an ongoing report, India's dairy fares have accomplished the subsequent best show ever in this budgetary year, following 4 years of delayed down. India's absolute fares of dairy products were worth \$ 404 million between April 2018 and February 2019, up 56 percent from \$260 million in the equivalent time frame a year ago. This is because of the deficiency driven worldwide cost increment in skimmed milk powder (SMP) and other milk products. Here the reasons why Indian dairy fares are thriving and have a gainful future.

### **Rising Demand in International Market**

Interest for dairy products in the International market is probably going to grow essentially in the coming years, driven by more consumers, higher earnings and more prominent enthusiasm for nourishment. The interest for quality dairy products is rising and production is likewise ascending in numerous developing nations. Consumption of handled and bundled dairy products is expanding in urban regions. In light of the expanding rivalry from the private sector, a few national and worldwide brands have entered the market and extended consumers' desire for quality.

### **Price Trends in the Dairy Industry**

The costs of worldwide dairy products expanded to its pinnacle and are relied upon to ascend in ostensible terms. Universal costs of margarine, entire milk powder and cheddar rose, supported by expanded import request fully expecting a fixing in trade availabilities on an occasional decrease in milk production. World market costs are required to be 10% higher for SMP and 30% higher for spread during the present decade finishing 2022.

### **Changing Lifestyle Pattern**

There has been a growing wave of Keto Diet everywhere throughout the world. With its quick and compelling outcomes for weight reduction, the Ketogenic diet has turned into the most looked for after diet plan. The ketogenic diet incorporates heaps of fats, similar to cheddar. This has expanded the interest for dairy products and is probably going to carry chances to the dairy industry. The apparent advantages among the consumers of different microorganisms strains have made Pro-biotic sector among the quickest growing dairy business. In spite of the fact that the wellbeing cases of useful dairy products are being returned to in a few nations, it gives huge marketing chances to high esteem included dairy products.

### **Recent Trends in Indian Dairy Industry**

India has been the main maker and consumer of dairy products worldwide since 1998 with a continued growth in the accessibility of milk and milk products. Dairy exercises structure a basic piece of the rural Indian economy, filling in as a significant wellspring of work and pay. India likewise has the biggest cow-like populace on the planet. Be that as it may, the milk production per animal is essentially low when contrasted with the other major dairy makers. Besides, almost the majority of the dairy produce in India is consumed locally, with most of it being sold as liquid milk. By virtue of this, the Indian dairy industry holds enormous potential for esteem expansion and generally development. As indicated by the most recent report by IMARC Group, titled "Dairy Industry in India 2019 Edition: Market Size, Growth, Prices, Segments, Cooperatives, Private Dairies, Procurement and Distribution", the dairy market in India arrived at an estimation of INR 9,168 Billion of every 2018. Alongside offering beneficial business openings, the dairy industry in India fills in as an instrument of socio-economic development. Keeping this in see, the Government of India has presented different schemes and activities went for the development of the dairy sector in the nation. For example, the "National Dairy Program

(Phase-I)" intends to improve cattle productivity and increment the production of milk extending and fortifying and growing the rural milk obtainment foundation and give more prominent market access to the farmers. Then again, the private investment in the Indian dairy sector has likewise expanded in the course of recent years. Both national and global players are entering the dairy industry, pulled in by the size and capability of the Indian market. The center is being given to esteem included products, for example, cheddar, yogurt, pro-biotic drinks, and so forth. They are likewise presenting imaginative products remembering the particular prerequisites of the Indian consumers. These players are likewise improving their milk acquirement organize which is further encouraging the development of the dairy industry in India. Looking forward, the market is relied upon to arrive at an estimation of INR 21,971 Billion by 2024, showing a CAGR of around 16% during 2019-2024.

### **Innovations and Advancements in the Indian Dairy Industry**

In spite of the fact that the dairy industry has encountered difficulties as of late, the hunger and interest for dairy products is on the ascent. With a growing white collar class who have increasingly discretionary cashflow, consumers searching out sound choices to fit in with a progressively dynamic way of life, and an emphasis on normal fixings, milk and dairy products are growing in fame. As the biggest maker of milk on the planet, India is a key player in the dairy industry and the open door for growth is critical. Be that as it may, the industry in India faces difficulties of disorganisation with just 18 to 20% of the all out milk created adhering to the suitable organised procedures. As one of the quickest growing refreshment fragments in the Indian market, dairy is anticipated to turn into a billion-dollar market by 2021 with the three key classifications of enhanced milk, chaas and lassi, and utilitarian yogurt beverages driving the way. In spite of the fact that the dairy industry faces organisational issues, the association spending plan 2018-19 gave a unique spotlight on the rural sector so as to add to the development of supply chain management and the presentation of innovation.

As of late there have been huge innovative progressions in the Indian dairy industry, including an AI stage developed by fire up MooFarm which will help handle mastitis, an ailment of the cow udder which prompts a yearly loss of a large portion of a billion dollars in India. Upheld by an award from Microsoft, MooFarm are attempting to give available to come back to work backing to farmers and plan to have staff situated in rural regions. Close by innovative developments to improve farming techniques and the organisational supply chain, huge information is another field which Indian organizations are going to. So as to precisely anticipate consumer conduct and purchasing behaviours, enormous information is key as organizations, for example, Doodhwala have found. Seeing a theme in millennial consumers organizing accommodation, Doodhwala made a membership based milk conveyance stage and now convey in excess of 30,000 litters of milk consistently before 7am in Bengaluru, Pune, and Hyderabad.

Associating with the changing needs and needs of consumers is significant for the dairy industry to keep over trends. The flavour profile and inclinations of Indian consumers is very differed, in any case, milk is a staple for the populace from babies to senior residents. The medical

advantages of milk are generally perceived including its commitment to stomach related health and the upsides of dairy proteins. With consumers reevaluating their dietary decisions, there has been a decrease in the consumption of starches and sugar, prompting an expansion in protein-based eating regimens. Dairy has turned into an appealing wellspring of common proteins, and all things considered numerous dairy products are being situated as useful nourishments and drinks.

As a key player in the worldwide dairy market, India is situated to be industry pioneers. Albeit operational difficulties still record for major loses, interest in innovation and thoughtfulness regarding changing consumer needs have just added to significant enhancements. With solid fare assessments gauge, the dairy industry in India stays one of the nation's most worthwhile markets.

### **Bloom of Indian Dairy Industry**

Dairy industry is a significant wellspring of unorganized economy similarly as with expanding mindfulness towards the sound way of life, moment accessibility and growing demand for dairy products from Indian consumers, dynamic venture conduct by significant players, combined with market changing strategies from the administration recommends a positive route ahead for fate of the dairy market in India. There are a few growth drivers in the dairy market in India. Some of them are recorded and clarified beneath.

### **Potentiality to Consume**

India as a developing country has an acknowledgment of milk and milk products in India as a piece of day by day consumption and for strict purposes too. As a developing country and there is high possibility and effective potential to ascend in salary source, urbanization and dispersion levels and is at risk to expanded probability of consumption.

### **Demand among Teenagers**

There is a growing demand for the seasoned milk section as moment drinking refreshments among the high school populace of age bunch between 10-19 years. Likewise, the gatekeepers are captivated towards moment drink due to its nutritious worth and comforts and simple versatility are the explanation behind its prominence for the most part among Indian.

### **Health Benefits and Nutritious Value**

Concerning medical advantages, dairy products are accepted to forestall the development of deadly malady and even mend them. Likewise, examines have appeared to help in lessening the danger of heart sicknesses. Research discoveries have recommended that calcium present in milk may help in the decrease of awful cholesterol in blood and addition of good cholesterol. Likewise, it is referred to have benefits as the defensive factor in ones with the higher hazard for colorectal and bosom malignancy. An ongoing report done on 45,000 men announced that men who drank 1.5 glasses of milk/day had 35% less possibility of gaining the infection than ones who had the low admission of milk for example under 2 glass for every week.

**Strong Helping Hands**

The legislative help has supported the dairy market to reinforce enabling farmers to show signs of improvement pay and systematize the extemporized method for gathering, handling and appropriation dairy products. Likewise, the association of the private sector and their exertion is surely to help and advance consumption of milk and milk products.

**Retail Trend Increment**

A striking increment in retail trend is another growth driver. The manners by which speedy assistance eateries are getting progressively prevalent and how innovative headways have affected the cutting edge retail tradee could be genuine models. Likewise, the appearance of nourishment multinationals has similarly added to the rising retail trend.

**Indian Dairy Industry – Market Restraints and Challenges**

Albeit perceived as the biggest milk maker, India's job in worldwide market situations is pretty much nothing. Dominant parts of created dairy products are consumed by its own kin. What's more, most of the dairy industry in India is still exceptionally unorganized commanded by little and minimal dairy farmers. A portion of the difficulties looked by dairy market include:

**Inadequate Supply of Feed and Fodder**

India's dairy industry is inclined to be influenced by market vacillation and shakiness. For example increment in the cost of maize that fills in as feed for animals may impede the dairy sector. Along these lines, the deficiency of the supply of feeds and grain influence the risk to the dairy industry.

**Shortage of Cold Storage Units**

In like manner, dairy products are transitory so mindful ought to be guarantee to keep up cold-chain foundation and required further coordination to upgrade obtainment and dispersion. Since the local farmers will most likely be unable to purchase cold-chain innovations that limit the dissemination. Therefore, poor supply chain and conveyance office additionally weaken the dairy market.

**Rise in Packaging Cost**

Bundling machines are on demand with the production of products and the hardware utilized for bundling are provided from nations like Germany, Italy and so on that sets up the weight to cost. So also, the import (traditions) obligation for bundling is likewise high.

**Maintaining Biodiversity**

To alleviate the rising difficulties from environmental change, keeping up biodiversity is viewed as danger as challenge as a portion of the indigenous breeds have developed protection from sickness and in this manner there is a demand to develop the hereditary capability of indigenous dairy breeds and contend safe example with outlandish breeds or their crosses.



## Conclusion

India happens to be the key player in the economic development of the nation with foreseen significant growth and the ubiquity over and its products in the nation that has aided the production, consumption of dairies in India. This additionally bolsters the horticultural production as livestock animals structure the significant wellspring of dairy industry and fill in as a device for socio-economic development. With this, Government of India has advanced different schemes and activities to advance the dairy sector in the nation. For instance, the "National Dairy Program (Phase-I)" will concentrate on developing steers productivity and upgrading the milk production in order to fortify and grow the rural milk production and bolster the nearby farmers of the nation.

This would go about as an aid to a few farmers and spur to work more earnestly and productivity. Other than legislative help, private interest would likewise be one to search for. A few national and universal players' entrance into dairy market would without a doubt help in flood for market potential in India.

## References

- Cozma, B. Martin, M. Guiader, P. Pradel, E. Tixier, and A. Ferlay, "Influence of calf presence during milking on yield, composition, fatty acid profile and lipolytic system of milk in Prim'Holstein and Salers cow breeds," *Dairy Science and Technology*, vol. 93, pp. 99-113, 2013.
- Hurtaud, M. Dutreuil, M. Coppa, C. Agabriel, and B. Martin, "Characterization of milk from feeding systems based on herbage or corn silage with or without flaxseed and authentication through fatty acid profile," *Dairy Science and Technology*, vol. 94, pp. 103-123, 2014.
- Wang, Z. Liu, D. Wang, J. Liu, H. Liu, and Z. Wu, "Effect of dietary phosphorus content on milk production and phosphorus excretion in dairy cows," *Journal of Animal Science and Biotechnology*, vol. 5, pp. 2-28, 2014.
- A. Tyapugin, S. E. Tyapugin, G. A. Simonov, V. K. Uglin, V. E. Nikiforov, and I. S. Serebrova, "Comparative evaluation of technological factors affecting milk production and quality with various milking technologies," *Russian Agricultural Sciences*, vol. 41, no. 4, pp. 266-270, 2015.
- M. Missanjo, V. E. Imbayarwo-Chikosi, and T. E. Halimani, "Environmental factors affecting milk, fat and protein yields in Jersey cattle in Zimbabwe," *Tropical Animal Health and Production*, vol. 43, pp. 665-667, 2011.
- G. Cherepanov and Z. N. Makar, "Physiological factors limiting milk production during hormonal stimulation of galactopoiesis in productive ruminants," *Russian Agricultural Sciences*, vol. 36, no. 6, pp. 463-465, 2010.
- Roda, S. Fialà, M. Vittorini, and F. Secundo, "Fatty acid composition and fat content in milk from cows grazing in the Alpine region," *European Food Research and Technology*, vol. 241, pp. 413-418, 2015.

- Grimley, A. Grandison, and M. Lewis, "Changes in milk composition and processing properties during the spring flush period," *Dairy Science and Technology*, vol. 89, pp. 405–416, 2009.
- Gaucher, T. Boubellouta, E. Beaucher, M. Piot, F. Gaucheron, and E. Dufour, "Investigation of the effects of season, milking region, sterilisation process and storage conditions on milk and UHT milk physico-chemical characteristics: A multidimensional statistical approach," *Dairy Science and Technology*, vol. 88, pp. 291–312, 2008.
- IFCN Long-term Dairy Outlook, The IFCN Vision of the Dairy World in 2025, IFCN - The Dairy Research Network, Germany, September 2016.
- A. Rhone, S. Koonawootrittriron, and M. A. Elzo, "Record keeping, genetic selection, educational experience and farm management effects on average milk yield per cow, milk fat percentage, bacterial score and bulk tank somatic cell count of dairy farms in the Central region of Thailand," *Tropical Animal Health and Production*, vol. 40, pp. 627-636, 2008.
- K. K. Msechu, M. Mgheni, and O. Syrstad, "Influence of various climatic factor son milk production in cattle in Tanzania," *Tropical Animal Health and Production*, vol. 27, pp. 121-126, 1995.
- Falchero, G. Lombardi, A. Gorlier, M. Lonati, M. Odoardi, and A. Cavallero, "Variation in fatty acid composition of milk and cheese from cows grazed on two alpine pastures," *Dairy Science and Technology*, vol. 90, pp. 657–672, 2010.
- Coppa, A. Gorlier, M. Lonati, B. Martin, E. M. Russo, and G. Lombardi, "The management of the transition from hayto pasture-based diets affects milk fatty acid kinetics," *Dairy Science and Technology*, vol. 92, pp. 279–295, 2012.
- T. Sraïri, M. E. Jaouhari, A. Saydi, M. Kuper, and P. Y. Le Gal, "Supporting small-scale dairy farmers in increasing milk production: evidence from Morocco," *Tropical Animal Health and Production*, vol. 43, pp. 41-49, 2011.
- Grimaud, M. Sserunjogi, M. Wesuta, N. Grillet, M. Kato, and B. Faye, "Effects of season and agro-ecological zone on the microbial quality of raw milk along the various levels of the value chain in Uganda," *Tropical Animal Health and Production*, vol. 41, pp. 883-890, 2009.
- Sembada, G. Duteurtre, B. P. Purwanto, and Suryahadi, "Improved milk production performance of smallholder farms in West Java (Indonesia)," *Tropical Animal Health and Production*, vol. 48, pp. 793-799, 2016.
- S. Vairamuthu, J. Sinniah, and K. Nagalingam, "Factors influencing production of hygienic raw milk by small scale dairy producers in selected areas of the Jaffna district, Sri Lanka," *Tropical Animal Health and Production*, vol. 42, pp. 357-362, 2010.
- The Export Potential of Romania. Milk and Dairy Products, Romanian Tradee and Invest (CRPCIS), Romania, 2012.
- Y. N. Msanga, M. J. Bryant, I. B. Rutam, F. N. Minja, and L. Zylstra, "Effect of environmental factors and of the proportion of Holstein blood on the milk yield and lactation length of crossbred dairy cattle on smallholder farms in north-east Tanzania," *Tropical Animal Health and Production*, vol. 32, pp. 23-31, 2000.