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Dairying in Bundelkhand region of Uttar Pradesh: Constraints to realizing the potential

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ABSTRACT

Dairying in Bundelkhand region continues to play a central role in providing livelihood security and coping mechanism to mitigate risks of the resource poor farmers. However, the development of this key sector has not progressed to the desired extent in comparison to other regions of Uttar Pradesh and also across other states. Thus, an attempt was made to study the present status and issues in dairying, analyze strengths, weaknesses, opportunities, threats (SWOT) and propose strategies for dairy sector development in Bundelkhand region of Uttar Pradesh using primary and secondary data in this study. The study identified various issues and constraints, viz. presence of low yielding non-descript cattle, low milk yield, less breedable population, dependency on grazing and crop residues utilization, lack of veterinary services, dominance of middle men in marketing, poor scientific knowledge etc. in the region. Further, it was found that this region of Uttar Pradesh is facing a tentative annual loss of ₹ 1,619 crores due to *Anna pratha*. There is also a need to calculate the losses like crop damage, indiscriminate animal breeding, high cost of production for unproductive animals, lack of milk availability leading to poor human nutrition, etc. Hence, there is a need to focus on short and long term strategies based on strengths, weaknesses, opportunities, threats (SWOT) of dairy sector in Bundelkhand region. A need based research and extension activities by different organizations in the region may be emphasized for the benefit of farming community.

Key words: *Anna pratha,* Bundelkhand**,** *Chhooth pratha*, Dairying, Strategies, SWOT Analysis

Bundelkhand region lies at the very heart of India, located below the Indo-Gangetic plain to the north with the undulating Vindhyan mountain range spread across the northwest to the south. The region spans across 13 districts: Jhansi, Jalaun, Lalitpur, Hamirpur, Mahoba, Banda and Chitrakoot in Uttar Pradesh and Datia, Tikamgarh, Chhatarpur, Damoh, Sagar and Panna in Madhya Pradesh. This region is drought prone which faces enormous problems of low rainfall, low agricultural and animal productivity, water crisis, soil erosion, degradation of water resources, fodder crisis, high rate of cattle mortality, non-sustainable sources of livelihoods, etc. It is predominantly an agrarian economy where 80% of the population is dependent on agriculture and livestock, generating 96% of the farmers' income, indicating the magnitude of dependency on these sectors in the region.

Agriculture in Bundelkhand is rainfed, diverse, complex and risky. The region has received about 850 mm rainfall during 2011–17 (IMD 2018). In the recent years, increasing vulnerability to the frequent and unseasonal extreme weather conditions, like droughts, short-term rain and flooding in fields has been observed, adding to uncertainties in cultivation and increasing poverty. The scarcity of water in this region with poor soil and low productivity further aggravates the problem of food security. Livestock in Bundelkhand region continues to play a central role in providing livelihood security and coping mechanism to mitigate risks of the resource poor farmers. However, the development of this key sector has not progressed to the desired extent in comparison to other regions of the country. Considerable potential exists for improving livestock production in the area. Among livestock components, dairy production and goat farming are important for the entire region. By and large even the landless and small farmers maintain at least one cow/ buffalo or few goats as an ensured source of income and asset.

This paper has focused on present status and issues in dairying, SWOT analysis and has proposed strategies for dairy sector development in Bundelkhand region of Uttar Pradesh using both primary and secondary data. The primary data included interaction and discussion with farmers, officers of State Department of Animal husbandry, Non-Government Organizations and BAIF officials. Further, observations and transact walk in the project villages have also supported this study. The group discussion and personal communication with veterinary officers and other experts was also conducted to evolve strategies for dairy sector development in Bundelkhand region. The secondary data from annual reports, websites and occasional publications

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of the SDAH, Government of India, Government of Uttar Pradesh and appraisal reports of Planning Commission and other agencies were used in this study.

Dairy Sector in Bundelkhand Region: Present Status and Issues

Dairy Animal Population

As per the livestock census of Bundelkhand region over the years (GoI Livestock Census Reports 2003, 2007 and 2012), composition of dairy animal population in the region has been quite revealing. Of the total bovine population in the region, more than half is cattle. By and large, non-descript indigenous cattle of very low productivity accounts for major cattle population followed by buffalo population in the region. The indigenous cattle compose about 15% of the cattle of Uttar Pradesh. Further, analysis of cattle population reveals that crossbred cattle accounts for a negligible population as against the national average of about 15%, indicative of low priority accorded to cross breeding programme in the region.

Bundelkhand's cattle population seems to be a liability rather than an asset from a macro perspective that looks at long-term effects of environmental degradation. Although, considerable effort is made by state government to improve cross-bred cattle numbers, but it appears that state has not been able to make very negligible dent in Bundelkhand region. Over the years, farmers in the region have begun to prefer buffalo rearing which is depicted through Fig. 1. Although buffalo population in Bundelkhand region is about

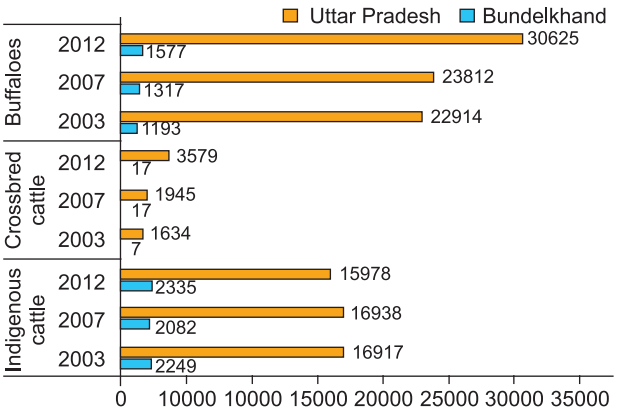

Fig.1. Bovine population in Bundelkhand region and Uttar Pradesh (in '000) (Graph by authors based on GoI Livestock Census Reports of 2003, 2007, 2012).

5% of Uttar Pradesh buffalo population, but it is interesting to note that buffalo population is increasing in the region over the period. It is interesting to note that semi-intensive buffalo rearing is followed in the region by the farmers while, intensive stall fed system of rearing buffaloes is very limited and mostly encountered in irrigated peri-urban areas in and around district headquarters like Jhansi.

Milk Production

Although, Uttar Pradesh is the leader in milk production in India, the milk yield per animal is low. Fig.2 depicts that bovine milk yield in Bundelkhand region is 2.933 kg/day while the milk yield in Uttar Pradesh is 4.015 kg/day. The milk yield varies about 2–3 kg/day, 3–4 kg/day and 5–6 kg/day for indigenous cattle, buffaloes and cross-bred cattle respectively in different districts of Bundelkhand region. Population of buffalo has been increasing steadily because of its adaptability to varied climates but requires genetic improvement in buffalo to provide a big push to the milk economy.

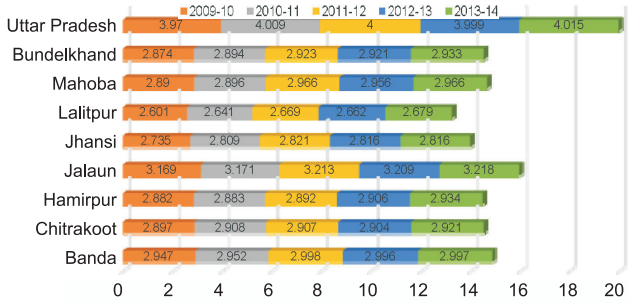

Fig. 2. District-wise bovine milk yield in Bundelkhand region of Uttar Pradesh (kg/day) (Graph by authors based on Reports of GoUP during 2009–10 to 2013–14).

Bundelkhand region with an average milk production of 21.66 lakh kg/ day contributes hardly 5% of the total milk production in Uttar Pradesh. As per reports of GoUP (2014–15), Bundelkhand region has bovine milk production of 1,257,000 MT, while the milk production of Uttar Pradesh is 23,910,000 MT. Among the Bundelkhand districts, Banda and Jaluan are leading in milk which might be due to their higher population of buffaloes and cross-bred cattle. Crossbreeding technology has been censured on grounds of being exotic and non-adaptable to varied climatic conditions. Cattle breeding research should therefore, explicitly focus on issues relating to ecological adaptability.

According to industry standards in dairying, unless two thirds of the herd is in milking, returns will always be negative. In Bundelkhand, only a third of the cattle and half of the buffaloes are in the reproductive stage. Further, analysis depicts that Bundelkhand possessed only 7% of in-milk bovine population in comparison to Uttar Pradesh. It was found that Bundelkhand region had low in-milk bovine population of 1,139,000 as compared to in-milk bovine population of 15,659,000 of Uttar Pradesh as per the reports of GoUP (2013–14). However, it was also found that indigenous cattle and buffaloes reached late puberty leading to late pregnancy and lactation.

Delayed First Calving and Reproduction related Practices

The age at first service of heifer cow is about 36 to 42 months, while in the case of buffalo heifer, the age at first service is 48 to 54 months. This is quite high considering the potential of animals which is obviously resulting in shortened productive life of animals. This can be attributed to the higher temperature prevailing in the region due to drought even in the monsoon months which is found to be

the breeding period. It is further aggravated due to feeding of low quality feed and fodder. The GoI census report (2012) indicates that Bundelkhand region had low breedable population of 1,185,000 indigenous cattle, 9,000 crossbred cattle and 922,000 buffaloes as compared to other regions of Uttar Pradesh. Further, the farmers also failed to identify heat in dairy animals but, few of the farmers could detect heat in animals by bellowing, restlessness, mounting on other animals and vaginal discharge. The farmers in the region preferred natural service with pedigree bull and preferred artificial insemination (AI) when bull was not available for natural service.

With regards to pregnancy diagnosis of dairy animals, experienced dairy farmers were consulted initially in village and veterinarian was least preferred to diagnose pregnancy due to their non-availability in the villages. Interestingly, few of them did not prefer to diagnose the pregnancy in their animals which indicates that farmers lack scientific knowledge about pregnancy diagnosis. In specific cases, when experienced dairy farmers were not able to diagnose the pregnancy, they would call the veterinarian. Few farmers also briefed that they shifted to natural service after they found poor conception rate with AI.

Breeds and Breeding Practices

The major breeds of dairy animals in this region are Murrah and Badawari breeds of buffalo and Hariana, Sahiwal and Gangateri breeds of cattle. Further, Jersey cross-bred animals dominate the region as compared to HF crossbred. The state has a specific livestock breeding policy which need a greater emphasis for implementation in the field conditions. Presently, less than 30% of the breedable cattle and buffalo are served by AI while the rest are left for indiscriminate breeding. The major players engaged in breeding services are the Animal Husbandry department (AHD), PCDF (State Dairy Federation), BAIF, IndiaGen and self-employed paravets. The Government of Uttar Pradesh has established artificial fertility centers and are functional in Bundelkhand region. As per the latest reports, Jaluan and Lalitpur had highest number of these centers in Bundelkhand region. However, this region had only about 5% of centers as compared to the total of 3,661 centers in Uttar Pradesh (NDDB 2017). However, only few farmers were aware about these centers and their activities for the benefit of farming community. This also indicates that state Department of animal husbandry has to play a major role in creating awareness about different activities performed and centers established for the benefit of farming community.

While the state has a huge demand for frozen semen, the government is able to supply less than 20% of the semen required from their Semen Freezing Laboratories established in three different locations. Their plan to intensify the AI through the Animal Husbandry Department is not practical as there are many players like BAIF and IndiaGen who are prepared to take up this programme on a self-sustainable basis with initial financial support. As on 2014–15, a total of 44,65,000 and 2,81,000 bovine AI were performed in Uttar Pradesh and Bundelkhand region respectively by Government agencies while, 120,000 bovine AI were performed by BAIF Centers (NDDB 2017) in Bundelkhand region of Uttar Pradesh. BAIF had a total of 174 centers for undertaking artificial insemination in Bundelkhand region (BAIF 2018). With regard to the paravets promoted by the State, although the initial support is very valuable, in the absence of regular input supply, these paravets are not able to take up AI as a sustainable activity. As a result, many of them indulge in illegal veterinary health care practices for earning their livelihood, thereby causing severe damage to dairy animals and farmers.

Due to poor planning for restricting the exotic blood level in cross breeding programme, infertility has become a major problem in the region. Further, nutritional deficiency and poor handling by semi-skilled paravets providing veterinary services have further accelerated this problem. Need based and demand driven efforts are required to popularize and conserve the indigenous breeds under field conditions in the region. There is a need for revisiting the livestock conservation policy in the state and reorganize accordingly to meet the field requirements.

Feeding Practices

Majority of the respondents preferred grazing during day time and rarely practiced stall feeding to their animals at home. The variation in frequency of feeding might be attributed to the availability of feed and fodder resources with the farmers also. Very limited farmers provided home-made concentrates for their animals while, very few of them purchased concentrates for pregnant and lactating dairy animals which might be due to their knowledge about its role in increasing milk production and maintenance of good health. However, feeding of common salt and mineral mixture was not followed in the region. Very few farmers provided extra concentrate to pregnant animals and lactating animals. The farmers did not follow any special ration for increasing fat content in milk and this might be due to high cost involved in the feeding (Singh 2014). Although manufacturing and distribution of compounded cattle feed is addressed by the state, but this activity still needs to be emphasized in Bundelkhand region.

Bundelkhand region is facing shortage of cultivated fodder for feeding the animals throughout the year due to lack of assured rainfall and fertile soils. The farmers provided green grasses available in the fields during monsoon season and leaves of trees. It should be noted that very negligible number of farmers cultivated fodder due to lack of land availability, irrigation facilities and inputs for fodder cultivation. However, since milk collection is not efficient in most of the districts of Bundelkhand, farmers are reluctant to devote their agricultural land for fodder production. On the similar lines, NDDB (2017) depicts that, of the gross sown area, less than 1% of land was allocated for fodder production in Bundelkhand region. Further, the analysis also revealed that Bundelkhand comprises of only

1.4% land for green fodder crops in comparison to Uttar Pradesh state. Further, forage seed production which is the key component for promoting enhanced production of green fodder also has not received the desired priority. Neither any well-established institutional mechanism nor a well-designed strategy for fodder seed production is in existence at present. Further, programmes for establishment of fodder banks and fodder block making units also need emphasis in Bundelkhand Region for ensuring feed and fodder availability in the region.

Crop residues contribute about 70% of the fodder, and straw (*Kadbi*) is an important factor in the choice of feeding. However, due to frequent deficiency of rainfall in the region, crop yields are lower in the region as a whole, consequently resulting in shortage of crop residues which is the staple feed in the region. It was also observed that stock of dry fodder (mainly paddy straw/sorghum straw/ pearl millet straw etc.) stored by the farmers could last up to middle or at best till the end of February month. Currently, whatever little dry fodder is available is being rationed for productive buffaloes/ cows and non-productive animals are the worst sufferers not receiving any attention. A study conducted by NIANP (2012) has depicted a shortage of dry matter availability in Bundelkhand region of Uttar Pradesh and the same scenario continues in the region.

Interaction with officials, villagers and observations on current availability of grazing resources in the region, show that there is shortage of feed and fodder in the region. Although it was claimed that Uttar Pradesh had set-up centers to distribute free fodder, very negligible number of farmers were aware about these centres in the region. With regards to drinking water related aspects, the region faced the problem of low water availability compounded with lower water table resulting in requirement of more power for water lifting. As a whole, although various initiatives are undertaken with regards to feed and fodder development in the region, there is still a need to make greater efforts in this direction.

Health Care Practices

The state has well-established network of veterinary clinics and hospitals in the field. These institutions are engaged in providing breeding and health care services, vaccination, disease investigation, promotion of fodder production and marketing of milk and other animal products. As a major stakeholder, the state government is making efforts in controlling various diseases of livestock on priority basis apart from creating awareness about prevention and control of livestock diseases. As per the reports, Bundelkhand region has 277 veterinary institutes as against 5,062 in Uttar Pradesh state (NDDB 2017). However, many of the veterinary officers are engaged in multiple tasks like treatment, AI, schemes monitoring and evaluation, supporting block and district administration etc. which is causing problems to the farmers and their animals. It is also found that due lack of scientific knowledge and poor socio-economic conditions of the farmers, the dairy animals remain unattended.

Majority of the farmers vaccinated their animals during vaccination programme against Foot and Mouth Disease (FMD), Hemorrhagic Septicemia (HS), Black Quarter etc. organized by State Animal Husbandry Department. As per the reports of GoUP, a total of 6,430,000 bovine vaccinations were performed by the department in Bundelkhand region, while the number was 85,101,000 for Uttar Pradesh during 2015–16. However, it was also interesting to note that farmers did not get their animals vaccinated on their own due to lack of knowledge about importance of vaccination. Very few farmers dewormed newly born calves since these farmers were aware about its importance. Further, it was noted that input dealers or pharmaceutical shop owners were the main source of information for deworming. When disease encountered in herd, self-medication with indigenous methods and input dealers (pharmaceutical stores) were major methods followed in the region whereas, few of them consulted progressive farmers or village quacks. However, very few of the farmers contacted the veterinarians for treatment of their animals. The cross-bred cattle and buffaloes received the priority by farmers for health care aspects as compared to the indigenous cattle in the region.

Management Practices

Free grazing or *anna pratha* (also called *chhooth pratha*), refers to the practice where animals are free to roam after the *rabi* crop is harvested. Usually, the farmers in Bundelkhand region abandon their cattle during the lean season and during the rainy season leading to poor emphasis for housing conditions for the cattle. However, cross-bred cattle and buffaloes have a provision of partially scientific animal shed. These animal sheds in the region have *kachcha* floor followed by semi-pucca floor and is mostly constructed using the locally available resources. However, the farmers with two to three animals tied their animals under the tree or other unutilized space. The cleaning of animal and animal shed was not a regular practice which led to poor hygiene and occurrence of various diseases.

With regards milking methods, majority of the farmers followed knuckling method of milking, followed by stripping method while very few farmers followed full hand milking method for milking the animals which might be due to lack of knowledge. The farmers in the region cleaned the milking utensils by water and ash and only few of them used detergents and further, only few of the farmers dried the milking utensils after washing. Further, at the time of calving, the farmers arranged the dry materials and crop residues as a bedding materials, and collected dung cake, crop residues, etc. for burning during winter season to keep warmness for both calves and mother. Further, the newly born calves are cleaned using cloth or jute bag/gunny bag and did not follow navel cord cutting, but preferred natural shedding of it. Similar findings were also reported by Singh (2014). This indicates that farmers lack knowledge about improved calf management practices.

Extension Services

The Animal Husbandry Department is presently playing a vital role in providing health care services based on the demand, as and when the farmers call them for the services. However, there is absolutely no mechanism for providing extension and training services to farmers, although short term training is organized by the department whenever they have some budget under centrally sponsored schemes. There are inadequate arrangements to assess the spread of extension messages, or to feedback findings from the field to planners or researchers. Just like majority of states in India, extension services are a weak link and very meager budget is allocated by animal husbandry departments towards various extension and training activities (Chander and Rathod 2013). However, in the villages and blocks where BAIF is operating its Cattle Development Programme, a series of programmes are organized to create awareness and provide technical guidance to the farmers. A coordinated effort between the Animal Husbandry Department, Dairy Federation and NGOs can provide effective extension services, only with a marginal increase in the existing budget.

Bundelkhand region of Uttar Pradesh has implemented various schemes and programmes in animal husbandry and dairying. However, the farmers and concerned agencies were unaware of these schemes and programmes which indicates the poor status of extension in the region. Further, it was also claimed that these programmes lacked planning and hence, could benefit negligible number of farmers in the region.

Marketing Practices

The dairy sector holds considerable promise for achieving higher growth rates over the years. However, to achieve this, certain key issues like strengthening of dairy cooperative network, increasing the share of marketable surplus milk in the organized sector, enhancing processing facilities and other related aspects need to be addressed with greater focus. Uttar Pradesh is the top milk producing state in the country and currently about 18% of India's total milk production comes from UP. Interestingly, per capita milk availability in Bundelkhand region is 386 g/day while, it is 327 g/day for Uttar Pradesh (NDDB 2017). As per the latest reports, though, UP produces 23.91 million tonnes of milk, only about 1 million tons of milk is processed through the organized cooperative dairy sector in the state which indicates that cooperatives have almost failed in providing efficient services in milk collection and competitive price for the produce (YES Bank 2016). Very few active dairy societies are involved in delivery of livestock services like supply of cattle feed, fodder seeds, etc. and the services are not satisfactory. As a result, they are not able to regain the confidence of the farmers and provide competitive services. There are also many private players in milk collection and marketing.

In case of Bundelkhand also, in the absence of efficient milk collection, a lot of unfair trade practices are adopted by the private players and the farmers are not able to realise better price. There is also lack of awareness among the consumers who are prepared to buy inferior quality milk from the private vendors. Very often, consumers prefer to buy cheaper milk even at the cost of the quality of the milk. This indicates a need for creating greater consumer awareness about the milk quality and pricing. The private sector and milk vendors or middle men have strong presence for milk marketing in the region. Majority of the private players have established milk processing plants in recent years and hence, dominate the markets accordingly.

Institutional Network

Bundelkhand region has various research and extension institutes and organizations emphasizing the development of farming community. Although these research and extension activities are looked after by the State Agriculture and Veterinary Universities, ICAR institutes, etc., proper coordination is lacking among these organizations and developmental agencies. An interaction between different multi-stakeholders in the form of feedback mechanism at the grassroots levels to establish policy dialogues and programmes for the future is very essential. Few of the premier institutions in the region are as follows:

- ICAR-Indian Grassland and Fodder Research Institute (IGFRI), Jhansi
- ICAR-Central Agroforestry Research Institute (CAFRI), Jhansi
- Uttar Pradesh Council of Agricultural Research, Lucknow
- Rani Lakshmi Bai Central Agricultural University, Jhansi
- Banda University of Agriculture and Technology, Banda

Further, activities of the livestock sector are also looked after by Department of Animal Husbandry, Dairy Development Department, Pradeshik Cooperative Dairy Federation (PCDF), organizations like Bharatiya Agro Industries Foundation (BAIF), input dealers or pharmaceutical companies, few organized private dairies are also involved in overall development of the sector. Since there is a poor linkage between these agencies, there is a need to strengthen and build a farmer friendly extension system for dairy production. Similar finding was also reported by Chander and Rathod (2015).

Anna Pratha

Bundelkhand region has traditionally been rainfed and suffers from shortage of water due to the vagaries of monsoon. In such conditions, the farmers generally leave their fields fallow during kharif and cultivate the main *rabi* crop using the residual moisture. Since the average landholding size is larger compared to other parts of UP, farmers therefore satisfy themselves even with one good crop. Fodder shortages in the region make the farmers to leave their cattle free to survive on whatever is available in the fields which is called as *Anna Pratha*. Free grazing or *anna pratha* (also called *chhooth pratha*), is an age-old

tradition in Bundelkhand where farmers let loose their cattle, especially unproductive and pregnant cows, to graze freely after the rabi crop is harvested. Usually, the farmers in Bundelkhand region abandon their cattle during the lean season and during the rainy season. Discussions with the villagers revealed that from April onwards, thousands of animals are left to graze free, till September or October, before the onset of the sowing for next season's *rabi* crop. Every year, this roaming cattle destroys almost 25 to 35% of the agriculture produce during the kharif crop. Most of the animals remain underfed and often move too far away from their homes and die. In addition, this practice adversely affects the breed improvement programmes, as local bulls are free to graze in the open fields and impregnate cows that are also left free. The artificial insemination programme suffers as a result in Bundelkhand region.

Pandey and Reddy (2012) have pointed out that land productivity of net sown area in Bundelkhand region is ₹ 14,500/ha. Further, as per Uttar Pradesh Government reports of 2015, the cropped area during the rabi (winter-spring) season was around 18.50 lakh hectares (lh). But, the fact that the corresponding area in kharif (summer-monsoon) has hovered just around 9 lakh hectares (lh) has meant that farmers are largely dependent on a single harvest (Prasad 2015). Such vast lands remaining uncropped is, of course, a national loss. Table 1 depicts a tentative loss of ₹ 1,619 crores per year for Bundelkhand region of Uttar Pradesh. Further, there is a need to analyze the losses for Uttar Pradesh and India on the similar lines.

Low planting during *kharif* is primarily attributed to *Anna Pratha*, a traditional system under which people leave their cattle unfettered to graze in others' fields, making farmers less inclined to sow their lands. However, very recently, Government of Uttar Pradesh has stepped in with a policy announcement to promote cultivation of til (sesame) in Bundelkhand region during *kharif*. The decision to promote sesame was taken consciously, considering that the cattle do not eat this crop. Sesame seed was procured in large quantities to be distributed among farmers and an aggressive campaign to boost acreages during this kharif season was launched, involving departmental officers, NGOs, district and divisional officers and all others concerned (Prasad 2015). The results have been extremely encouraging. As compared to previous *kharif* seasons, the area under sesame alone has gone up irrespective of *Anna Pratha*. The economics of sesame cultivation is equally revealing since it has good market availability with good prices (Prasad 2015). However, it should not become a crucial issue since the animals would lack the dry fodder or crop residue for feeding in the region.

The damage caused by these stray cattle on the rampage is yet to be tabulated and may be expected to be in crores of rupees. On the other hand, if dairy farmers are forced to rear unproductive animals, their cost of production of milk will also go up. The probable impact of increased stray cattle will result in the import of diseases, especially foot and mouth disease in wild animals, and vegetation composition change owing to selective grazing and finally affect the predator-prey relationship too.

Dairying and Drought

Unlike crops where the effect of drought is seen immediately by way of failure of crop, the impact in case of dairy animals is realized only after a lag period. Without adequate supply of quality feed and fodder, the primary effect is on the productive and reproductive performance of animals and if the situation prolongs for any considerable duration it would be extremely difficult to restore the reproductive efficiency of animals to normal. In view of this, even though livestock species are more resilient to droughts, it would be ill advised to show any sort of neglect in providing adequate nutrition to animals during drought situations. Drought causes heat stress in animals resulting in dehydration in animals, which generally results in reduction in milk yield and even death of animals. Further, few of the farmers in the region reduced the herd size by culling unproductive animals to save feed and fodder for productive animals. It is also found that large animals are being replaced with small ruminants to have economy in feeding.

Low rainfall causes poor pasture growth and may also lead to a decline in fodder supplies from crop residues. Insufficient levels of fodder around the village lead to weight loss and increased deaths among stock, especially where immigrant herds put further pressure on limited local pastures. Thus, sedentary herds can be greatly affected during the drought. In a similar study Upadhyay *et al.* (2007) stated that thermal stress on Indian livestock particularly cattle and buffalo decreases oestrus expression and conception rate. Further, Maurya (2010) also concluded that length of service period and dry period of all dairy animals was increased from normal during drought. Further, it should be noted that meteorological parameters like temperature, humidity and rainfall lead to variations in the

Table 1. Annual economic losses for Bundelkhand region of Uttar Pradesh

Cropped area in *Rabi* (year 2015)	Cropped area in *Kharif* (year 2016)	Area not utilized		Income loss*
18,50,000 hectares	9,00,000 hectares	left without sowing – 9,50,000 ha Total 11,17,000 ha	Other Fallow land– 1,67,000 ha	₹ 16,196,500,000/–

*Considering a productivity loss of ₹ 14,500/ha for Bundelkhand region (estimation by authors).

seasonality of diseases like Foot and Mouth Disease (FMD). As a whole, the rising temperature decreases the total productivity of dairy animals.

SWOT Analysis

The SWOT (strengths, weaknesses, opportunities, threats) analysis is a strategic planning tool widely used for ex-ante assessments of projects or any sector.

Strengths

- Constant and sustainable growth despite limited investment from public and private sector.
- Mega biodiversity and vast dairy animal population is vital asset for the region. Unlike many other natural resources which may deplete over the years, a sustainable production system will continue to propel the economy.
- Variable agro-climatic conditions and diverse dairy animal production systems with varying input and output levels.
- Dairy farming in the region thrives largely on crop residues and agricultural byproducts keeping the input costs low.
- Males are still used for drought agriculture indicating less mechanization in agriculture.
- Presence of strong indigenous cattle and buffalo base in the region.
- As the milk productivity of dairy animals is low, there is a vast scope for improvement of milk production and consequently increased marketable surplus of milk for processing.
- Milk consumption is regular part of the diet in the region and hence, demand would rise continuously.
- Vast pool of highly trained and qualified technical manpower is available in department and institutions at all levels to support R&D as well as field level activities.

Weakness

- Though cross breeding programmes have improved animal productivity, milk production system is still largely dominated by low yielding cattle and buffalo population.
- Wide gap between availability and requirement of progeny tested proven dairy sires
- Shortage of feed and fodder; continuous reduction in area under fodder production
- Poor transport facilities and erratic power supply remain a major challenge for procurement and supply of good quality raw milk. Furthermore, raw milk collection systems in the region remain fairly underdeveloped.
- Poor organized marketing system indicating that middle men and vendors have a major share in marketing.
- In case of organized marketing, the milk produced is required to be transported to nearby processing plant which incurs cold storage and transportation costs. Maintenance of cold chain is still a major handicap.
- Majority of producers are unaware about scientific dairy farming practices and value addition.
- Absence of comprehensive and reliable milk production data, impact assessment studies are almost non-existent, investments in dairy research is also not commensurate with returns and potential.
- Lack of coordination and cooperation among multiple stakeholders in the region with regards to implementation, monitoring and evaluation of R&D programmes.
- Major focus on curative health care as compared to preventive health care of dairy animals.

Opportunities

- Technology driven production enhancement by emphasizing on indigenous cattle and buffaloes in the region.
- Expanding market and initiation of organized marketing can create enormous job and self-employment opportunities.
- Economy is growing in the region, consequently, the investment opportunities are also increasing continually.
- Fodder development and identification of alternative feed sources suitable for Bundelkhand region apart from tapping of non-conventional fodder resources.
- Demand for dairy products is income elastic and hence, continued rise in human population will have varied consumption patterns in favour of demand for liquid milk and value added products.
- Untapped indigenous milk products market and also optimum utilization of value added products and byproducts of the dairy industry.
- Utilization of indigenous technical Knowledge (ITK).
- Protection of weaker section and promotion of youth and women participation in dairying.
- Introduction of ICT for diffusion and adoption of scientific practices.
- Greater scope for Public private partnership (PPP) in the region.

Threats

- Issue of *Anna pratha*- Excessive grazing pressure on marginal and small community lands has resulted in almost complete degradation of land and decreased crop production. Further, indiscriminate breeding could lead to disappearance of valuable indigenous breeds and increase in low yielding animals.
- Organized dairy sector handles very less share of the milk produced. Hence, cost effective technologies, mechanization, and quality control measures remain as key issues in unorganized sector.
- Lack of credit availability to farmers and exploitation by money lenders, middle men, traders etc.
- Non-implementation of stringent quality control measures in liquid milk marketing

- Competition and entry of multi-national companies suppressing the individual farmers.
- Research activities not much applicable to field conditions and uneven development priorities.

Strategies for dairy sector development in Bundelkhand region

The dairy sector has not progressed to the desired extent in comparison to other regions of the Uttar Pradesh and also across other states. Hence, following strategies may be planned for dairy sector development in the region.

i. Need for progressive reduction in population of unproductive indigenous non-descript cattle which is substantially higher in the region. This may be addressed through massive and focused castration programme to avoid indiscriminate natural breeding, incentivize farmers for rearing productive cattle and preserve established native breeds of cattle in the region as source of rare genes. Further, upgradation of local cattle and buffaloes using improved breeds of Tharparkar and Sahiwal cattle and Murrah breed of buffalo has considerable scope in the region. Also, crossbreeding with Jersey may also be undertaken depending on the needs and demands of the farmers. Hence, effectively implementing breeding policy in the state has to be prioritized.

ii. Efficient mechanism for effective breeding and health care service delivery is urgently needed. Utilizing the services of trained paravets on a large scale for effective AI and vaccination programmes should be thought as an alternate strategy. Further, sorted sexed semen has become an innovative technology being initiated by BAIF in different states including Bundelkhand region of Uttar Pradesh. This can produce breeds of choice for the farming community.

iii. Cultivation of dual purpose coarse cereal crops, drought resistant or less water consuming legume and non-legume crops/trees like cactus, sesbania etc. need to be promoted in the region. A shift from traditional feeding of cattle and buffaloes to feeding of complete feed blocks, region specific mineral mixture, supplementary feeding etc. would ensure balanced ration in dairying. Further, the efforts to utilize the common grazing lands are urgently required to maximize the benefits to farming community.

iv. Large scale facilities for feed processing like crop residue baling, compaction and preparing Total Mixed Ration, establishment of feed and fodder banks etc. should be created on priority which would help the region during frequent droughts. This *in situ* conservation of bulky dry fodder would help for easy inter-district and intra-district transport. A suitable extension programme with supply of appropriate inputs like fodder mini kits and its follow-up is also very essential.

v. Commercialization or entrepreneurship in green fodder production can also be developed to meet the fodder requirements of adjoining regions. The existing department fodder farms need to be strengthened for production of foundation and certified seeds. The foundation seeds must be further multiplied by the certified seed growers to increase the availability of seeds suitable for different agro-climatic zones.

vi. Training, demonstration and field visits of field staff and other stakeholders must be taken-up on timely basis to update their knowledge and carry out further dissemination to farming community. These programmes can even focus on effective fodder utilization practices like silage making, dry fodder enrichment etc.

vii. Suitable models towards integration of fodder species with the intensive agricultural practices needs to be developed using GIS mapping/ remote sensing in collaboration with research institutes or universities and can be promoted on large scale. Further, availability of reliable data on fodder cultivation will be useful for better planning of livestock development in the state. Concerted efforts should be made by the government departments to systematically collect and publish data on fodder cultivation.

viii. Improving health of animals through orientation programmes/camps on deworming, vaccination etc. and promote use of optimum feed mixtures and area specific mineral mixtures based on mineral mapping and nutritional deficiencies. The major focus should shift from clinical services to preventive health care services in the region. Also, rejuvenation of the Department by filling vacancies of veterinarians and coordination with other agencies is essential for improving the productivity and to accelerate the growth rate.

ix. The state has to take necessary initiatives for establishment of innovative institutional mechanism like producer companies / cooperatives, well developed market linkages and adequate collection and processing facilities in the region. Shift from prevailing traditional milk marketing system to modern private – producer – consumer cooperative entrepreneurship would bring in immense benefit to the farmers. The farmers' associations like livestock interest groups, self-help groups, dairy cooperatives etc. can become more effective partners in these endeavours. Further, reviewing the existing institutions through SWOT analysis and promote PPP in selected areas would be one of the solutions for dairy development.

x. Capacity building should be of utmost importance for various stakeholders' as a priority for farmers, field professionals, university faculty, youth, women etc. for improving the productivity. The focus of extension must shift from production oriented approach to market oriented approaches and entrepreneurship development.

xi. Since there is a strong informal association of rural women with livestock, it is necessary to create matching programmes and budgeting for women so that their participation gets institutionalized or else they will continue to remain invisible workers. It would be more effective, if women extension workers disseminate the technologies to the women farmers both in formal and informal mode.

xii. The state has to essentially address the issue of *Anna pratha* on priority by developing a comprehensive strategy and implement the same in a mission mode. Farmers of the region are to be educated for the need to discontinue the traditional practice of *anna pratha*, which is causing immense damage to the socio-economic fabric of the region.

xiii. In the current globalized scenario, Information and Communication Technologies (ICTs) as strategic mass media could be useful tool to promote livestock technologies. The tools like social media, e-extension, m-extension, etc. may be effectively utilized in the region.

Conclusion

The study has identified various issues and constraints, viz. presence of low yielding non-descript cattle, low milk yield, less breedable population, lack of green fodder and dependency on grazing and crop residues utilization, lack of preventive and clinical veterinary service, dominance of middle men in marketing, poor scientific knowledge etc. in the region. Further, it was also found that Bundelkhand region of Uttar Pradesh is facing a tentative annual loss of ₹ 1,619 crores. There is also a need to calculate the losses like crop damage, indiscriminate animal breeding, high cost of production for unproductive animals, lack of milk availability leading to poor human nutrition, etc. Hence, there is a need to focus on short and long term strategies based on strengths, weaknesses, opportunities, threats (SWOT) of dairy sector in Bundelkhand region. A need based research and extension activities by different organizations in the region may be emphasized for the benefit of farming community.

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