Breeding, Feeding and Distribution of Milch Animal Holdings in India: An Analysis Based on the Data from the National Dairy Sample Survey

K.N, Nair and C.S, Krishnakumar

Centre for Livestock Development and Policy Research, Centre for Livestock Development and Policy Research

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K.N. Nair and C.S.Krishnakumar

Centre for Livestock Development and Policy Research,
Kerala Veterinary and Animal Science University.
Thiruvananthapuram, Kerala, India
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[Dr. K.N. Nair is Honorary Consultant Professor at Centre for Livestock Development and Policy Research, and former Director, Centre for Development Studies, Thiruvananthapuram.
e-mail: knntvm@gmail.com, Phone: +91 9447050759

Dr. C.S.Krishnakumar is Research Officer, at Centre for Livestock Development and Policy Research, Thiruvananthapuram. e-mail: krishnaidr@gmail.com]

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Abstract

This paper is prepared against the broader background of the policy debates on the breeding, feeding and distributional consequences of dairy development in India. The data for the study is drawn from the National Dairy Sample Survey covering 186 districts spread over 14 major States in the Country. Analysis presented in the paper shows that the diffusion and adoption of crossbreeding technology is an important factor contributing to the level, pattern, and sources of milk production. There is no evidence to show that the increase in milk production and widespread adoption of crossbreeding technology resulted in the intensification of the pressure on land resources for the production of livestock feed. The production of milk is carried out largely by the weaker sections of the rural society. Since agriculture is rapidly getting mechanized, draught power requirement would not work as a constraint on the diffusion and adoption of new breeds of milch animals. Drawing on the main findings, the paper offers a number of recommendations for the consolidation and acceleration of milk production and the sustainable income generation for the rural poor.

I. Introduction

As per the latest estimates of the Government of India, the total production of milk in the Country is 132.4 million tonnes in 2012-13 (Govt. of India, 2014). This milk was produced by an estimated 83.15 million milch animals. From a situation of low levels of productivity, India's milch animal population has been transformed into relatively better yielding animals making India, the largest milk producing Country in the world. It is significant to note that the livestock sector has been able to contribute about 4 to 5 percent of the Gross Domestic Product due to the impressive performance of the dairy sector (Govt. of India, 2014). In a situation characterized by fall in the share of crop sector to agricultural output, the performance of the dairy sector has helped to a certain extent to arrest the fall in the contribution of agriculture and allied sectors to GDP.

However, recent years witnessed deceleration in the rates of growth in the productivity of milch animals and production of milk. In order to reverse this trend, Government of India in collaboration with State Governments has initiated the planning and implementation of the National Dairy Plan[1] in the 12th Five Year Plan (DRS, 2013). As part of the implementation of

[1] The National Dairy Plan Phase I (NDP I) also referred to as the National Dairy Support Project was launched on April 19, 2012 with an objective to address the challenges of meeting projected demand for milk, by increasing milk production through enhancing productivity of milch animals and by providing greater access to the organised milk-processing sector. The project covers 189 districts out of the 427 districts in 14 major

this programmes, the National Dairy Development Board (the Central Co-ordinating Agency for the implementation of the Plan) has undertaken a National Sample Survey[2] covering 14 major States and 184 districts in the Country to create a bench mark data base on the milch animal holdings, their various production characteristics, input use and its procurement, production and disposal of milk by producer households and the important socio-economic characteristics of households owning milch animals etc. The districts covered by the survey were included in the past in major dairy development initiatives like the Operation Flood. They are infrastructurally more advanced in the procurement and processing of milk, breeding, health care, and extension for efficient herd management to realize higher levels of productivity of milch animals.

A census of 3.44 lakh rural households were conducted in the project areas of these States to identify households owning milch animals at the first stage and 14992 households owning milch animals at the second stage to collect the relevant data[3]. The report of this survey along with key estimates are published in the website of the National Dairy Development Board (www.nddb.org) for wider dissemination of the data and the findings from the survey[4].

This paper makes use of this data to examine some of the issues debated in the context of the development of dairying in India during the past four decades[5]. More specifically, we would like to address the following: (1) Crossbreeding the non-descript cattle with exotic foreign breeds, upgradation of the Indian buffaloes with selective breeding, the development of a national milch animal herd, formed an important component of the strategy for increasing milk production in the Country, since the implementation of the Operation Flood Projects. This strategy has been criticised on the ground that (a) the crossbred male cattle is an inefficient work animal and farmers would not adopt crossbreeding unless it is accompanied by the substitution of draught cattle by mechanization of agriculture. (b) The raising of

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dairying states of the country (Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal).

[2] The survey was conducted by Development and Research Services Pvt. Ltd,-an independent agency

[3] Three stage sampling design was used for selecting sample households. In the first stage, Taluks were selected with probability proportional to population size (population from Census of India 2001). In the second stage, villages were selected from the selected taluks with probability proportional to population size and third stage, households having adults cows/buffaloes with each village using equal probability systematic sampling. For details of sampling see DRS (2014).

[4] Since the survey did not cover the entire area of the States the estimates presented should not be taken fully representatives of the States. Again only 186 districts in the 14 States were covered in the survey, the aggregate estimates derived from the survey should be treated as fully representative of the entire Country. However, the data would definitely indicate the pattern of dairying in the Country and the States covered.

[5] Most of this discussions and debates have happened in the context of strategy for Dairy Development in the Country unfolded with the design and implementation of the Operation Flood Projects from the early seventies. For a review of these debates see Doornbos et.al., 1990; Doombos and Nair, (1990).

crossbred cows and upgraded she-buffaloes would require cultivated green fodder and nutritions manufactured balanced feeds to realize technically and economically efficient productivity levels envisaged and therefore, with the implementation of the new breeding and feeding strategy would have to give way the traditional feeding practice based on crop residues and other by-products like oil cakes to more intensive form of feed production by bringing more land under fodder crops and the diversion of coarse grains, oil cakes etc. for the production of concentrate feeds. Such a process in the long run could contribute to increase in the pressure on land resources for the production of food crops for direct human consumption and production of crops for feeding livestock. (II) The benefits of the green revolution accrued largely to the medium and large farmers compared with land less, marginal and small farmers. Since, the distribution of milch animals are weighed more in favour of the bottom segments of the rural society, compared with the distribution of land, the programme for intensification of milk production would benefit more the weaker sections. However, this strategy has been questioned on the ground that the high yielding animals are more expensive and risky to maintain since they require more purchased inputs and are prone to diseases and therefore, the better segments of the rural society would be in a position to take more advantage of it than the weaker sections[6]. These issues have implications for the sustainable development of dairying in the Country. The data available from the National Dairy Sample Survey is useful in addressing some of these issues, since the survey covered the major milksheds in the Country where the national strategy for increasing milk production has been under implementation.

This paper is organized as follows: Section 2, will examine the extent of diffusion of modern breeding technology in cows and she-buffaloes across regions. This is followed by an analysis of the extent of adoption of new breeds by milch animal holdings in Section 3. We make a distinction between diffusion and adoption of breeding technology to highlight the following points: (1) Diffusion of breeding technology essentially implies the process of taking of Artificial Insemination using high yielding breeds instead of the traditional practice of Natural Service. (2) Adoption implies how the new technology of breeding is internalised by the farm holdings and resulted in the transformation of traditional milch animal herds into modern high

[6] The national strategy of increasing milk production based on crossbreeding of cattle and upgradation the she-buffaloes with the supporting infrastructure for breeding, animal health, and other production enhancing inputs and services on the one hand, and procurement, processing and marketing of milk on the other has been implemented in the major milkshed regions of the Country during the past four decades. The official estimates of milk production as we noted earlier do show that the Country has made rapid strides in milk production and that the percentage of crossbred cows in the milch animal herd has increased and the increase in yield of the milch animals has been a major factor that contributed to the increase in milk output.

yielding animals. The issue of the feeding of milch animals is examined in Section 4. Section 5 will analyse the household ownership and distribution of milch animals and Section 6 on the household production of milk. The main finding and its implication are highlighted in the concluding section.

II. Diffusion of Technology in Cattle and Buffalo Breeding

Utilization of Artificial Insemination (AI) using exotic breeds constituted the main content of this technological change. Diffusion of AI Technology developed unevenly across regions in the Country depending on the number of years since the AI programme has been implemented, its coverage and effectiveness etc on the one hand, and the farm level factors that shaped the adoption levels. It is seen that there is a very high correlation between the percentage of CB in the milch animal herd and the percentage of animals covered by the AI[7] (r=0.85 significant 1% level). The AI technology for buffaloes for breed improvement is based on the use of high yielding Indian buffalo breeds.

Analysis of the data for IC, CB and SB for different States separately (See Table I) has shown the following findings: (1) the diffusion of AI among IC was seen to be very high in Tamil Nadu, Kerala, Karnataka and Andhra Pradesh and in the States of Punjab and Haryana. In Maharashtra, Bihar and West Bengal, diffusion of AI is at level lower than in the Southern States. (2) In the States of Rajasthan, Utter Pradesh, Odisha and Madhya Pradesh, the diffusion of AI among IC are found to be low. As is to be expected in States where the diffusion of AI has been higher the transformation of IC into CB would have taken place at a much faster rate. Though the diffusion of AI for CB was very high in a large number of States, in few States it is found to be relatively low. This could be due to the inefficient delivery of AI services. (3) The service of SBs with AI is much lower compared with CB. Part of the reason for this is that the farmers experience with AI for she-buffaloes is much shorter compared with their exposure of AI for cattle. However, there is a close association between the diffusion of AI in cattle and diffusion of AI among buffaloes. This is what one would expect since the provision of infrastructure for AI in cattle and buffaloes is the same: (4) In States where the diffusion of AI is low the diffusion of NS is high. (5) While the provision of AI infrastructure is a crucial determinant of the level and pattern of AI diffusion across regions in the Country, the adoption of AI at the farm level is determined by number of farm specific factors. Regarding the diffusion of the breeding technology, the important

[7] As per the Sample Survey 47 percent of the female adult bovines were serviced with AI, 51 percent with NS and 2 percent with AI and NS for all the States together.

factors to be taken into account include: (a) the infrastructure for the servicing and selection of mother bulls for collection of semen, its freezing and storage and distribution to the service providers (b) trained personals for the upkeep and maintenance of the infrastructure and delivery of the service to the farmers. Some of the States (mostly in the South) had an early start in building these infrastructure with in the State sector with about 40 to 50 years of exposure to the AI technology[8]. Other States, who are late comers has expanded the AI infrastructure with the development of various dairy development and milk production programmes. However, it is now well recognized that the availability and quality of AI infrastructure including trained manpower has considerable interstate disparities: (c) the delivery of AI services were initially within the purview of the State agencies: however, with the emphasis given to the privatization of Animal Husbandry services in recent years, private agencies and dairy co-operatives are also allowed to deliver AI services. Thus, multiplicity of agencies are now delivering AI services to the milch animal holdings. The survey has provided data to understand the relative importance of various agencies at the State level.

Table I Percentage of cows and she-buffaloes covered by AI and NS across States in the Country

Sl. No	State	Percentage of cows & she-buffaloes covered with AI				Percentage of cows & she-buffaloes covered with NS			
		IC	CB	SB	Total	IC	CB	SB	Total
1	Punjab	61	78	52	58	38	21	47	41
2	Haryana	51	76	24	31	48	22	75	68
3	Rajasthan	17	60	10	17	82	35	88	82
4	Uttar Pradesh	27	48	8	15	76	49	91	83
5	Bihar	30	81	27	39	69	17	69	58
6	West Bengal	36	85	56	50	62	15	44	49
7	Odisha	10	76	53	26	89	22	45	72
8	Madhya Pradesh	6	0	0	3	93	57	97	92
9	Gujarat	27	95	42	43	72	5	56	55
10	Maharashtra	40	98	33	54	60	11	66	45
11	Andhra Pradesh	60	91	47	56	39	6	48	40
12	Karnataka	69	88	67	76	31	10	30	22
13	Kerala	81	97	60	92	18	2	38	6
14	Tamil Nadu	88	94	91	92	7	4	9	5
15	All States	35	85	32	47	63	12	65	51

IC-Indigenous Cow, CB-Crossbred Cow, SB-She-buffalo

Source- Sample Survey on Dairying

[8] Initial interventions in crossbreeding in the Country began under bilateral collaboration: It started in the mid-sixties with the Indo-Swiss project in Kerala subsequently there was Indo-Danish project in Tamil Nadu, Indo-German project in Karnataka, Indo-Swiss collaboration in Orissa. These States could move faster with the crossbreeding programmes than other regions in the Country. The technology to freeze buffalo semen was developed for field application only in the recent past and its success rate has been low compared to crossbreed cattle. This could be one reason for slow diffusion of Ai in SBs compared to cows.

For all the State together, Government, and private sector/ NGO's are seen as the two dominant providers accounting for about 40 percent each of the AI provided to the MAH. Milk Co-operatives and MAITS are the other two sources accounting for about 13 and 5 percent respectively (Table 2). The relative importance of these service providers varied across regions in the Country. Government as the provider of AI was the highest in Kerala (94%), it is found to be negligible in a number of States, especially in Punjab, Utter Pradesh, Bihar and West Bengal, followed by Tamil Nadu (54%), Andhra Pradesh (57%), Odisha (69%) and Haryana (44%). The role of NGO/ Private sector in the provision of AI was very high in Punjab, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu. In Gujarat, Karnataka, Haryana and Uttar Pradesh, Co-operatives were also present in the AI service delivery. In couple of States, Madhya Pradesh and Bihar MAITS also accounted for about 27 and 37 percent of the AI service.

Table 2: Percentage of AI services delivered by provider type

State	milk coop	MAITS	NGO/Pvt	Govt	Others	Total
Punjab	8	10	79	3	0	100
Haryana	22	5	29	44	0	100
Rajasthan	4	6	66	22	2	100
Uttar Pradesh	19	15	52	10	4	100
Bihar	9	37	51	1	2	100
West Bengal	5	0	78	11	6	100
Odisha	9	3	17	69	2	100
Madhya Pradesh	10	27	37	18	8	100
Gujarat	44	6	34	15	1	100
Maharashtra	9	1	54	34	2	100
Andhra Pradesh	9	3	26	57	5	100
Karnataka	37	1	26	32	4	100
Kerala	1	0	5	94	0	100
Tamil Nadu	2	1	35	54	8	100
All States	13	5	39	40	3	100

Source of Data: DRS (2013)

Table 3: Percentage of Households Owning Milch Cows expressing their Preference for AI and NS

State	AI	NS	No Response
Punjab	71	24	4
Haryana	65	27	8
Rajasthan	34	63	3
Uttar Pradesh	42	54	4
Bihar	41	46	13
West Bengal	47	49	4
Odisha	84	16	1
Madhya Pradesh	11	83	6
Gujarat	44	54	2
Maharashtra	79	20	2
Andhra Pradesh	82	8	9
Karnataka	79	18	4
Kerala	92	6	2
Tamil Nadu	91	5	4
All States	64	32	4

Source of Data: DRS(2013)

Since, AI has been widely diffused for breeding cattle in a large number of States, it seems to have significantly influenced the farmer's choice between AI and NS. For all States together 64% of the sample households revealed their preference for AI and 32% for NS for breeding their cows (Table 3), Across regions the preference for AI is seen to be very high in the Southern States followed by Maharashtra, Odisha, Punjab and Haryana and very law in Madhya Pradesh. In the case of the SBs the survey could not provide the reliable data on the choice of breeding technique, due to the high percentage of respondents who could not state their preference. For the Country as a whole 18% of the respondents revealed their preference for AI, 30% for NS and 52% could not state their preference. (Table 4). Obviously, the non-response from farmers is a reflection of their lack of exposure to the effectiveness of AI in buffalo breeding. This is evident from the fact that in States, where the percentage of SB', receiving AI the non-response is low, since, the farmers could assess the effectiveness between AI and NS.

Table 4: Percentage of Households Owning She-buffaloes expressing their Preference for AI and NS

State	AI	NS	No Response
Punjab	44	38	18
Haryana	22	68	11
Rajasthan	11	57	32
Uttar Pradesh	6	73	21
Bihar	9	18	73
West Bengal	1	1	98
Odisha	3	1	97
Madhya Pradesh	2	41	57
Gujarat	36	44	20
Maharashtra	22	29	50
Andhra Pradesh	46	32	22
Karnataka	32	12	56
Kerala	3	1	96
Tamil Nadu	10	1	90
All States	18	30	52

Source of Data: DRS (2013)

The survey attempted to capture the reasons for the choice of AI and NS from the respondents. The reasons listed in the survey schedule were the following: (1) door step service, (2) higher chances of conception, (3) better progeny, (4) low service cost, (5) availing this service for long time, (6) bull not available in the village and (7) confidence in the service provider. For the Country as a whole, the data revealed that 24% of the respondents reported the first, 25% the second, 23% third and 13% the fourth as the reasons for their preference for AI for cows. The other reasons were reported as insignificant. More or less the same pattern of reasons were reported across regions in the Country (Table 5). Regarding the she-buffaloes, the reasons for the preference for AI followed the same order as that noted for cows[9]. The reasons given for the preference for Natural Service for cows showed that higher chances of conception (24), better progeny (17), low service cost, traditionally availing this service (16), bull available in the village (16) and door step service[10] (9). Though, there are differences in the values of the reasons reported by the respondents across States, the pattern in the distribution of reasons noted for the Country as a whole, is seen to hold for a large number of States in the Country. Regarding the use of NS for she-buffaloes, door step

[9] The reasons for the preference of AI is based on the number of respondents who reported the use of AI. Since the percentage of non-response is very high for buffaloes the information collected will be of some use only for few states which the non-response is low. For State wise data see NDDB Table 10

[10] Figures in the bracket refers in this sentence and the following one relates to the percentage of respondents.

delivery (29), high chances of conception (19), low service cost (19), availing service for long term (13) and better progeny (14) are reported as reasons by respondents. See DRS (2013).

Table 5: Percentage of Households Owning Cows reporting reasons for preference of AI

State	Doorstep service	Higher chances of conception	Better progeny	Low service cost	Availing this service for long time	Bull not available in the village	Confidence in the service provide	No alternative
Punjab	28	27	25	10	8	2	1	0
Haryana	23	19	28	19	5	6	1	0
Rajasthan	24	25	24	11	5	7	4	0
Uttar Pradesh	21	28	22	11	6	8	4	1
Bihar	32	26	29	5	1	6	1	1
West Bengal	31	26	16	6	3	11	5	2
Odisha	31	26	27	12	3	0	0	0
Madhya Pradesh	21	22	24	9	6	11	6	1
Gujarat	28	32	24	9	0	4	2	0
Maharashtra	23	33	31	6	1	2	2	2
Andhra Pradesh	24	26	22	15	0	10	2	0
Karnataka	19	28	21	17	6	7	2	1
Kerala	25	13	26	14	3	6	12	2
Tamil Nadu	15	26	17	18	1	17	4	1
All States	24	25	23	13	3	7	4	1

Source of Data: DRS (2013)

The diffusion of AI by land holdings class, reveals that in the Country as a whole the level of diffusion tends to decline with increase in the size of land holding. The diffusion level is seen to be high among the landless (56% for all India) followed by the marginal farmers (50%), and it further declined to 42% for small farmers, 39% for semi medium, 34% each for medium, and large farmers. However, at the State level, in some States, differences are noted in the diffusion levels across size group of holdings, whereas in a number of other States, no clear pattern is visible. (Table 6). The survey has also provided data on the relation between herd size and diffusion of AI. For the Country as a whole it is seen that the diffusion level of households owning one MAH is lower than those owning two or more animals (Table 7 and see NDB Survey report Table No.7.8c). These lack of any clear relationships points to two limitations of the data: (1) the diffusion figures are combined for cows and she-buffaloes. Since, there is significant differences in the difussion of AI for the two across regions, combining the two might have vitiated the pattern and (2) respondents in some States are exposed to AI for a longer period than in other States, and in the former States the level of

diffusion is likely to be higher than latter. Therefore, it is not possible to interpret the patterns at the State level unless we take into account such differences.

Table 6: Percentage of Households owning Milch Animals reporting the utilization of AI Service by Land Holding Class

State	Landless	Marginal farmers (<1Ha)	Small Farmers (1-2Ha)	Semi-medium Farmers (2-4Ha)	Medium Farmers (4-10Ha)	Large Farmers >10Ha	All
Punjab	59	60	60	55	51	46	58
Haryana	32	28	33	27	35	50	31
Rajasthan	12	18	18	16	12	8	17
Uttar Pradesh	17	17	15	12	16	11	15
Bihar	36	40	35	51			39
West Bengal	54	46	62				50
Odisha	31	22	27	43	44		26
Madhya Pradesh	5	3	3	1	4	3	3
Gujarat	25	54	39	42	25		43
Maharashtra	52	52	54	57	55		54
Andhra Pradesh	53	59	60	52	31		56
Karnataka	66	81	71	81	63		76
Kerala	99	88					92
Tamil Nadu	87	95	96	95	100		92
All States	56	50	42	39	34	34	47

Source of Data: DRS (2013)

Table 7: Percentage of Households reporting the use of AI by number of Milch Animals

State	milch animal holding size					All
	1 milch animal	2 milch animal	3 milch animal	4 milch animal	> 4 milch animal	
Punjab	55	60	58	50	64	58
Haryana	29	31	34	37	46	31
Rajasthan	14	19	20	13	15	17
Uttar Pradesh	15	17	14	13	10	15
Bihar	41	33				39
West Bengal	46	51	57	33	68	50
Odisha	22	31	37		42	26
Madhya Pradesh	5	3	1	2	2	3
Gujarat	41	44	52	45	39	43
Maharashtra	48	52	60	60	56	54
Andhra Pradesh	55	60	59	52	50	56
Karnataka	74	75	76	75	81	76
Kerala	95	93	92	82	90	92
Tamil Nadu	92	91	93	96	88	92
All States	43	49	50	48	53	47

Source of Data: DRS (2013)

The survey also provide information on the cost of AI and NS incurred by the MAH. For the Country as a whole the cost per AI for cows was Rs.107; the cost of the service from the Government was lower than that of the NGO/Private and the co-operative sector. For she-buffaloes the cost per AI was higher from NGO/Private sector compared with Government or the co-operative sector. However, we should note that from the perspective of the farmer, more than the cost per AI, it is the cost incurred for AI for getting a cow or buffalo pregnant is more important than the cost per AI. The latter would depend on the success rate of AI. Since such information is not available it is not possible to interpret this data.

In sum the analysis presented in this Section shows significant variations in the diffusion of the AI technology across regions in the Country. In general, the level of diffusion is high in the South Indian States. Followed by Punjab and Haryana and other States falls in between. The diffusion level is higher in cows compared to she-buffaloes. In the delivery of AI Service both public and private agencies are involved. In States where the diffusion of AI Service is low, private agencies are found to be more important than the State agencies. It is also seen that in States where diffusion AI in cows are higher, it is to higher for she-buffaloes. Doorstep service, better progeny and lower service cost are some of the reasons noted by the farmers for the use of AI technology. The variations in the level of diffusion of AI technique between different size of farmers and socio-economic groups are also found to be insignificant.

III. Adoption of Breeding Technology and Production Traits of Milch Animals.

The impact of the diffusion of improved breeding technology on the adoption of the breed quality of the milch animal population will be reflected in the relative importance of improved animals in the milch animal population and its production traits.

The Sample Survey has collected data on the species and breed composition of Milch Animals (MAS). The investigators employed in the survey were given training to identify Indigenous Cows (IC) and Crossbred Cows (CB) in collection of these data from the respondent households. Therefore, we would expect this survey to provide fairly accurate data on the Indigenous and Crossbred Cattle in the cattle population. However in the case of buffaloes, no data on the improved breeds are available and thus it is not possible to examine the differences in the quality of breeds due to the diffusion of improved breeding technology. Analysis of the data shows that for all the regions together, she-cattle accounts for about 51 percent of the Milch Animal Holdings (MAHs) and the remaining 49 percent were SBs. There exist striking interstate variations in the composition of MAH. SBs dominates MAH in the

North Western and Central Indian States (Table 8) as well as in the Southern State of Andhra Pradesh. For all the States together: at the disaggregated level, in CB cows' accounts for 26 percent of the MAH. Kerala, Tamil Nadu, Karnataka and Maharashtra recorded the highest percentages of CB in MAH. In few other States, namely Odisha, West Bengal, Bihar, Punjab and Andhra Pradesh, the population of CB cows has also gained importance. In the eastern Indian states of Bihar, Odisha and West Bengal and in the State of Madhya Pradesh IC has retained its importance in the breed composition of milch cattle. It is clearly evident from the data that the breed composition of the milch cattle has undergone significant shift towards crossbred cattle in several States as a result of the crossbreeding programme implemented in the past.

Table 8: Percentage Distribution of Milch Animals by Breed and Species Composition

State	IC	CB	SB	Total
Punjab	7	21	72	100
Haryana	8	10	82	100
Rajasthan	31	9	60	100
Uttar Pradesh	12	14	74	100
Bihar	43	20	37	100
West Bengal	70	26	4	100
Odisha	75	23	2	100
Madhya Pradesh	50	6	44	100
Gujarat	19	8	73	100
Maharashtra	23	35	42	100
Andhra Pradesh	8	18	74	100
Karnataka	28	40	32	100
Kerala	9	87	4	100
Tamil Nadu	19	69	12	100
All States	25	26	49	100

Source of Data: DRS (2013)

The survey provides data on the composition of female bovine stock into young and adult categories. In the case of IC for the Country as a whole, young stock roughly constituted 1/3rd of the female stock; for CB, it formed about 1/4th and for SBs about 30 percent. The lower percentage noted for CB could be due to the lower age (Table 9) of first calving leading to, more young stock joining the adult herd, compared to IC or SBs. Regarding the variation in this percentage across regions in the Country, it is more than 1/4th in all States except in Kerala and Andhra Pradesh. Young stock are held as inventory to meet the replacement and growth requirements of the adult stock, and where, the value of this percentage is high, it would imply that the growth and replacement requirement of the adult stock with young stock is high. In regions where these requirement is met by interregional trade, the percentage

would not necessarily reflect the actual rate of replacement of the adult stock. In States where this percentage is very slow, it would imply a fall in the replacement requirement of the adult stock as a consequence of the fall in the adult population[11]. The low percentage of young stock to total stock noted in Kerala could be a reflection of this, since the adult female population has shown a sharp fall in recent years. The situation noted in Andhra Pradesh is somewhat puzzling; the percentage of young stock in the total stock in IC, CB and SB is low in the State. This is another State like Kerala where the cattle and buffalo population has shown a falling trend in recent decades.

Table 9: Profile of female bovine animals by growth stage

State	Indigenous female cattle			Crossbred female cattle			Buffalo(female)			All		
	Young stock	Adult	Total	young stock	adult	total	Young stock	Adult	Total	Young stock	Adult	Total
Punjab	35	65	100	33	67	100	36	64	100	35	65	100
Haryana	23	77	100	32	68	100	35	65	100	34	66	100
Rajasthan	39	61	100	38	62	100	38	62	100	38	62	100
Uttar Pradesh	25	75	100	29	71	100	27	73	100	27	73	100
Bihar	23	77	100	33	67	100	28	72	100	27	73	100
West Bengal	33	67	100	35	65	100	10	90	100	33	67	100
Odisha	38	62	100	40	60	100	34	66	100	38	62	100
Madhya Pradesh	34	66	100	34	66	100	33	67	100	33	67	100
Gujarat	38	62	100	31	69	100	42	58	100	40	60	100
Maharashtra	29	71	100	31	69	100	34	66	100	32	68	100
Andhra Pradesh	10	90	100	15	85	100	10	90	100	11	89	100
Karnataka	26	74	100	26	74	100	22	78	100	25	75	100
Kerala	60	40	100	11	89	100	8	92	100	20	80	100
Tamil Nadu	44	56	100	23	77	100	30	70	100	29	71	100
All States	34	66	100	26	74	100	31	69	100	31	69	100

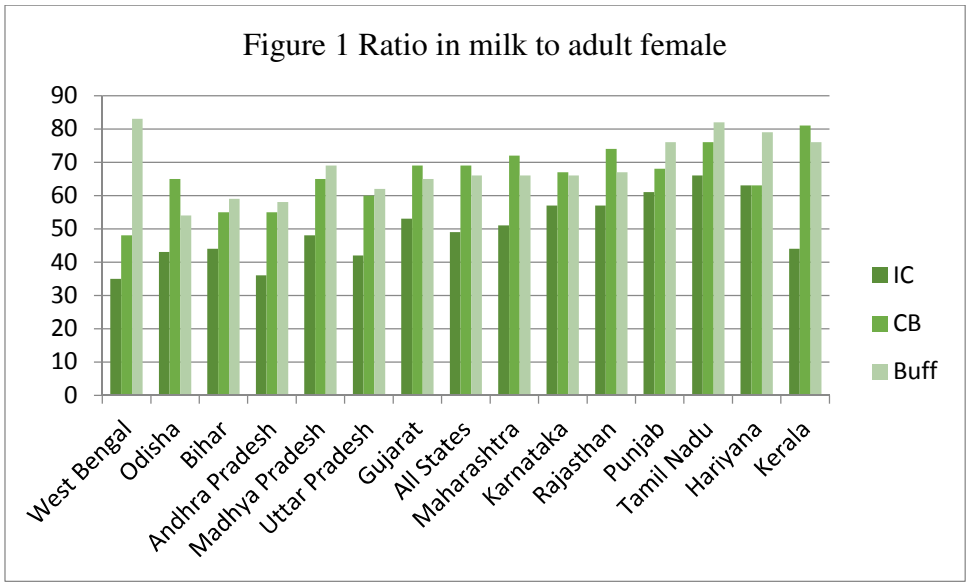
Source of Data: DRS (2013)

To assess production traits of MAs, the survey provides data on the following parameters: (a) percentage of animal's in-milk to the total MAs, (b) age of first calving, (c) distribution of MAs by number of calves born and (d) yield of MAs. These data suffers from the limitation

[11] It is necessary to point out the limitation of this data. Since the survey on each State covered only about 1000 households, owning milch stock, the animal population involved is only of a lower order. Compilation of the ratio of young stock to adult stock, therefore would not give a robust picture. It is ideal to compile this using Livestock Census Data.

of recall lapse by the respondents, and therefore results derived from the analysis if this data would have to be treated as indicative.

As the average lactation length of the milch animal herd increases, the dry period tends to decline and this would imply that the percentage of animal's in-milk in the herd would tend to increase. In other words, it would imply a fall in the non-yielding milch animals in the herd and thus increase in the efficiency of the herd. It is generally seen from the surveys conducted in the past that the percentage of animals in-milk is lower for IC, compared to CB and SBs. The data collected in the Sample Survey reinforces these findings. For the Country as a whole, for IC, 49 percent of the MAs was in-milk: the corresponding percentages for CB was 69 and 66 for SBs. The value of this variable varied considerably across regions in the Country. See figure 1. Some of the important features to be noted in this context are as follows: (1) the percentage of animals in-milk for CB was much higher than IC in large number of States except in Punjab and Haryana, where the figure for IC was very close to that of CB. The reasons for this could be that the IC in these States are some of the best milk yielders in the Country and are as good as the CB in terms of various production traits, (2) the percentage of SBs in-milk for the Country as a whole was fairly close to that of crossbred cows (66 against 69). However in Punjab and Haryana, the percentage of she-buffaloes in-milk were much higher than crossbred cattle, reflecting the relative superiority of the she-buffaloes in these regions over CB. In States where SBs occupies the predominant position as milch animals, the percentage of SBs in-milk were very close to the values for CB, (3) in the States where the percentage of CB cows in the total milch animal herd is high (especially in Kerala, Tamil Nadu, Karnataka to a large extent and in Maharashtra, Odisha, West Bengal and Bihar in limited extent), this would imply a significant improvement in the lactating efficiency of the milch animal herd.



Source of Data: DRS (2013)

Regarding the age of first calving, the percentage of animals in all the three categories for which no data could be obtained is very high: about 30 to 35 percent at the all India level and in several States it was significantly higher than the all India average. (Table 10) Therefore, we did not subject this data into further analysis except to examine the pattern at the all India level. The figures for IC, CB and she-buffaloes are given below. The findings are along the expected lines:

Table 10: Distribution of Milch Animals by Age of First Calving. (All India)

Sl. No	Type of Milch Animal	Age of First Calving (months)					
		0-23	24-36	37-48	>48	No recall	Total
1	Indigenous cows (6944)	0	21	39	10	3	100
2	Crossbred Cows (7129)	1	37	23	3	36	100
3	She-Buffalo (11649)	0	16	37	12	35	100

Note: figures in the bracket shows the number of animals for which the estimates wise based.

The percentage of MAs with lower age of first calving is higher for CB compared with IC and SBs. (ie with in the age group of 2 to 3 years). For IC and SBs, the age at first calving is concentrated more in the age group of 3 to 4 years.

Since the non-response error has shown significant variations across States, the data on the distribution of milch animals by number of calves born is analysed only for the Country as whole (Table 11).

Table 11 Distribution of Milch Animals by Number of Calves Born.

Sl. No	Type of Animals	Number of calves born						
		1	2	3	4	>4	No response	Total
1	Indigenous Cows (6944)	28	29	15	7	6	15	100
2	Crossbred Cows (7129)	27	26	13	6	3	25	100
3	She-Buffaloes (11649)	23	27	18	7	5	20	100

Note: figures in Bracket shows the number of animals for which the estimates are derived

The pattern revealed by the data indicates that the probability of MAs (irrespective of IC, CB or SBs) giving two calves are higher than three or more. This is evident from the fact that the percentage of MAs with three or more calves shows a sharp fall compared to one and two. If the probability of the MAH, at the bottom age group moving in to the higher age is equal, one would expect equal distribution of MAs with number of calves born. On the other hand, if the probability of MAs moving from lower to higher age groups tends to decline with increase in the number of calves born, the percentage of MAs in the higher age groups would tend to decline with increase in the number of calves born: however, testing such relationships would require distribution of MAs by age and number of calves born.

We recalculated the value of the above two parameters by excluding the number of no-recall cases. The results further reinforces our argument. Regarding the age of first calving, 58 percent of the CB cows was within the range of 24-36 months: it also showed that the percentage of animals in this age range higher than the calculations done by including the no-recall cases. However, the magnitude of the value is much higher for CB. A similar result is seen in the case of distribution of cows with number of calves born. The estimated average number of calves born shows that it is 2.3 for IC, 2.1 for CB and 2.4 for SB. The lower value for CB may be due to its lower life span, compared to IC and SB.

Table 12: Distribution of Milch Animals by Age of First Calving (excluding the No recall)

Sl. No	Types of Milch Animals	Age of First Calving				
		0-23	24-36	37-48	>49	Total
1	Indigenous Cows	0	30.0	55.7	14.3	100
2	Crossbred Cows	1.6	57.8	35.9	4.7	100
3	She-Buffaloes	0	24.6	56.9	18.5	100

Table 13: Distribution of Milch Animals by Number of Calves Born (excluding the No recall)

Sl. No	Types of Milch Animals	Number of Calves Born					
		1	2	3	4	>5	Total
1	Indigenous Cows	32.9	34.1	17.6	8.2	7.1	100
2	Crossbred Cows	36.0	34.7	17.3	8.0	4.0	100
3	She-Buffaloes	28.8	33.8	22.5	8.8	6.3	100

Analysis of the data on the average daily milk yield per animal in-milk showed that for ICs it was 3.06 litres for the Country as a whole; the corresponding yield for CBs was 6.30 litres and it was 5.11 litres for SBs. Thus, the yield of CBs was more than twice that of ICs. On the other hand the yield of SBs was about 20 percent lower than that of the CBs. The gap in yield between IC and CB are noted in all the regions in the Country, and few States; especially in Bihar, Odisha, Madhya Pradesh and Kerala the gap is sharper than in other States. This could be a reflection of the low milk yield of ICs in these States. Regarding the yield gap between CBs and SBs, it is seen that the yield of latter is lower than the former in most of the States except in Haryana, Utter Pradesh, where it is slightly higher than that of CBs.

Table 14: Average Daily Milk Yield (in litres) per animal in milk by type of Animal

	IC	CB	Buffalo	All in Milk
Punjab	4.6	9.1	5.6	6.2
Hariyana	3.5	6.3	6.6	6.4
Rajasthan	4.7	6.8	6.2	5.9
Uttar Pradesh	2.9	5	5.1	4.9
Bihar	2.0	4.7	3.5	3.3
West Bengal	1.7	3.4	4.4	2.2
Odisha	1.7	4.4	2.6	2.7
Madhya Pradesh	2.4	5.5	4.3	3.6
Gujarat	4.3	8.6	5.3	5.3
Maharashtra	3.2	6.1	4.9	5.0
Andhra Pradesh	3.4	5.9	3.7	4.2
Karnataka	3.5	6.4	3.6	4.8
Kerala	2.7	9.4	9.6	9.0
Tamil Nadu	3.4	6.6	4.6	6.0
All States	3.06	6.30	5.11	5.03

The variations in the composition of MAs and their yield levels noted across regions in the Country is reflected in the share of different breeds/species of MAs to the total milk

production. It is estimated from the survey that in the Country as a whole, 53 percent of the milk production was contributed by the SBs; (see DRS (2013), Table 5.1) the CBs contributed to 35 percent and the remaining 12 percent by ICs. It is striking to note that in the States of Kerala, Tamil Nadu, Karnataka, Odisha and Maharashtra, CBs contributed to the highest share in milk production. The ICs contributed to about 54 percent of milk production on West Bengal, 38 percent in Odisha, 26 percent in Madhya Pradesh and 21 percent in Bihar. In the rest of the regions its contribution is seen to be insignificant.

In brief, the breed and species composition of milch animals has undergone significant transformation across regions. In the Southern States (Kerala, Tamil Nadu and Karnataka) the share of crossbreds in the milch animal herd is significantly higher than in other State. In States where she-buffaloes are traditionally raised as milch animals, it continue to dominate the herd, but the share of crossbreds in some of the States suggest that it has gained importance. There are groups of States where (especially in Eastern India) indigenous milch cattle dominates the milch animal herd: but the CB has also gained importance. In States where the she-buffaloes dominates as milch animals, the share of crossbreds in the milch animal herd is found to be low. Analysis of the various indicators of the production traits of milch animals shows that the crossbreds fare better in terms of lower age of first calving and dry period, and higher milk yield compared with she-buffaloes and indigenous cattle. Because of these advantages, the share of crossbreds in the estimated milk production is much higher than its share in the milch animal herd across regions in the Country.

IV. Feed Recourses and Feeding Practises of Milch Animals

Commentators on India's livestock has attributed the chronic shortage of feeds and fodder as a major reason for the low productivity of milch animals[12]. It is argued on the basis of empirical studies on feed input milk yield relationships that the milk yield of cows and she-buffaloes could be increased substantially with improvement in the quantity and quality of feed inputs, disease control and management. These studies also points out that the level of feeding (especially that of concentrates) which is crucial in increasing milk yields is a function of the relative price of feed and milk. The latter would very much depend on the degree of commercialisation of the milk economy and the conditions of the demand for milk. Over the last three decades, commercialisation of dairying has expanded rapidly in the length

[12] The 12th Five Year Plan has identified feed and fodder as the major constraint for livestock development in the Country. According to the Plan document, India is deficit in dry fodder by 11% green fodder by 35% and concentrate feed to see for details Government of India (undated).

and breadth of the Country: the fairly accelerated growth in the levels of per capita income in recent decades and the expansion of urbanisation and changes in the consumption habits of the population have created conditions that are favourable for the rapid growth in the demand for milk. On the supply of feed resources, significant changes have occurred due to the changes in land use and cropping pattern and productivity of crops across regions in the Country. Such changes would have to be viewed along with the nature of technological changes in agriculture and its effect on the pattern of household allocation of feed resources among different types of livestock. During the past four decades, the spread of green revolution, draught animals utilized in various agricultural operations has been replaced by mechanical equipments in large parts of the Country. Consequently, the adult male cattle population and its follower stock has shown a rapid decline. Traditionally, draught animals constituted an integral part of the input requirements for sustaining cultivation and therefore, they received the first priority in the farmer's allocation of feed resources. With the decline in the dependence on draught animals, one would expect increase in the availability of feed resources for raising the female bovine stock.

Unfortunately, there is no data available on the quantity of different types of feed fed to bovines belonging to various age and sex composition. Most of the empirical studies on feed-milk relationship are based on the data provided by the Farm Management Surveys or from the Small Scale Surveys done by individual researchers. The integrated Sample Surveys for the estimation of milk production by the State Animal Husbandry Departments do collect such data but is based on the non-weighment of quantity of feed fed to milch animals. Even this data, with its limitations can be put to useful empirical analysis, but is not available to the researchers. There has been attempts to estimate the changes in the availability of feed in the Country by estimating the quantity from various agricultural crops by applying the relevant ratios like (the straw/ grain rations) to the quantity of crop output and then converting the estimated feed from various sources in to energy and protein equivalent units (TDN and DCP). An earlier attempt provides TDN and DCP per adult equivalent bovine units for major States in the Country for the years 1972 and 1982. (Vaidhyanathan, 1988). Following the same methodology, we have estimated the TDN and DCP for adult bovine unit for 2007 and compared this with the estimates from the earlier study for 1972 to get a rough idea, on the long term shift in the feed situation. These estimates are given in Table 15.

Table 15. Feed Supply per Adult Equivalent of Bovines[1] by State for 1972 and 2007

Sl.No	States	1972[a]		2007[b]	
		DCP[2]	TDN[3]	DCP	TDN
1	Andhra Pradesh	16.0	313.0	26.7	699.9
2	Assam	5.2	222.0	6.6	294.7
3	Bihar	5.4	323.0	8.8	436.7
4	Gujarat	53.5	485.0	81.3	547.8
5	Karnataka	21.2	452.0	22.1	712.5
6	Kerala	2.6	359.0	2.6	262.5
7	Madhya Pradesh	8.4	264.0	14.6	323.5
8	Maharashtra	13.1	280.0	25	543.4
9	Odisha	5.6	213.0	5.6	382.5
10	Punjab	35.4	911.0	94.4	2679.3
11	Rajasthan	13.4	333.0	81.4	787.0
12	Tamil Nadu	24	410.0	22.5	484.0
13	Uttar Pradesh	14.2	328.0	26.2	885.9
14	West Bengal	5.6	416.0	15.7	650.1

Source: a: taken form A. Vaidhyanathan (1988).
b: Indian Livestock Census (2007) and Central Statistical Organization.

Note:1. For computing adult equivalent, 1 young stock animal is assumed to be equal to half an Adult.
2. DCP stands for Digestible Crude Protein and TDN stands for Total Digestible Nutrient.
3. Bihar includes Jharkhand, Madhya Pradesh includes Chhattisgarh, Punjab includes Haryana and Uttar Pradesh includes Uttarakhand.

The estimates showed significant inter-regional and inter-state variations reflecting the trends and patterns of agricultural production. In general it is seen that in the States of North West (Punjab/Haryana, Rajasthan, and Uttar Pradesh) and Central India (Maharashtra and Gujarat) showed significant improvement in the feed situation. In the Southern States, there has been very little improvement in the feed situation and in Kerala even it has worsed overtime. The number of drought animals and its density per unit of cultivated area has shown a sharp fall in number of States: in some States it is either stagnant or has shown marginal fall. Though the population pressure on land and marginalization of land holding pattern could be one of the factors behind this, the increase in the intensity of agricultural mechanization has been a major contributing factor to the decline in the work animal stock. Since different regions in the Country has witnessed differential trends in the draught animal stock impact of such changes in the feed supply situation would have been different across regions in the Country.

In this context, it is important to address the following issues: (1) what are the emerging patterns of feeding of milch animals across regions in the Country. Are the feeding pattern based on the utilization of crop residues and traditional items of concentrate feeds or has it

been undergoing transformation in to cultivated green fodder and manufactured feed and nutrients. (2) since the distribution of milch animal holdings has been highly in favour of land less and marginal holdings, one would expect the commercialization of milk production to result in the development of market for feed resources, increased dependence of the tiny producers in the market for the procurement of feed resources like green and dry fodder. What sort of pattern has emerged in the procurement of such feed resources? The data from the National Dairy Sample Survey do provide some data to address these issues.

Feeding of MAH by types of feed

The dry fodder fed to livestock in the Country has been largely obtained as the by-products of food grains, pulses, oilseeds and a number of other crops cultivated across regions. Depending on the combination of crops grown in different regions, the feeding pattern of animals with various crop by-products has shown significant variations[13].

Table 16 provides data on the relative incidence of various crops, in the feeding practice adopted by households keeping MAs in different States. The points emerging from this table are briefly as follows: (1) Wheat and Paddy straw constituted the widely used dry fodder in all the States except Gujarat, Maharashtra and Tamil Nadu where its feeding is limited to a smaller percentage of households. As it is well known, larger States has both wet and arid regions where the cropping pattern and the animal agriculture varies a great deal. For instance in Tamil Nadu, some districts paddy is an important crop, grown under irrigated conditions, and paddy straw is an important by-product. In number of other districts, with low rainfall, coarse grains, oilseeds and pulses dominates the cropping pattern, and these crops supplied the dry fodder to animals. (2) Because of the factor noted earlier, the wide variations in the agro-climatic conditions across states/regions in the Country, the availability of dry fodder and its feeding by cattle keeping households has shown significant variations. The changes in the cropping pattern overtime has changed the sources of supply of dry fodder. For instance in Madhya Pradesh 44% of the households reported, feeding of crop residues from soybean crop, and it is a newly introduced crop and replaced the area under coarse grains and other crops.

[13] It needs to be noted that the historical pattern of feeding of animals with crop by products has been undergoing rapid shift in recent decades due to the changes in the cropping patterns. In many regions, area under coarse grains and pulses (the by-products of which are richer in terms of nutritive value for animals) has been replaced by rice, wheat and oilseeds and other commercial crops. Since the straw grain ration is lower for the high yielding varieties compared to the traditional varieties, and the estimates of the ratio separately for the two varieties are not available, for the purpose of the estimates of feed supply we have used the ratio available from the crop cutting surveys conducted in the late sixties. This would have resulted in on the over estimation of the feed supply.

Table 16: Percentage of Milch Animal Holding Households Feeding Various items of Dry Fodder by States

State	Types of Dry Fodder										
	Wheat	Paddy	Bajra	Maize	Jower	Ground nut	Gram	Ragi	potato	casavo	Others
Punjab	96.2	1.6	1.2	1.9	0.7						
Haryana	91.0	11.0	9.0		5.4						0.57
Rajasthan	35.1		69.9	8.6	31.9						2.5
Uttar Pradesh	87.8	2.6	14.4		1.6						1.6
Bihar	85.8	77.9		4.1	1.2						2.8
West Bengal	1.3	45.2		1.6	2.5						69.0
Odisha	0.8	92.9		0.5	0.9		19.3				5.0
Madhya Pradesh	86.4		38.3	10.6							5.6
Gujarat		23.1	16.3	15.1	56.4						11.7
Maharashtra		9.0		20.6	72.5						10.3
Andhra Pradesh		93.2		13.4	4.3	18.6					0.6
Karnataka		66.2		16.1	25.7			22.4			7.3
Kerala		98.3			0.8				0.9		3.6
Tamil Nadu	11.3	23.0		11.3	42.5						8.9
All States	36.0	40.7	11.0		17.9						8.9

Notes: In Madhya Pradesh 44.1 percent of the households reported feeding of crop residues from soybean crop.

Another important source of roughage fed to milch animals is green fodder obtained from cultivated crops, green fodder and natural grass collected from fields. The relative importance of these sources on the feeding practice persued by MAHs given in Table 17, shows the following pattern: (1) The feeding of cultivated green fodder is widespread only in few States, namely Punjab and Haryana, to a large extent and in Madhya Pradesh and Gujarat to a limited extent. (2) The feeding of other grass is generally high in States dominated by rain fed agriculture. (3) The feeding of green fodder from agricultural crops has been noted in a large majority of States. In few States sugarcane top is seen as important source. Coarse grain crops namely Jowar, Bajra, Ragi and Maize are found to be important in some of the States. By-products from crops that are found to be important in specific regions of the Country are also used in the feeding of livestock.

Table 17: Percentage of Milch Animal Households Feeding Green Fodder by type of Fodder

State	Types of Green Fodder							
	Cultivated Green Fodder	Other Grass	Sugar cane top	Jowar	Bajra	Maize	Barley	Other items
Punjab	89.1	1.7	0.6	-	-	-	-	-
Haryana	65.7	10.3	3.7	-	-	-	-	-
Rajasthan	1.9	22.5	-	9.5	9.8	-	-	-
Uttar Pradesh	8.1	12.3	26.9	9.9	15.9	-	-	-
Bihar	2.6	66.8	-	-	-	3.3	-	-
West Bengal	1.2	41.8	-	-	-	-	-	-
Odisha	-	76.8	6.5	-	-	-	-	-
Madhya Pradesh	22.8	67.0	-	4.6	-	6.9	-	-
Gujarat	33.5	22.6	-	9.0	-	19.6	-	-
Maharashtra	4.6	32.9	51.4	28.2	-	37.2	-	
Andhra Pradesh	5.3	4.0		27.9	22.5			
Karnataka	2.7	10.0	12.0	21.4		16.4		
Kerala		89.0						
Tamil Nadu		22.4	12.5	56.4		7.3		

Notes:

1. West Bengal MAH, 4.2% fed cabbage leaves, 2.2% banana leaves
2. Odisha 2.8% of the MA households fed banana leaves, and 1.4% coconut leaves
3. Karnataka 35% of the households fed banana leaves, 2.4%of the households fed hybrid Napier grass, 12.4% of the households fed ragi fodder
4. Kerala 3.7% of the households fed banana leaves, 2.7% of the households given grass, 2.4% hybrid Napier

The survey also provides information on the percentage of households cultivating fodder crops. The crops/fodder varieties included in the definition of fodder crops are not clear from the survey data. One would assume that apart from fodder grass, it may include maize or similar crops cultivated both for grain and fodder. It is seen from the data that the percentage of households cultivating fodder crops is generally very high in the North Western States (Punjab, Haryana, Rajasthan), followed by Uttar Pradesh, Gujarat, Madhya Pradesh, Maharashtra and Karnataka. In the remaining States, the incidence is very low. (Table 18). It is also shown by the data that, the cultivation of fodder crops largely for feeding farm animals and a small percentage of households also raise fodder crops for the purpose of raising fodder seeds for sale. This is generally higher in the North Western States, where the incidence of fodder cultivation is high.

Table 18: Percentage of Households growing Fodder Crops with purpose for Cultivation by States

State	Percentage of Households growing Fodder Crops	Purpose of growing			
		For Own Animals	Fodder for Sale	Fodder Seed for Own Use	Sale of Fodder Seed
Punjab	59	98	5	75	21
Haryana	66	95	2	46	1
Rajasthan	61	97	3	37	24
Uttar Pradesh	74	93	4	39	2
Bihar	13	70	0	3	1
West Bengal	6	48	3	2	2
Odisha	0				
Madhya Pradesh	39	93	0	14	5
Gujarat	68	98	3	13	4
Maharashtra	25	84	1	20	1
Andhra Pradesh	9	85	2	25	3
Karnataka	25	85	3	18	4
Kerala	6	89	3	19	5
Tamil Nadu	13	95	36	28	21
All States	33	93	4	38	8

Table 19: Incidence of MAH Sending Animals for Grazing

State	Percentage of MAH Sending Animals for Grazing	Duration of Grazing			Types of Animals Send for Grazing
		< 6 Months	>6 Months	Total	All Types
Punjab	1	-	-	-	-
Haryana	1	-	-	-	-
Rajasthan	41	66	34	100	45
Uttar Pradesh	18	40	60	100	61
Bihar	28	47	53	100	64
West Bengal	37	68	32	100	74
Odisha	73	37	63	100	94
Madhya Pradesh	65	35	65	100	85
Gujarat	28	33	67	100	33
Maharashtra	26	44	56	100	71
Andhra Pradesh	91	29	71	100	81
Karnataka	56	47	53	100	44
Kerala	38	33	67	100	61
Tamil Nadu	42	38	62	100	54
All States	39	42	58	100	69

Note: Indigenous Cows, Crossbred Cows and Buffaloes, all are taken for grazing. For the Country as a whole IC are send more for grazing followed by buffaloes and CBs. There is regional patterns in this. In Punjab and Haryana no grazing

The practice of sending milch animal for grazing is widespread in some States, but is practically absent in a number of other States. (Table 19) For all the States together 39 percent of the MAH households reported sending their animals for grazing. About 42 percent of the households reported the duration of grazing in a year is less than six months and 58 percent more than six months. In the States of Punjab and Haryana, the grazing by MAH was practically absent. It was 41 percent in Rajasthan, 73 percent in Odisha, 65 percent in Madhya Pradesh, 91 percent in Andhra Pradesh, 56 percent in Karnataka and about 40 percent in Kerala and Tamil Nadu. In the remaining States the figures varied roughly between 20 to 30 percent. About 70 percent of the households send all types of animals for grazing at the all India level and it showed certain degree of variations across States. The scope for sending animals for grazing depends very much on the nature of property rights on land. Apart from privately owned land, non-agricultural land owned by the State, and other uncultivated land by private ownership and available for grazing during some part of the year are the other types of land utilized for grazing. It is seen from the data that 35 percent of the MAH households, used owned land for grazing; 54 percent used common property land and 37 percent used other uncultivated land. (Table 20) In Rajasthan, Bihar, West Bengal, Odisha and Gujarat, the practice of using common property land has been widespread. It was seen to be very low in Uttar Pradesh, Kerala and Tamil Nadu. The use of own land for grazing was insignificant in Bihar, West Bengal and Odisha. As far as the utilization of other uncultivated land was concerned, it was relatively high in Kerala, Tamil Nadu, Andhra Pradesh, Maharashtra and Gujarat. Access to private land for grazing, when there are no standing crops, (and where there are no enclosures) would vary depending on the current fallow, cropping intensity etc. Apart from agro-climatic conditions, availability of irrigation etc., institutional factors also play a crucial role in the availability of such lands. For instance in Kerala, fallow land has been increasing overtime due to the decline in Paddy cultivation because of the scarcity of labour, poor State of agricultural mechanization and increase in the cost of cultivation. Such lands kept fallow has provided opportunities for land less and marginal farmers not only for grazing their animals, but also for the cultivation of grass for stall feeding of animals.

Table 20: Percentage of MAH households sending Animals for grazing by type of grazing land

State	Non-agricultural Land	Own Land	Other Uncultivated Land	Others
Punjab	-	-	-	-
Haryana	-	-	-	-
Rajasthan	60	66	34	4
Uttar Pradesh	18	64	19	10
Bihar	64	11	33	4
West Bengal	56	11	36	14
Odisha	85	3	30	8
Madhya Pradesh	45	47	20	9
Gujarat	81	27	54	12
Maharashtra	49	42	42	14
Andhra Pradesh	44	36	51	11
Karnataka	57	61	21	20
Kerala	38	45	63	21
Tamil Nadu	29	48	54	9
All States	54	35	37	11

Regarding the feeding of concentrate feed to animals, significant difference are noted in the sources and pattern of feeding across regions in the Country. (Table 21). Some of the salient aspects to be noted in this context are briefly summarised as follows: (1) Oil cakes continue to retain its dominant position in the feeding practice of milch animals. The type of oil cake fed is very much influenced by the production pattern: (2) feeding of whole grain is reported to a certain extent in many States. The use of wheat grain as animal feed is noted in States where wheat is cultivated as an important crop. In a number of States, feeding of coarse grains like maize and bajra is also noted. (3) Wheat and Rice bran are fed to milch animals in most of the States. (4) Balanced cattle feed which is better from a nutritional perspective for high yielding milch animals are widely fed only in couple of States (Kerala and Karnataka): though few other States also reports its feeding the incidence is very low. The feeding of bypass protein and mineral mixture are also practically absent in most of the States. (5) In large part of the Country, farmers seems to follow the traditional practice of concentrate feeding.

Table 21: Top Five Concentrate Feeds Fed to Milch Animals

State	Maximum No.of HHs	2nd Max. No. of HHs	3rd Max. No. of HHs	4th Max.No.of HHs	5th Max.No.of HHs
Punjab	Mustard Cake (42.6)	Cottonseed Cake (24.1)	Wheat Grain (17.8)	Maize Grain(15.2)	Chunni(14.0)
Haryana	Mustard Cake (36.9)	Cottonseed Cake(35.6)	Wheat Grain (28.6)	Wheat Bran(25.2)	Cottonseed (10.7)
Rajasthan	Cottonseed Cake (31.3)	Mustard cake(20.5)	Cottonseed (10.0)	Balance Cattle Feed(8.0)	Chunni (7.9)
Uttar Pradesh	Mustard Cake (64.9)	Wheat Bran(39.5)	Wheat Grain (10.7)	Bajra(6.5)	Chunni (4.9)
Bihar	Mustard Cake (29.0)	Wheat Bran(19.1)	Wheat Grain (14.2)	Maize Grain(8.6)	Others (6.1)
West Bengal	Mustard Cake (53.3)	Other(35.3)	Rice Bran(9.2)	Maize Grain(5.6)	Wheat Bran (5.6)
Odisha	Rice Bran (88.2)	Wheat Bran(11.0)	Chunni(3.0)	Others(2.9)	Balance Cattle Feed (1.5)
Madhya Pradesh	Cottonseed Cake (22.9)	Wheat Bran(18.4)	Chunni (6.1)	Mustard cake(4.2)	Balance Cattle Feed (4.2)
Gujarat	Cottonseed Cake (50.4)	Other(12.4)	Maize Grain (10.1)	Balance Cattle Feed (8.7)	Wheat Grain (6.3)
Maharashtra	Cottonseed Cake (47.8)	Wheat Bran(11.9)	Balance cattle Feed(10.1)	Others (7.5)	Maize Grain (6.8)
Andhra Pradesh	Rice Bran (18.5)	Other (16.0)	Mineral Mixture (13.6)	Gur (8.3)	Bajra (6.6)
Karnataka	Balance Cattle Feed (24.1)	Groundnut Cake(16.7)	Others(9.3)	Bypass Protein (8.0)	Chunni (6.8)
Kerala	Balance Cattle Feed (59.1)	Coconut Cake (30.5)	Groundnut Cake (11.0)	Wheat Bran (6.1)	Rice Bran (2.4)
Tamil Nadu	Cottonseed (26.0)	Cottonseed Cake (22.0)	Rice Bran (15.6)	Coconut Cake (11.7)	Groundnut Cake (6.8)
All States	Mustard Cake (18.4)	Cottonseed (17.6)	Wheat Bran(11.2)	Rice Bran (9.1)	Balance Cattle Feed (8.9)

Source of Data: DRS (2013)

Note: Parenthesis gives the percentage

Procurement of Feed and Feeding Practice

Due to the asymmetry in the distribution of milch animals and owned land trading of feed resources in the open market or between farmers etc. has become a regular feature of the rural economy. By utilizing the data from the National Dairy Sample Survey, we will examine the prevalence of these trading activities in different regions of the Country. In the case of green fodder, 21 percent of the sample households in the Country as a whole, reported its purchase. (Table 22). Across States, 49 percent in Maharashtra, 45 percent in Kerala, about 40 percent in Tamil Nadu, Andhra Pradesh and Punjab reported purchase of green fodder. In the remaining States, the incidence of purchase was very low or negligible. In 12 out of 14 States in the Country, more than 1/3rd of the MAH households reported its purchase for 9 to 12 months of the year. (Table 23). Break down of the distribution of purchase to meet the green fodder requirement for shorter periods did not reveal any pattern across regions: it varied from State to State. It appears from the incidence of purchase and its distribution by duration of requirement, that there has been development of a market for green fodder.

Table 22: Percentage of MAH households reporting purchase of Feed and Fodder

State	Green Fodder	Dry Fodder	Concentrates
Punjab	40	48	84
Haryana	15	33	69
Rajasthan	7	23	70
Uttar Pradesh	7	32	69
Bihar	3	52	42
West Bengal	8	66	67
Odisha	0	9	39
Madhya Pradesh	11	27	37
Gujarat	13	28	74
Maharashtra	49	33	70
Andhra Pradesh	40	70	49
Karnataka	18	31	47
Kerala	45	64	73
Tamil Nadu	41	36	63
All States	21	39	61

Source of Data: DRS (2013)

Table 23: Percentage of MAH households purchasing Feed and Fodder by duration of Requirement: Green Fodder

State	Up to 3 Months	3 to 6 Months	6 to 9 Months	9 to 12 Months	All
Punjab	6	63	3	28	100
Haryana	32	57	0	11	100
Rajasthan	19	40	24	17	100
Uttar Pradesh	30	40	5	25	100
Bihar	24	40	12	24	100
West Bengal	56	10	5	29	100
Odisha	34	33	0	33	100
Madhya Pradesh	13	35	10	42	100
Gujarat	21	41	15	23	100
Maharashtra	23	40	10	27	100
Andhra Pradesh	37	35	1	27	100
Karnataka	64	9	3	24	100
Kerala	34	3	3	60	100
Tamil Nadu	11	37	18	34	100
All States	26	35	7	32	100

Source of Data: DRS (2013)

Table 24: Percentage of MAH households purchasing Feed and Fodder by duration of Requirement: Dry Fodder

State	Up to 3 Months	3 to 6 Months	6 to 9 Months	9 to 12 Months	All
Punjab	1	13	3	83	100
Haryana	5	13	5	77	100
Rajasthan	12	44	11	33	100
Uttar Pradesh	13	35	12	40	100
Bihar	10	61	9	20	100
West Bengal	7	19	10	64	100
Odisha	14	46	25	15	100
Madhya Pradesh	8	27	17	48	100
Gujarat	15	25	13	47	100
Maharashtra	23	50	8	19	100
Andhra Pradesh	16	34	3	47	100
Karnataka	48	21	6	25	100
Kerala	30	8	7	55	100
Tamil Nadu	19	45	15	21	100
All States	16	29	9	46	100

Source of Data: DRS (2013)

Coming to dry fodder, the percentage of households reporting its purchase is much higher than green fodder in all regions in the Country. (Table 24). For all the States taken together

about 40 percent of the MAH households reported purchase of dry fodder: In few States namely Kerala, Andhra Pradesh and West Bengal, the incidence of purchase was about 60 to 70 percent, in Punjab and Bihar, it was about 50 percent and in few States it ranged between 30 to 40 percent. Only in Odisha its incidence was very low; less than 10 percent. As far as the duration of purchase is concerned, 46 percent of the MAH households who reported purchase, procured 9 to 12 months of this requirement. In four States, namely Kerala, West Bengal, Punjab and Haryana, more than 50 percent of the households reporting purchase of dry fodder procured it to meet the requirement till the last quarter of the year. In another four States it ranged between 30 to 40 percent and in some States it was less than 20 percent.

Coming to concentrate feeds, 61 percent of the MAH households reported its purchase. The percentage was above all India average in Kerala, Tamil Nadu, Maharashtra, Gujarat, West Bengal, Uttar Pradesh, Rajasthan, Haryana and Punjab and ranged between 40 to 50 percent in Bihar, Andhra Pradesh and Karnataka and was 34 percent in Orissa, and 37 percent in Madhya Pradesh. The distribution of procurements to meet the requirement over periods of the year, did not show any pattern except that in some States, the percentage of MAH households reporting its purchase to meet the requirement for a major part of the year (9 to 12 months) is very high in few States. (Table 25).

Table 25: Percentage of MAH households purchasing Feed and Fodder by duration of Requirement: Concentrates

State	Up to 3 Months	3 to 6 Months	6 to 9 Months	9 to 12 Months	All
Punjab	1	5	4	90	100
Haryana	2	21	24	53	100
Rajasthan	2	8	13	77	100
Uttar Pradesh	5	16	7	72	100
Bihar	14	31	10	45	100
West Bengal	7	13	6	74	100
Odisha	9	38	15	38	100
Madhya Pradesh	16	10	11	63	100
Gujarat	6	24	22	48	100
Maharashtra	14	41	7	38	100
Andhra Pradesh	57	13	1	29	100
Karnataka	80	4	1	15	100
Kerala	39	1	4	56	100
Tamil Nadu	17	35	21	27	100
All States	17	18	10	55	100

Source of Data: DRS (2013)

The difference in the pattern of procurement of different types of feed across regions in the Country would have to be viewed keeping in mind (a) the seasonality in the availability and (b) the financial position of MAH households to procure and store the feed for longer periods. More farm level studies are needed to understand the behaviour of MAH households in the procurement and storage of feed resources. In this context, an interesting information available for the NDSS is the sources of purchase of different types of feed. The sources of purchase included in the survey were the Co-operative Marketing Organizations, fellow farmers in the village, fellow farmers from the other villages and from the open market. (See Table 26). The survey revealed that for all the regions taken together, 52 percent of the MAH households, procured green fodder from fellow farmers, in the village, 13 percent from fellow farmers from outside the village, and 29 percent from the open market. The role of Co-operative organizations were insignificant; so also was the incidence of procurement from multiple sources. It is also seen that in general the MAH households in the Southern States procured bulk of their green fodder from the open market and from the fellow farmers with in the village, whereas, those who are in North and Central India made bulk of their procurement from fellow farmers with in the village.

Table 26: Percentage of MAH households practising Green Fodder by Sources

State	Sources of Purchase					
	Only DCS/ NGC/ Milk Union	Only Fellow Farmers in the Village	Only Farmer from Other Villages	Open Market	More than One Source	All
Punjab	0	88	8	4	0	100
Haryana	1	64	28	7	0	100
Rajasthan	0	37	55	7	1	100
Uttar Pradesh	0	75	6	19	0	100
Bihar	3	61	15	21	0	100
West Bengal	0	40	6	49	5	100
Odisha	0	0	0	100	0	100
Madhya Pradesh	0	87	3	9	1	100
Gujarat	1	69	11	17	2	100
Maharashtra	1	71	15	6	7	100
Andhra Pradesh	3	19	15	61	2	100
Karnataka	21	20	10	48	1	100
Kerala	4	40	5	51	0	100
Tamil Nadu	0	34	18	40	8	100
All States	3	52	13	29	3	100

Source of Data: DRS (2013)

Regarding the procurement of dry fodder, for all the regions together 53 percent of the MAH households purchased it from fellow farmers with in the village, 21 percent from fellow farmers from other villagers, and 22 percent from the open market. (Table 27). Across regions MAH households in North and Central India obtained substantial part of their requirement from fellow farmers from within the village. All the three sources seems to be important, in the Southern States. In Kerala open market is more important than the other sources. In the case of concentrate feeds, open market purchase dominated in all the States, except Karnataka, Kerala, Maharashtra and Gujarat, where Co-operatives has also played an important role.

Table 27: Percentage of MAH households purchasing Dry Fodder by Sources

State	Only DCS/ NGC/ Milk Union	Only Fellow Farmers in the Village	Only Farmer from Other Villages	Open Market	More than One Source	All
Punjab	0	90	6	4	0	100
Haryana	0	58	37	4	1	100
Rajasthan	0	46	32	20	2	100
Uttar Pradesh	0	60	25	15	0	100
Bihar	0	67	18	13	2	100
West Bengal	0	61	11	18	10	100
Odisha	0	64	18	15	3	100
Madhya Pradesh	0	78	11	8	3	100
Gujarat	1	64	17	16	2	100
Maharashtra	1	68	17	11	3	100
Andhra Pradesh	1	30	38	30	1	100
Karnataka	12	31	19	37	1	100
Kerala	1	24	13	61	1	100
Tamil Nadu	0	34	26	33	7	100
All States	1	53	21	22	3	100

Source of Data: DRS (2013)

Table 28: Percentage of MAH households Feeding Milch Animals by Feed and Fodder type

State	Feed & Fodder Type		
	Green Fodder	Dry Fodder	Concentrates
Punjab	94	100	84
Haryana	85	100	90
Rajasthan	43	100	79
Uttar Pradesh	66	100	90
Bihar	75	100	56
West Bengal	52	100	76
Odisha	79	100	94
Madhya Pradesh	81	100	54
Gujarat	80	100	80
Maharashtra	91	100	77
Andhra Pradesh	77	100	55
Karnataka	59	100	65
Kerala	96	100	91
Tamil Nadu	99	100	88
All States	77	100	77

Source of Data: DRS (2013)

Table 29: Incidence of Concentrate Feeding by Animal Type

State	In Milk Animal		Dry Animal	
	Base	Percent	Base	Percent
Punjab	964	89	327	30
Haryana	976	89	231	71
Rajasthan	899	83	419	34
Uttar Pradesh	822	90	460	63
Bihar	677	48	453	40
West Bengal	624	73	628	60
Odisha	611	88	568	88
Madhya Pradesh	788	58	581	23
Gujarat	872	90	436	13
Maharashtra	864	79	476	24
Andhra Pradesh	925	44	645	33
Karnataka	999	58	409	38
Kerala	932	83	285	79
Tamil Nadu	936	84	339	66
All States	11889	76	6257	46

Source of Data: DRS (2013)

Note: Base, number of milch animals in the sample holdings.

Certain features of the feeding practice followed by MAH households are available from the survey. (Table 28). For all the States together, all the MAH households reported feeding of dry fodder to their animals: however, the incidence of feeding of green fodder and concentrates tend to be lower: 77 percent. In the case of green fodder, for a large number of States, it was above 75 percent, in Rajasthan, West Bengal and Karnataka, it was relatively low. The incidence of concentrate feeding, was above 75 percent in all the States, except in Bihar, Madhya Pradesh and Andhra Pradesh, where it was only about 55 percent. As is to be expected, the percentage of in-milk animals fed with concentrate feeds was significantly higher than that of dry animals. For the Country as a whole, the percentage for in-milk animals was 71 percent against 46 percent for dry animals. Across States, significant difference are noted in the incidence of concentrate feeding for in-milk and dry animals. (Table 29). For instance in Gujarat 96 percent of the in-milk animals are fed with concentrates, whereas only 13 percent of the dry animals are fed with concentrates. On the other hand in Kerala and Tamil Nadu, the differences in the incidence between the two groups of animals are relatively low. A variety of factors could have contributed to these differences: for instance if the inter calving intervals is low, by and large all the dry animals are also fed concentrates with in-milk animals. If a large percentage of animals remain dry and the calving intervals is longer, farmers may not feed these dry animals with expensive feeds. More research is needed to understand the factors behind such variations.

In brief, analysis of the data on the feeding practices of milch animals, reveals that the practise are very much shaped by the availability of local feed resources like crop residues, oil cakes etc. The use of manufactured cattle feed, mineral mixture etc is very limited and is confined largely to one or two States. The use of cultivated green fodder is not widespread and confined mostly to few States in Western India. However a market has developed for grass and green fodder as evident from the percentage of households who are involved in its purchase. Similarly, market for dry fodder has also developed in all the regions of the Country. The frequency and duration of purchase of these two items further reinforces this argument. The practise of sending milch animals for grazing is widespread and in most of the States (except Punjab and Haryana) and no uniform pattern is noted on the nature of land where the animals were send for grazing. However, the data shows the importance of common grazing land in most of the States; and in few States, other un-cultivated land (land kept fallow) is also seen to be important.

V. Distribution of Milch Animals.

The census of 3.44 lakh households spread over the 14 major States showed that in the Country as a whole, 35 percent of the rural households owned milch animals[14]. Across different State, its ownership was the lowest in Kerala (8 percent) followed by Tamil Nadu (16 percent) and the highest was in Utter Pradesh (57 percent), closely followed by Rajasthan, Madhya Pradesh and Haryana (Table 30). In a large number of States, its ownership ranged from 30 to 40 percent. The average number of milch animals per reporting household for the Country as a whole was 1.8. For a large majority of States it varied between 1.7 and 2.1 and the States that reported below this range were Bihar and Odisha.

Table 30: Percentage of Rural Households Reporting MAH and Average Number of Animals per reporting Households

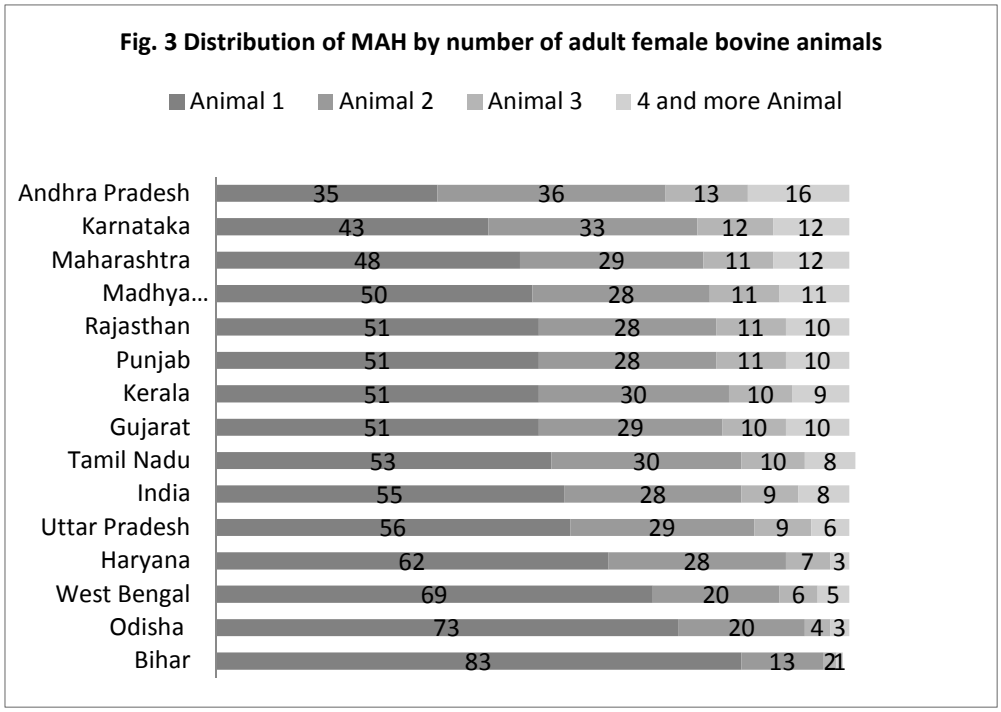
Sl. No	State	Incidence of Milch Animal Ownership		Adult Female Bovine Holdings	
		Total number of HH listed	Milch animal owning HHs (%)	Number of Sample households	Number of animals per holding
1	Punjab	21450	38	1080	1.9
2	Haryana	30005	53	1080	1.6
3	Rajasthan	20418	55	1080	1.9
4	Uttar Pradesh	23462	57	1080	1.7
5	Bihar	26092	33	1081	1.3
6	West Bengal	25103	27	1081	1.7
7	Odisha	16377	32	1080	1.4
8	Madhya Pradesh	16283	52	1080	2
9	Gujarat	27119	32	1079	1.7
10	Maharashtra	25013	34	1080	2.1
11	Andhra Pradesh	25600	31	1077	2.1
12	Karnataka	24768	40	1081	2.1
13	Kerala	33077	8	985	1.8
14	Tamil Nadu	29462	16	1048	1.8
15	India	344229	35	14992	1.8

Source of Data: DRS (2013)

The data on the distribution of MAH by number of animals owned per reporting household revealed the following: (1) For the Country as a whole, 55 percent of the holdings reported one animal, 28 percent two animals, 9 percent three animals and 8 percent four or more animals. (2) Significant variations are noted in this across States in the Country. In the States of Haryana, Bihar, West Bengal and Odisha, the percentage of holdings with one animal were

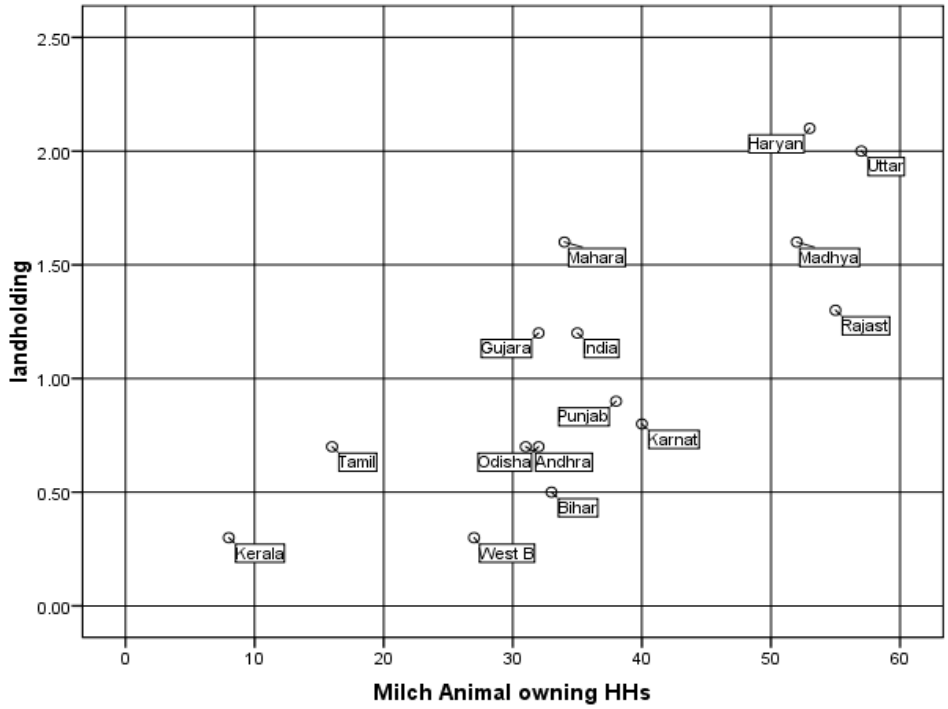
[14] Whether the pattern of ownership and distribution of milch animals has been undergoing rapid shift in recent years in very difficult to examine in the absence of comparable data.

much higher than the all India average: whereas in Karnataka and Andhra Pradesh, were far below the all India average. (3) In States where the single MAs dominated the structure, the percentage of holdings with three or more MA are much lower than in other States. It is also noted that in States were households with one or two MAs are higher, their percentage share of MHs in the total, accounts for a lower share compared to their share in the total number of holdings. At the all India level, 83 percent of the holdings reported only one or two MAs, they accounted for 61 percent of the MAs, whereas 17 percent of the holdings with more than three MAs accounted for 39 percent of the MAs.



The distribution of MAs owning households by number of MAs needs to be viewed in the broader background of the distribution of MAs by size distribution of land holding. It is seen from the data that the land less households accounts 23 percent of the MAs. This percentage varied significantly across regions in the Country with highest (52 percent) in Tamil Nadu, followed by Punjab (41 percent) and the lowest in Rajasthan (9 percent) and Odisha (5 percent). If we add the share of the land less with that of the marginal holdings, they would account for more than 2/3rd of the MAs in the Country. For a number of States, their share is more than 80 percent and in a few States, especially Utter Pradesh, Maharashtra, Madhya Pradesh and Rajasthan, the share of the larger size of holdings are found to be relatively high.

Figure 4 Scatter plot showing landholdings and milch animal ownership, 2013



Source of Data: DRS (2013)

Table 31: Average land holding by Land Holding Class (in Ha)

State	Marginal Farmers (<1Hz)	Small Farmers (1-2Ha)	Semi-medium Farmers (2-4 Ha)	Medium Farmers (4-10 Ha)	Large Farmers (>10Ha)	All
Punjab	0.4	1.3	2.6	5.3	12.4	0.9
Haryana	0.5	1.4	2.7	5.7	12.9	2.1
Rajasthan	0.4	1.2	2.5	5.4	12.9	1.3
Uttar Pradesh	0.5	1.3	2.7	5.8	12.5	2
Bihar	0.3	1.2	2.5	5.7	13.1	0.5
West Bengal	0.3	1.4	2.2	6.4	-	0.3
Odisha	0.5	1.3	2.3	5.6	15.7	0.7
Madhya Pradesh	0.5	1.3	2.6	5.7	13.2	1.6
Gujarat	0.4	1.5	2.7	5.4	13.2	1.2
Maharashtra	0.5	1.4	2.4	5.4	12.7	1.6
Andhra Pradesh	0.4	1.3	2.4	5.5	15.5	0.7
Karnataka	0.5	1.4	2.4	5.9	12.9	0.8
Kerala	0.1	1.2	2.8	4.8	18.2	0.3
Tamil Nadu	0.6	1.4	2.5	5.3	10.4	0.7
All States	0.4	1.3	2.6	5.6	12.6	1.2

Source of Data: DRS (2013)

It is interesting to highlight socio-economic characteristics of households owning MAs. The average size of land cultivated by MAH households was about 1.2 ha for the Country as a whole, with the lowest of 0.3 ha for Kerala and West Bengal to the higher of about 2 ha in Haryana and Utter Pradesh. The scatter plot mapping the relationships between land holdings and milch animal ownership shows that as one moves from regions with land size of holdings, the percentage of households owing milch animals also tends to increase (see fig 4). However, there exists a number of outliers due to high percentage of land less households owning milch animals. On an average the marginal holdings who accounts for a substantial share of MAHs owned only less than half a hectare of land in all the States in the Country. This combined with the fact that land less households also constitutes an important segment of the MAHs implies that the production of milk is largely carried out by resource poor and weaker sections of the society. This fact is further evident from other indicators relating to their position in the poverty ladder, social groups, educational attainment and occupational pattern. A distribution of MAH households by APL, BPL categories showed that about ½ of the households belonged to the BPL category for the Country as a whole. (Table 32)

Table 32: Percentage distribution of MAH by economic group

State	APL	BPL+Antyodya	Total
Punjab	85	15	100
Haryana	76	24	100
Rajasthan	80	20	100
Uttar Pradesh	70	30	100
Bihar	46	54	100
West Bengal	51	49	100
Odisha	48	52	100
Madhya Pradesh	52	48	100
Gujarat	60	40	100
Maharashtra	59	41	100
Andhra Pradesh	8	92	100
Karnataka	22	78	100
Kerala	53	47	100
Tamil Nadu	28	72	100
All States	54	46	100

Source of Data: DRS (2013)

However, this varied across States in the Country with the highest percentages in Andhra Pradesh (92%), Karnataka (78%) and Tamil Nadu (72%) and the lowest percentages in

Punjab (15) and Haryana. Coming to the distribution of MAH by social groups at the all India level, 49 percent of the MAH households belonged to OBC, 27 percent to the forwarded communities, 18 percent SC and 6 percent ST. the composition of social groups and MAH holdings showed differences across States in the Country. In Punjab, Haryana, West Bengal, Maharashtra, Karnataka and Kerala about 50 percent of the MAH holdings belonged to the forward communities: the participation of OBC households in the rearing of MAs is seen to be relatively very high in all the States except Punjab (14%), Haryana (31%), West Bengal (10%) and Maharashtra (31%). The percentage of SC households is relatively high in Punjab and West Bengal and few States namely Rajasthan, Madhya Pradesh, Gujarat and Karnataka, the share of ST's in the MAH households are relatively better than in other States. (Table 33).

Table 33: Percentage distribution of MAH by Social Group

State	General	SC	ST	OBC	Total
Punjab	50	36	0	14	100
Haryana	50	19	0	31	100
Rajasthan	22	15	11	52	100
Uttar Pradesh	20	23	0	57	100
Bihar	27	16	4	53	100
West Bengal	47	37	6	10	100
Odisha	30	20	7	43	100
Madhya Pradesh	18	16	10	56	100
Gujarat	24	6	17	53	100
Maharashtra	56	9	4	31	100
Andhra Pradesh	35	17	3	45	100
Karnataka	46	15	10	29	100
Kerala	47	9	1	43	100
Tamil Nadu	4	15	6	75	100
All States	27	18	6	49	100

Source of Data: DRS (2013)

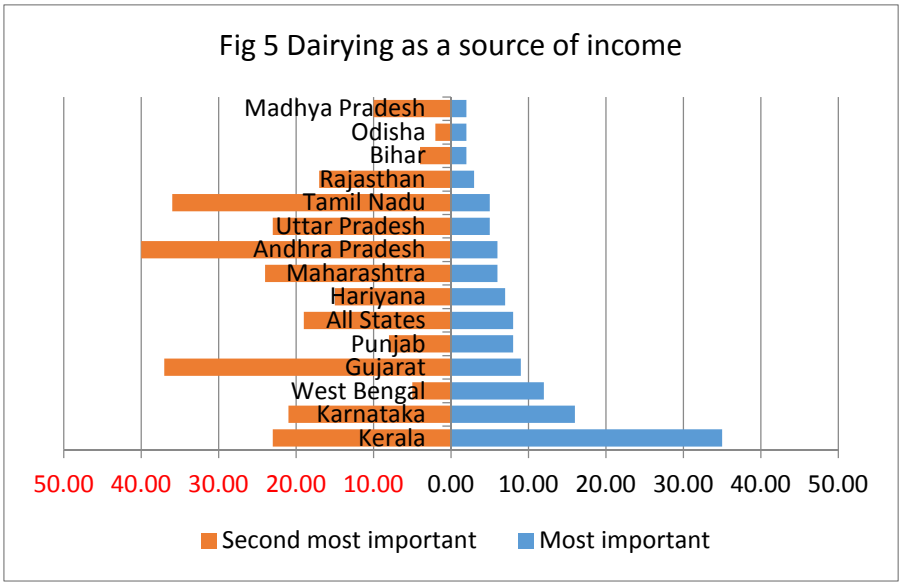
The survey also showed that MAH households belonged to the educationally backward with 42 percent of the members belonging to the category of illiterate or with no formal education and 31 percent with below 8th standard for all the States together. Across States, about 70 to 75 percent of the MAH households belonged to the illiterate and below 8th standard educational groups; the only exception in this context was Kerala where 42 percent of the MAH had educational levels above 8th standard (Table 34).

Table 34: Percentage distribution of the head of MAH households by level of education

State	Illiterate/no formal education	till class 8	class 9 to class 12	Graduation and above	
Punjab	39	30	28	3	100
Haryana	37	31	28	4	100
Rajasthan	45	31	17	7	100
Uttar Pradesh	40	29	26	5	100
Bihar	53	21	21	5	100
West Bengal	47	36	15	2	100
Odisha	30	40	25	5	100
Madhya Pradesh	48	37	12	3	100
Gujarat	47	32	18	3	100
Maharashtra	31	37	27	5	100
Andhra Pradesh	67	18	13	2	100
Karnataka	46	24	26	4	100
Kerala	13	45	38	4	100
Tamil Nadu	48	27	21	4	100
All States	42	31	23	4	100

Source of Data: DRS (2013)

Data on the importance of dairying as a source of household income. Showed that only for 8 percent of the MAH households, this activity constituted as the most important source of income. However, there exists variations in this across States in the Country, with MAH households in Kerala reporting this as the highest source of income (for 35%), followed by Karnataka (16 percent). In a large number of States, dairying is the second most important source of income. (Table Figure 5).



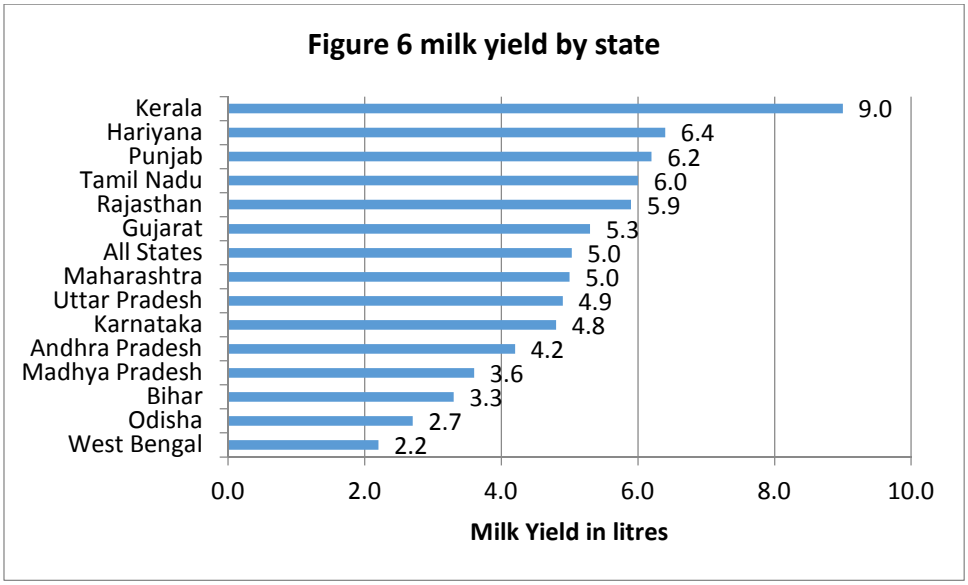
Source of Data: DRS (2013)

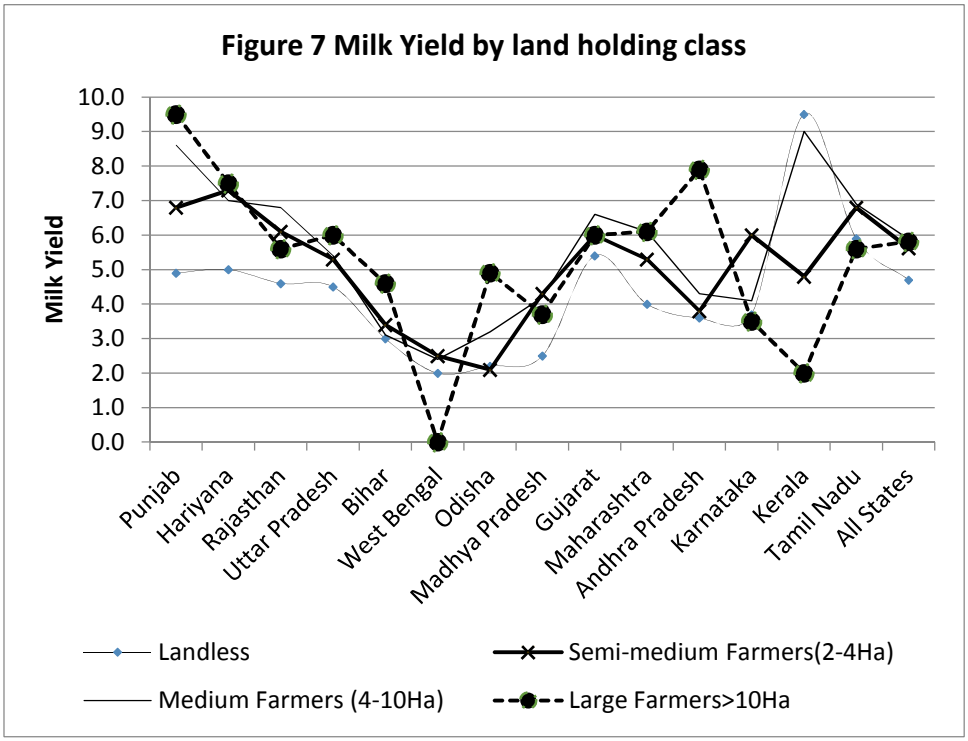
In brief, analysis of the data on the socio-economic characteristics of owners of milch animal holdings showed that there exists significant variations in the percentage of households owing it: from as low as 8 percent in Kerala to the highest of 57 percent in Uttar Pradesh. The average number of animals per households varied in between 1.3 to 2 across regions with a very high share of households with one animal in all the States except Andhra Pradesh. The percentage share of land less households in the total milch animal holdings is high in number of States. The land less along with marginal farmers accounted for more than 70 percent of the milch animals in different regions there by showing that the animal ownership is largely with the weaker sections of the society. Data on other socio-economic characteristics further reinforces this argument. Dairying is seen to be second most important source of income for MAH households in most of the States. However in Kerala and Karnataka, it is seen to be the most important source of income, than in other States.

VI. Household Production of Milk

The survey provides estimates of the average yield per animal in-milk by land holding class, social and household economic group. It is seen that the average daily milk yield of MAs (break up of yield figures for cows and She-Buffaloes are not available separately in the survey) for all the States together was 5.03 litres per day: The average daily milk yield per milch animal across States reveals that it is the highest in Kerala, followed by Haryana, Punjab and Tamil Nadu and lowest in Odisha and West Bengal (See graph 6).

The data reveals an increase in the yield levels, as one moves from landless and marginal categories to small, semi-medium and medium farmers and remains fairly stable in the subsequent category of large farmers (graph 7). Across different States in the Country, a large majority of the States, one could see the positive relationship between milk yield and size land holding: the exceptions to this pattern are noted in the southern States of Kerala and Tamil Nadu where the yield levels obtained by the landless and marginal groups are close to the levels realised by other size groups.





Source of Data: DRS (2013)

The yield levels per milk animals realized by households in the APL group was seen to be higher than that of the BPL group. This pattern is seen to hold in most of the states (Table 35) except in the South, where the differences in the yield levels between the two groups were negligible. Coming to social groups, at the all India level, the milk yield obtained by the general category (forward communities) and the OBC were more or less equal, the levels achieved by SC and ST were found to be lower. (Table 36).

This combined with a similar relation between yields per animal in-milk and size of land holdings would imply that the average milk production per household would increase with increase in size of land holding. This seems to hold across States in the Country, except Kerala; the reasons why Kerala is outside this relationship may be due to the fact that the average household production by the landless and marginal categories of holdings are much higher than in other size groups.

The estimates of the distribution of milk production by size of land holdings showed that 20 percent was contributed by landless, and 43 percent by the marginal holdings and the rest of the size categories contributed to the remaining 35 percent of the production. Across regions in the Country, the estimates revealed the importance of landless and marginal land holdings to the total milk production: however, the relative importance of other size of classes has shown considerable variations. In the States of Punjab, Haryana, Rajasthan, Uttar Pradesh, Madhya Pradesh and Maharashtra, the contribution of small farmers and above were higher than the all India share. On the other hand, in the remaining States, the share of landless and marginal holdings were higher than the all India share. The estimates clearly indicates the prominent role played by the resource poor segments of the rural households in the production of milk.

Table 35: Average daily milk yield per animal in milk (in litres) by economic group

	Economic Group		
State	APL	BPL+Antyodaya	All
Punjab	6.40	4.90	6.20
Haryana	6.80	4.80	6.40
Rajasthan	6.00	5.50	5.90
Uttar Pradesh	4.90	4.70	4.90
Bihar	3.60	3.00	3.30
West Bengal	2.50	1.80	2.20
Odisha	2.90	2.40	2.70
Madhya Pradesh	3.80	3.40	3.60
Gujarat	5.70	4.70	5.30
Maharashtra	5.40	4.50	5.00
Andhra Pradesh	4.10	4.20	4.20
Karnataka	4.80	4.70	4.80
Kerala	9.00	9.00	9.00
Tamil Nadu	6.50	5.70	6.00
All States	5.32	4.63	5.03

Source of Data: DRS (2013)

Table 36: Average Daily Milk Yield of animals in milk (in litres) by Social Group

State		Social Group			
	General	SC	ST	OBC	All
Punjab	6.70	5.10	-	6.00	6.20
Haryana	6.80	4.80	-	6.50	6.40
Rajasthan	5.20	5.20	5.90	6.30	5.90
Uttar Pradesh	5.30	4.30	3.60	4.90	4.90
Bihar	3.30	3.10	1.80	3.40	3.30
West Bengal	2.30	1.80	2.30	2.70	2.20
Odisha	3.60	2.20	1.10	2.40	2.70
Madhya Pradesh	4.10	2.70	2.40	3.80	3.60
Gujarat	5.60	5.50	3.10	5.60	5.30
Maharashtra	5.40	5.00	3.50	4.50	5.00
Andhra Pradesh	4.30	3.80	3.30	4.20	4.20
Karnataka	5.20	4.10	4.90	4.40	4.80
Kerala	8.90	8.80	9.90	9.10	9.00
Tamil Nadu	4.40	5.90	5.40	6.20	6.00
All States	5.14	4.33	4.43	5.22	5.03

Source of Data: DRS (2013)

Table 37: Milk Production per household by Land Holding Class

State	Landless	Marginal farmers (<1Ha)	Small Farmers (1-2Ha)	Semi-medium Farmers(2-4Ha)	Medium Farmers (4-10Ha)	Large Farmers >10Ha	All
Punjab	5.66	9.85	13.6	12.13	21.15	32.01	9.76
Haryana	5.75	8.09	8.24	10.47	10.61	10.39	8.48
Rajasthan	5.34	7.92	10.28	9.63	11.5	13.62	8.86
Uttar Pradesh	5.5	5.33	6.17	7.84	7.96	11.31	6.65
Bihar	3.2	3.54	5.54	3.91	3.08	6.93	3.64
West Bengal	2.19	2.62	2.58	4.71	2.95	-	2.51
Odisha	2.33	3.27	3.74	2.94	6.22	14.75	3.29
Madhya Pradesh	3.24	5	5.33	6.97	7.41	8.16	5.49
Gujarat	6.88	6.57	7.96	9.21	10.61	11.09	7.46
Maharashtra	6.18	7.24	9.19	9.3	12.72	12.54	8.55
Andhra Pradesh	5.32	6.51	8.8	10.81	12.61	15.63	6.85
Karnataka	5.52	7.18	7.24	9.47	6.84	4.47	7.01
Kerala	14.6	13.35	8.75	4.81	9	2	13.43
Tamil Nadu	8.26	8.02	10.79	12.37	20.74	33.04	9.42
All States	6.11	6.32	7.82	8.89	10.11	12.97	7.23

Source of Data: DRS (2013)

The analysis presented in this Section shows that there are notable variations in the average households production of milk. One would expect this to be higher in States dominated by she-buffaloes, because of the higher yields of the species. However, with the widespread adoption of crossbred cows this pattern has undergone change with States like Kerala and Tamil Nadu recording higher levels of production. The yield of milch animals recorded by landless and marginal holdings are lower than other size groups. In fact there is a positive association between yield per milk animal and size of holdings. It is seen from our estimates that the land less, marginal and small farmers together contributes to bulk of the milk production in the Country.

Table 38: Percentage Distribution of milk production of MAH by landholding class

State	Landless	Marginal farmers (<1Ha)	Small Farmers (1-2Ha)	Semi-medium Farmers (2-4Ha)	Medium Farmers (4-10Ha)	Large Farmers >10Ha	All
Punjab	24.3	34.1	15.7	11.4	11.1	3.4	100.0
Haryana	17.2	24.2	14.8	21.3	16.5	6.2	100.0
Rajasthan	3.0	47.6	23.3	15.3	9.1	1.5	100.0
Uttar Pradesh	13.3	21.8	21.5	23.8	14.5	5.1	100.0
Bihar	25.7	56.9	12.3	4.3	0.9	0.0	100.0
West Bengal	28.0	64.9	5.2	1.9	0.0	0.0	100.0
Odisha	6.4	71.1	16.0	4.5	1.9	0.0	100.0
Madhya Pradesh	11.0	35.9	20.2	17.1	12.6	3.1	100.0
Gujarat	13.0	48.0	16.2	11.2	10.1	1.5	100.0
Maharashtra	10.9	28.0	21.5	21.8	16.4	1.5	100.0
Andhra Pradesh	21.4	49.7	15.2	7.8	3.6	2.3	100.0
Karnataka	15.0	57.6	16.6	8.1	2.0	0.6	100.0
Kerala	28.1	70.2	1.3	0.4	0.0	0.0	100.0
Tamil Nadu	46.0	20.6	16.2	9.3	4.4	3.5	100.0
All States	19.5	43.1	15.4	11.8	8.0	2.3	100.0

Source of Data: DRS (2013)

VII. Conclusions and Implications

Analysis presented in the proceeding chapters shows that the diffusion and adoption of crossbreeding technology is an important factor contributing to the level, pattern and sources of milk production in the Country. There is no evidence to show that the increase in milk production and widespread adoption of the crossbred cows resulted in the intensification of the pressure on land resources for the production of livestock feed. The production of milk is largely carried out by the relatively weaker sections of the rural society. Since agriculture is

rapidly getting mechanized, draught power requirement would not work as a constraint for the diffusion and adoption of new breeds of milk animals. The challenge will be to consolidate the past gains and sustain the pace of milk production and sustainable income generation for the rural poor. Drawing on the main findings of the study, some of the steps needed in this direction are briefly indicated below.

Diffusion of Breeding Technology

The uneven diffusion of breeding technology across regions is an important point emerging from the data: In few States, about 80 to 90 percent of the adult female bovines are covered by the AI, where as in large number of State, it did not cover even one fourth of the adult breedable female population. The diffusion of AI is seen to be closely associated with the agencies, involved in service delivery. In States, where AI has diffused at higher levels happens to be States, where the public provision played the dominant role in the delivery of this service, whereas in States, where the diffusion level is low, the service is delivered by Private/NGO sector. In the 1970's and 80's, when the Country launched the large scale dairy development programmes, public and co-operative sector had the major responsibility of the planning and implementation of the breeding programmes. However, in the 1990's, the policy has shifted in favour of private agencies in the delivery of AI services, in partnership with the public sector. This policy shift has been due to the widespread view expressed by policy experts and by the international organizations like FAO/ World Bank that the privatization of Veterinary and Animal Health Services, would significantly improve the coverage, and efficiency of services delivered to the farmers[15]. While the choice of breeds, rearing of the mother bulls, production of semen and its quality control are left to the responsibility of the public sector, it is envisaged that the private providers with trained manpower could be engaged in the delivery of AI services to the farmers and they could complement the public sector in accelerating the breed improvement programmes. As revealed in the survey, in large number of States, presently, the private providers are the major source of AI service to the dairy farmers. It may be noted that in States where the private agencies are dominant mode of the diffusion of AI technology, the breed improvement still remains at a low level, which is contrary to the expectation from the shift in the organizational arrangements for the implications of the breeding policy. In this context, it is important to examine whether this has been due to the low coverage of AI, its poor quality and lack of co-ordination between the

[15] There exists a large number of studies that examined the features of public and private sector activities in the services and developed the case for privatization. See for example Dina L Umali et.al (1992), Sarah Holden et.al (1996) David Ward et.al (2000) and Ahuja et.al (2001).

private and public agencies etc. It is recommended that the NDDB in collaboration with the Ministry of Animal Husbandry of the Government of India and the State Animal Husbandry Departments undertake an evaluation of the lack of effectiveness of the private public partnership in the improvement of the cattle and buffalo breeding in the Country. More specifically, such an evaluation should cover, the success rate of AI under various organizational interventions, the cost of delivery, the strength and weakness of the different organizational arrangements, the skill and knowledge levels of the technicians, and the technical and organizational effectiveness of the core support activities like semen production, storage and distribution by the public sector agencies.

Level of adoption of improved breeds.

The uneven pattern in the diffusion of breeding technology across regions in cows and she-buffaloes is very much reflected in the adoption rates of new breeds of animals. Unfortunately, we have no data to show the extent to which improvements in breeding technology has transformed, the quality of breeds for she-buffaloes. However, the data to bring out the adoption levels of crossbred cows are available and its analysis has revealed the following: (1) The adoption rates of crossbred cows are very high in the southern States of Kerala, Tamil Nadu and Karnataka; it is found to be generally low in States where she-buffaloes is the dominant milch animal. There is no significant difference in the adoption levels across land holding classes and social groups. (2) A comparison of the production traits of crossbred cows with that of indigenous cows and she-buffaloes clearly establishes the advantages of the crossbred cows in terms of higher milk yield, lower age of first calving, higher lactation length and lower dry period compared to the other two categories of milch animals. Because of these advantages the contribution of crossbred cows to the overall milk production in the Country far outweigh its share in the population of milch animals. This is especially so, in States where she-cattle is the main source of milk production. (3) With the rapid adoption of crossbred cows, the composition of the cattle population has undergone significant transformation and is now somewhat identical with that of the buffalo population.

Because of the comparative advantage of the crossbred cows, its cost of milk production is likely to be lower than that of the she-buffalo. The cost of milk production surveys conducted in the past confirm this. One would expect the profitability of milk production to go up with the adoption of crossbred cows. However, the present system of milk pricing adopted by the dairy co-operatives in the Country follows the two axis system taking in to account both fat and solid non-fat (SNF) in the milk. This pricing is more beneficial to the she-buffalo based

production system since, the fat content of buffalo milk is higher than that of the crossbred cattle. For procurement of milk by the dairy co-operatives minimum fat (3.5 percent) and SNF (8.4 percent) is to be measured in the milk poured by the members. Research has shown that the fat content of milk in crossbred cows tends to fall with the increase in the lactation length. Besides, the fat content is also conditioned by factors like the mixture of feed inputs and the genetic variability of the crossbred cows. There is widespread complaints and protests from farmers who pour milk to co-operatives from States where crossbreeding has made impressive gains that they receive prices much lower than the average procurement price because of low fat and SNF content. Farmer members are not allowed to pour their milk in co-operatives; if the standard fat and SNF content of their milk falls below the minimum levels. A research conducted by the Kerala Veterinary and Animal Sciences University showed that the percentage of farmers who are adversely affected by this phenomena is very high in the State[16]. Similar data is not available from other States. It may be noted that while to some extent the problem can be corrected by scientific feeding practice for the crossbred cows, the contribution of the genetic variability is not possible to mitigate in the short run. Since the creation of the genetic quality of the cow is product of a public policy where the choice for the farmer is limited, and since they have internalised a public good to obtain a private good, the loss occurring to them needs to be compensated by the State. Therefore, it is suggested that the present pricing system by the public sector dairy co-operatives be modified to mitigate the risks faced by the owners of crossbred cows.

The significant genetic transformation of cattle, achieved in southern India would spread rapidly to eastern India (where cattle is the dominant bovine species) and also to other States in the Country where she-buffalo is the dominant milch animal, with increase in the intensity of agricultural mechanization and growth in the demand for milk and commercialization of milk production. However, the negative consequences of the crossbreeding programme namely, the crossbred cow is prone to various diseases, require more nutritious feed and expensive to maintain and costly to acquire by the farmers, not well adapted to the climatic

[16] Using the standard producers for the collection, analysis and preservation of samples, the Kerala Veterinary and Animal Sciences University investigated the Fat and SNF for 549 samples of milk collected from Research farms, private dairy farms and ordinary milk producers pouring milk to co-operative Societies. The samples were collected from the source of production. The analysis of the data showed that out of the 319 samples collected in the morning 43.9% showed fat percentage below 3.5 and the rest above 3.5; and out of the 230 samples analysed in the evening 20.4 percent showed fat percentage below 3.5 and the remaining above 3.5. Regarding the solid fat out of the 319 samples in the morning 49.5 percent showed SNF below 8.4 and the remaining above 8.4. The study conducted from the analysis of the sample that even under scientific management conditions, the fat and SNF levels could go below the standard fixed for pricing. The study showed that 15.9 percent of the samples falls below the standard fixed for the procurement of milk by the co-operatives from the farmers. For details see KVASU (2014)

conditions in the Country, would become more evident with the increase in the percentage of crossbred cows in the milch animal herd. This is especially so with the impact of climate change. In this context, it is important to review the crossbreeding programmes at the State level, and give less emphasis to the exotic breeds, and give priority to the use of high yielding Indian breeds in the breeding programmes. Such a policy shift would have to be accompanied by measures for the conservation of indigenous breeds of cattle. Modern breeding technology should be expanded to include the indigenous breeds, so that farmers could go for a wider choice of obtaining a crossbred cow or indigenous cow depending on his preference. In other words, instead of homogenization of the zebu, the approach should be to maintain the genetic diversity of cattle. Another issue closely related to this is regarding the male calf. With the use work animals becoming redundant in agriculture the scope for utilising them for meat has to be explored. Already, in States, where the legal ban on slaughter of cattle is selective or absent, the male calves ends up in the slaughter houses. In States, where there exists total ban on slaughter of cattle, the existing rules may be re-examined to permit the slaughter of the male cattle, so that it is possible to obtain the meat and leather and other products for adding value to cattle stock. Since, India has emerged as the leading exporter of meat to the world market, the liberalisation of cattle slaughter could further enhance the export earnings.

Feeding Milch Animals.

The fact that production of milk did not result in the intensification of pressure on land resources is evident from the analysis of the data on the pattern of utilization and access to feed resources. Direct use of land for the cultivation of fodder crops is confined to few States and even the extent of area under its cultivation is very limited. What is largely utilized is the feed resources obtained from crop residues, oilcakes etc. The use of manufactured concentrate feeds is negligible in most States of the Country. Milch animals are fed from grass available from common and uncultivated land. The practice of grazing is widespread in most parts of the Country. Analysis of the data on the procurement of feed resources shows, that apart from the market for oilcakes and other concentrate feeds, there exists a market for green fodder (green grass) and dry fodder. The implication of these findings are briefly as follows: (1) Since there exists a mismatch between those who own animals and those who have land, measures should be urgently planned and implemented to augment the overall availability of feed resources. The components of this strategy should include programmes for augmenting the productive capacity of the common land and cultivated agricultural land for increasing the supply of green fodder, and increasing the nutritive value of crop residues by application of

innovative technologies. Regarding the augmentation of green fodder, the effective utilization of some of the programmes like MGNREGA, and other rural development programmes for this purpose should be considered. Regarding the scope for improving the nutritive value of crop residues, though technologies are available, it did not diffuse to the owners of milch animals and therefore it is necessary to find out the underlying reasons. Much more research and extension work has to be done by the R and D system to enrich the nutritive value of crop residues. (2) Agricultural research in the Country should take in to account the requirement of feed from crop by-products for the livestock sector. The experience so far shows that when the yield of the main crop output (for instance grains) is higher the yield of by-products tends to be lower. From the perspective of sustainable development, agricultural research should take into account not only the production crops for direct human consumption, but also the supply of by-products for the consumption of livestock, whose output again enters in the human consumption basket. (3) For increasing the productivity of milch animals, feeding nutritionally balanced concentrate feed is essential. Though, this has been well recognized, the progress made is not satisfactory. The problem require a two pronged approach. (a) Effective extension work among dairy farmers so that they are made aware of the need to adopt balanced feeding practice to reduce costs and increase productivity and (b) Research to develop nutritionally balanced concentrate feeds at the regional level taking in to account the climatic conditions and local feed resources base and a policy environment to create expansion of the capacity in the manufacture of balanced concentrate feed in the private and cooperative sector, with the stringent standards of quality to be monitored and regulated by the Government.

Distribution of Milch Animals

It is evident from the findings of the present study that the landless, marginal and small farmers together accounts for major share of the milch animal stock in the study regions. They contributes to bulk of the milk production. The data did not reveal significant difference in the adoption of breeding technology or feeding practice and yield levels of milch animals. Evidence also points out that the ownership of milch animals is valued as one of the important source of household income for the vulnerable sections of the rural households. Thus, from the perspective of reducing rural poverty, promotion of dairying will continue to remain important in the near future. Many of the measures we have suggested earlier assumes lot of significance in this context. However, it is important to consider the following g measures that assumes critical importance in sustaining the development in the sector. (a) We highlighted

the importance of reviewing the two Axis pricing system for changing the inbuilt disadvantages to those who raise crossbred milch animals. This argument needs to be extended further to incorporate the changes in cost of production in the pricing of milk. In the case of a large number of agricultural commodities where bulk of the marketed surplus is contributed by the medium and large farmers, pricing decisions are significantly influenced by the use of scientific data on input structure and costs collected under the direction of the agricultural costs and prices commission. However, in the case of milk, produced largely by the rural poor, the pricing is done arbitrarily without following the use of scientific data on cost of production. Though, the Co-operative Milk Marketing Federations technically can fix the price of milk supplied by the member producers, these federations largely work with in the control of the State Governments who take the crucial decision of milk pricing. These pricing decision made at periodic intervals are largely based on consultations with various stake holder groups and has no significant bearing on the cost of production and profit margins of the milk producers. Sustaining this activity would require providing an assured profit margins to the producers and therefore the pricing system will have to be based on actual data on cost of production and reasonable profit margins to the producers of milk. The task of collecting the cost data could be entrusted with the agricultural costs and prices commission by including milk as one of the commodities to be covered and entrust them to make recommendations on pricing. Or alternatively, the State Governments who are conducting the Integrated Sample Surveys on milk production could modify this schedule to cover the cost components of milk production and the pricing decisions to be left to a State level pricing committee to be constituted by the respective State Governments.

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Abbreviations

AI	Artificial Insemination
CB	Cross Bred
IC	Indigenous cows
SB	She-buffalo
NS	Natural Service
NGO	Non Governmental Organisation
MAHs	Milch Animal Holdings
NDB	National Dairy Board
MAS	Milch Animals
TDN	Digestible Crude Protein
DCP	Total Digestible Nutrient
APL	Above Poverty Line
BPL	Below Poverty Line
SC	Schedule Caste
ST	Schedule Tribe
OBC	Other Backward Community