# A STUDY ON BUFFALO PRODUCTION PRACTICES IN RURAL, SEMI-URBAN AND URBAN AREAS OF KRISHNA DISTRICT OF ANDHRA PRADESH

*By*

**B.RANGAMMA**

B.V.Sc. & A.H.

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**SRI VENKATESWARA VETERINARY UNIVERSITY**
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# Certificate

***Ms. B.RANGAMMA*** *has satisfactorily prosecuted the course of research and that the thesis entitled* **"A STUDY ON BUFFALO PRODUCTION PRACTICES IN RURAL, SEMI-URBAN AND URBAN AREAS OF KRISHNA DISTRICT OF ANDHRA PRADESH"** *submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part thereof has not been previously submitted by her for a degree of any University.*

*Date: 21 November, 2011.*
*Place: Gannavaram*

MAJOR ADVISOR
**(Dr. S. JAGADEESWARA RAO)**
Professor & Head
Department of Livestock Production and management
NTR College of Veterinary Science
Gannavaram-521102.

# Certificate

*This is to certify that the thesis entitled* **"A STUDY ON BUFFALO PRODUCTION PRACTICES IN RURAL, SEMI-URBAN AND URBAN AREAS OF KRISHNA DISTRICT OF ANDHRA PRADESH"** *submitted in partial fulfillment of the requirements for the degree of* ***"MASTER OF VETERINARY SCIENCE"*** *of the Sri Venkateswara Veterinary University, Tirupati, is a record of the bonafide research work carried out by* ***Ms.B.Rangamma*** *under our guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee.*

*No part of the thesis has been submitted for any other degree or diploma. The published part has been fully acknowledged. All assistance and help received during the course of investigations have been duly acknowledged by the author of the thesis.*

**(Dr. S. JAGADEESWARA RAO)**
**Chairman of the Advisory Committee**

Thesis approved by the Student's Advisory Committee

**CHAIRMAN :** **Dr. S. JAGADEESWARA RAO** _____
Professor and Head
Department of Livestock production and management
NTR College of Veterinary Science
GANNAVARAM-521102.

**MEMBER :** **Dr. R.M.V.PRASAD** _____
Assistant Professor (S.G)
Department of Livestock production and management
NTR College of Veterinary Science
GANNAVARAM-521102.

**MEMBER :** **Dr. E.RAGHAVA RAO** _____
Associate Dean
NTR College of Veterinary Science
GANNAVARAM-521102.

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***Dr.B.Rangamma . .***

# DECLARATION

*I **Ms.B.RANGAMMA** hereby declare that the thesis entitled* **"A STUDY ON BUFFALO PRODUCTION PRACTICES IN RURAL, SEMI-URBAN AND URBAN AREAS OF KRISHNA DISTRICT OF ANDHRA PRADESH"** *submitted to Sri Venkateswara Veterinary University, Tirupati for the degree of MASTER OF VETERINARY SCIENCE is the result of original research work done by me. I also declare that the materials contained in this thesis have not been published earlier.*

Date: 21 November, 2011.

Place: Gannvaram **(B.RANGAMMA)**

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|---|---|---|
| Name of the author | : | **B.RANGAMMA** |
| Title of the Thesis | : | **A STUDY ON BUFFALO PRODUCTION PRACTICES IN RURAL, SEMI-URBAN AND URBAN AREAS OF KRISHNA DISTRICT OF ANDHRA PRADESH** |
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| Major Advisor | : | **Dr. S. JAGADEESWARA RAO** |
| University | : | **SRI VENKATESWARA VETERINARY UNIVERSITY** |
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## ABSTRACT

An investigation was carried out to study the buffalo production and management practices in rural, semi-urban and urban areas of Krishna district in Andhra Pradesh. The buffalo population was increased by 31.52 per cent, whereas cattle population was decreased by 43.01 per cent during 1993 to 2007 in the district. The annual buffalo milk production was increased by 109.25 per cent and the contribution ranged from 73.97 to 96.81 per cent in the district.

The mean number of Murrah, graded Murrah and local buffaloes possessed by the milk producers in urban area was significantly ($P \leq 0.01$) higher than that in semi-urban and rural areas. The average age at first calving, service period, calving interval and dry period of graded Murrah buffaloes was significantly ($P \leq 0.05$) lower in urban area than that in semi-urban and rural areas. The mean peak yield, lactation milk yield of graded Murrah and local buffaloes was significantly ($P \leq 0.05$) higher in the urban area than that in semi-urban and rural areas. The location had no significant effect on the above reproduction and production characters of Murrah buffaloes within the district. It might be due to better feeding and management of pure bred Murrah buffaloes in rural, semi-urban and urban areas. The average age at first calving, service period, calving interval, lactation length and dry period was significantly ($P \leq 0.05$) lower in Murrah than that in graded Murrah and local buffaloes. The mean peak yield and lactation milk yield was significantly ($P \leq 0.05$) higher in Murrah than that in graded Murrah and local buffaloes in the study area.

Majority of milk producers adopted rearing of high milk producing buffalo breeds like Murrah and graded Murrah in urban (100%), semi-urban (99%) and rural (93%) areas. Most of the respondents adopted AI in buffaloes in urban (78%), semi-

urban (79%) and rural (67%) areas. Majority of the milk producers bred their buffaloes between 3-5 months after calving in urban (96%), semi-urban (87%) and rural (65%) areas. Most of the respondents followed pregnancy diagnosis in the urban (94%) and semi-urban (92%) than that in rural (76%) area. Overall majority of buffaloes calved in rainy season (55.20%) followed by winter (39.20%) and summer (5.60%) season.

Most of the milk producers adopted green fodder production in rural (84%), semi-urban (79%) and urban (84%) areas. Majority of respondents provided homemade concentrate mixture to buffaloes in rural (74%), semi-urban (58%) and urban (32%) areas. Overall 99.6 per cent of the milk producers did not adopt silage making and urea treatment of paddy straw, whereas 10.80 per cent of respondents practiced hay making in the study area. Majority of the milk producers in rural (63%), semi-urban (62%) and urban (60%) areas located the buffalo shed nearer to their dwelling. Wallowing of buffaloes was practiced by most of the rural (98%), semi-urban (83%) and urban (46%) milk producers. Colostrum feeding to new born calf within 1-2 hours of birth was adopted by majority of urban (94%), rural (76%) and semi-urban (68%) milk producers. Most of the milk producers did not provide calf starter. Regular deworming and vaccination of calves was followed by majority of the milk producers.

Full hand method of milking was adopted by majority of urban (60%), semi-urban (45%) and rural (38%) milk producers. No respondent adopted machine milking in buffaloes. A few urban (20%) and semi-urban (10%) milk producers used oxytocin injection for letdown of milk in buffaloes, whereas it was not followed in rural area. All the milk producers (100%) did not follow the strip cup test before milking, dipping of teats in povidone iodine after milking and dry cow therapy in the study area.

High cost of pure bred buffaloes, feed ingredients and hired labour, lack of financial assistance for purchase of high milk producing buffaloes and equipment, lack of extension activities and non remunerative price for milk were observed to be some of the major constraints perceived by the buffalo milk producers. Problem of anestrous or silent heat, repeat breeding, mastitis, calf mortality, lack of subsidy on animal feeds and inadequate facilities for diagnostic purpose and specialized treatment were found to be the major constraints felt by the field veterinarians in buffalo production in the study area.

Based upon the findings and on observation of analysed results, the following recommendations were suggested.

The existing AI programme should be strengthened by providing more number of AI centres to provide AI services at the farmers' door step in rural and urban areas. Fertility camps should be organised frequently. The procurement price of milk should be based, as far as, possible on the average cost of milk production. All the technical services and inputs should be made available regularly to the milk producers. Extension activities are to be organised frequently so as to improve the knowledge and skills of the buffalo milk producers. All the technical and para technical persons of Department of animal husbandry and milk cooperative societies should be sent for refresher training programme in order to improve their skills in production and health care of buffaloes.

# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| AI | : | Artificial Insemination |
| SE | : | Standard Error |
| B.L.D.O | : | Block livestock development officer |
| NDRI | : | National Dairy Research Institute |
| ICDP | : | Intensive Cattle Development Programme |
| A.H | : | Animal Husbandry |
| MT’s | : | Metric tones |
| FMD | : | Foot and Mouth disease |
| HS | : | Haemorrhagic Septicaemia |
| BQ | : | Black quarter |
| Sq.Km | : | Square Kilometre |
| % | : | Per cent |
| N | : | Number of observations |
| Kg | : | Kilogram |
| S.No. | : | Serial Number |
| P | : | Probability |

# INTRODUCTION

# CHAPTER – I

# INTRODUCTION

Dairying is an integral part of the farming system in India. It plays an important role in generating income, employment and improving household nutrition. Cattle and buffalo have a complementary, supplementary and sustainable relationship with crops in the mixed farming system. India ranks first in the world with a total of 112.5 million tonnes of milk production which amounts to 15.79 per cent of total milk production in the world. The characteristic feature of Indian dairy industry is that buffalo milk contributes 55 per cent of the total milk production in the country. India contributes 67.79 per cent of total world buffalo milk production.

Buffalo forms back bone of Indian dairy industry. Traditionally buffaloes are being preferred over cattle because of their superior quality of milk (high fat and protein; low cholesterol), better efficiency in utilization of nutrients from poor quality fibrous tropical feeds and relative better disease resistance and adaptability to tropical climate. Buffaloes are kept under two major dairy production systems viz. rural small holding system and urban/peri-urban commercial system. They play a crucial role in the small holders' dairy production systems in India and in many Asian countries. Urban and peri-urban commercial dairy farms are highly intensive and profit motivated.

Andhra Pradesh is one of the major milk producing states of the country. It ranks second in India with respect to buffalo population of 106.29 lakhs ($17^{th}$ Livestock Census, 2006-07). Andhra Pradesh state has nine agro-climatic zones that influence the growth rate in agriculture and allied sectors. The district of Krishna is under the Krishna agro-climatic zone. All cattle and dairy development programmes like Key

village Scheme, Intensive Cattle Development programme, Operation Flood programme and National Project for Cattle and Buffalo breeding (NPCBB) were implemented in the district. It is now considered one of the best areas for buffalo rearing and dairy development in Andhra Pradesh.

Production and management practices play a vital role in the improvement of productivity of buffaloes and milk production in a particular area. Majority of buffalo owners are agricultural labourers, marginal and small farmers. They have not yet developed a commercial attitude towards buffalo farming. The information on the production and management practices especially for buffaloes is limited. Hence, an investigation was carried out in Krishna district with following objectives.

1. To study the socio economic profile of buffalo milk producers and distribution of buffalo breeds in rural, semi- urban and urban areas of Krishna district.
2. To analyze the existing breeding, feeding, management and health care practices followed by buffalo milk producers in the rural, semi-urban and urban areas of Krishna district.
3. To identify the constraints perceived by the buffalo milk producers and field veterinarians in buffalo production and management in the district.
4. To suggest suitable recommendations and solutions for increasing buffalo milk production in Krishna district.

# REVIEW

# OF LITERATURE

# CHAPTER II

# REVIEW OF LITERATURE

## 2.1 POPULATION, MILK PRODUCTION AND DISTRIBUTION OF BUFFALOES

Lehman *et al.* (1994) observed that the total bovine population of Andhra Pradesh state had a steady increase in the period 1956-1983 (27%). Growth was more in buffaloes at 46 per cent as against that of 17 per cent in cattle.

Ravikiran *et al.* (1994) reported that the average number of cattle and buffaloes possessed by the farmers were 2.83 and 2.54, respectively, in the study area of Krishna district.

Jain *et al.* (1998) found that the average population growth rate for female buffaloes of breeding age and young buffaloes was 1.57 and 1.54 per cent, respectively, the corresponding values for cattle were 0.84 and 0.64 per cent during the period 1951-1982.

Mudgal (2000) reported that the cattle population of the world, over the last 20-22 years has gone up by less than one per cent, while the buffalo population in India has gone up by 3.5 per cent per annum indicating the relative importance of this species in India.

Yedukondalu *et al.* (2000) observed that there was a reduction of 14 per cent of total cattle and an increase of 10 per cent buffalo population in a span of 6 years in Medak district of Andhra Pradesh. It was further observed that there was an increase of 29.99 and 22.65 per cent of buffalo and cow milk production, respectively, from 1991-1996 in the district.

Sahu (2001) found that small and large farmers kept more number of buffaloes than the marginal and land less farmers. On the contrary, the per cent of milch animals was higher among landless, marginal and small farmers as compared to large farmers. This was due to more number of young stock and dry animals in herds owned by the large farmers.

Tomar and Thakur (2002) observed that the average number of buffaloes reared per family were 3.49 and 5.81 with small and large farmers, respectively.

Govindaiah (2003) reported an annual growth rate of 2.33 per cent in buffalo population in the last 50 years.

Thammiraju *et al.* (2004) found that growth rates for different categories of buffaloes in the three regions *i.e* Telanagana, Rayalaseema, Coastal Andhra and Andhra Pradesh as a whole were -3.44, -5.62, -4.21 and -3.97 for adult male; 4.8, 1.2, 3.2 and 3.3 for adult females; 5.1, 1.9, 2.5 and 3.8 for young stock and 3.7, 1.1, 1.8 and 2.5 for total buffalo population, respectively. Female buffalo population recorded a positive growth rate in the three regions of the state. It was also observed that densities of buffaloes were 0.296, 0.192, 0.535 and 0.351 for three regions *viz*. Telanagana, Rayalaseema, Coastal Andhra and Andhra Pradesh as a whole, respectively.

Vinodkumar and Dahiya (2005) reported that 40 per cent farmers had 3-5 buffaloes and only 2.5 per cent farmers had more than 15 buffaloes in rural area of Haryana state.

Garcia *et al.* (2006) found that farms with 2 to 3 dairy animals and 1 to 2 hectares of land represent the most common farm type found in Andhra Pradesh.

Gautam *et al.* (2007) revealed that the majority of the dairy beneficiaries (60.4%) having medium herd size (3-4 animal) in Varanasi district of Utter Pradesh.

Rao *et al.* (2007) observed that buffalo population has positive increase (>15%). Among buffaloes, proportion of females and young stock recorded an increase of about 20 per cent indicating shift in farmer's preference for milch buffaloes during post green revolution period (1972-2003) in Andhra Pradesh.

Parmar *et al.* (2009) reported that the mean herd size of the farms was 64.30 (range 18-460), which composed of 60.5 per cent adults, 19.9 per cent heifers, 17.9 per cent calves and 1.7 per cent adult males in different districts of Punjab.

Sinha *et al.* (2009a) observed that desi (non-descriptive) buffaloes were predominantly present in rural, semi-urban areas whereas urban area had more Murrah buffaloes than desi buffaloes in Bareilly district of Utter Pradesh.

Ahirwar *et al.* (2010) reported that the majority of the rural farmers had small size dairies (1-5 dairy animals) but in urban areas, there were medium to large size buffalo herds because of the fact that the majority of the urban farmers were commercial dairy farmers.

According to FAO (2010) the buffalo population was found to be 180.7 millions in world, out of which 96.4 per cent were present in Asian countries only. Further, India possessed 98.595 million (54.5%) of buffaloes in 2008.

Modi *et al.* ( 2010) observed that 42 per cent farmers preferred medium size herd (6 to 10 animals) followed by 37 per cent small herd size ( 1-5 animals) and 21 per cent large herd size(>10 animals) in rural area of milk shed of Gujarat.

Dhaka *et al.* (2011) found that the percentage of respondents having non descriptive animals was very high (66.8%), whereas only 12.8 per cent of respondents had crossbred animals in Bundi district of Rajasthan.

Singh *et al.* (2011) observed that the small, medium and large buffalo farmers had 1.05, 2.36 and 4.65 lactating buffaloes and 3.44, 6.70 and 15.47 total buffaloes, respectively, in Patiala district of Punjab. It was also reported that the population density of buffaloes in Punjab was 89.3 per square Kilometre as compared to 38.2 for Cattle.

## 2.2 SOCIO-ECONOMIC CHARACTERISTICS OF BUFFALO MILK PRODUCERS

Prasad *et al.* (1991) reported that dairy farming was the subsidiary occupation for 90.48 per cent while main occupation for 9.02 per cent of farmers in Chittoor milk shed area of Andhra Pradesh.

Kumar (1992) found the majority of beneficiaries were middle aged, illiterate, marginal farmers with dairying as subsidiary occupation. Most of them had high mass media exposure, medium herd size and medium extension contact.

Rao (1992) observed that majority of the respondents were of middle age group and illiterate, majority of respondents had medium herd size, medium extension contact, medium information seeking behavior and medium socio-economic status.

Rao (1993) reported that majority of the respondents were middle aged, illiterate and agricultural labourers. Most of them had medium socio-economic status, herd size, extension contact, innovativeness and information seeking behavior and sold their milk through cooperative milk collection centres.

Ravikiran *et al*. (1994) reported that in the total income, 36.14 per cent was from dairying, 34.4 per cent was from agriculture and 9.16 per cent was from other sources in the study area of Krishna district of Andhra Pradesh.

Thammiraju *et al.* (1996) observed that majority of the farmers were middle age with medium socio-economic status, mass media exposure, information seeking and innovativeness in Krishna district of Andhra Pradesh.

George *et al.* (2000) found that the cattle rearing was the main occupation (50.46%) of farmers in Kerala.

Prasad *et al.* (2001) revealed that the dairying was the main occupation for 64 per cent of milk producers and subsidiary occupation for the remaining 36 per cent, showing the importance of dairying in and around Hyderabad city.

Goswami *et al.* (2001) reported that majority of the livestock owners used radio as an effective mass media with respect to adoption sources of information about the animal husbandry practices whereas the farm publications were least used by the livestock owners in West Bengal. He also observed that majority of the livestock owners used B.L.D.O as an effective personal source of information for the adoption of the selected animal husbandry practices.

Vij and Tantia (2005) observed that among buffalo farmers 34.1 per cent were landless, 15.1 per cent marginal (0-1 ha), 24 per cent small (1-2 ha), 17.6 per cent lower medium (2-4 ha), 6.9 per cent upper medium (4-8 ha) and 2.3 per cent large farmers (>8 ha) in their study area of Punjab.

Soysal *et al.* (2005) found that 79 per cent of family dealing with water buffalo rising had the age ranged between 18-60 years, while 12.5 per cent and 8.5 per cent of families had the age over 60 years and below the 18 years, respectively. 93 per cent of total village people had total 5 years education, 7 per cent had never take any education

and 60 per cent of families had 4-5 members, 13 per cent had 2 members and 27 per cent of families had more than 5 members.

Islam *et al.* (2006) observed that greater number of rural dairy farmers belonged to age group of 35-50 years (61%). 58 and 42 per cent of dairy farmers were hindu and muslims by religion, respectively. 61 per cent of the dairy farmers had cultivation as main occupation. 33, 26, 13, 12, 9, and 7 per cent dairy farmers had educational level primary, middle, graduate, high school, illiterate and can read and write, respectively. 44 and 56 per cent dairy farmers had family size up to 5 members and above 5 members, respectively.

Gangasagare and Karanjkar (2009) reported that 59 per cent of the dairy farmers belong to general (unreserved) category, 25 per cent were backward class and only 8 per cent each of SC and ST in Marathwada region of Maharashtra.

Manivannan *et al.* (2009) found that majority of the respondents were males (84%), belonged to backward community. Majority of the respondents carried out Agriculture + Animal Husbandry as the primary occupation (68 %). 62 per cent of the respondents were from medium annual income group in Namakkal district of Tamil Naidu.

Ahirwar *et al.* (2010) revealed that the majority of the buffalo farmers in both rural (78%) and urban areas (79%) belonged to other backward caste. Their main occupation was agricultural farming and dairying was a subsidiary occupation. Majority of respondents were land less (59%) in urban area. Majority of respondents in rural area had primary (46.33%) school education while in urban area majority had education of metric (42.00%) level in Indore district of Madhya Pradesh.

Debasish *et al.* (2010) reported that higher per cent (30%) of livestock farmers were engaged in business followed by cultivation (25.42 %), agriculture labour (20.83%), service (17.92%), and independent profession (5.83%). Majority of the livestock farmers were illiterate (35.83%) followed by those who could read and write (20.00%). Majority of the farmers were having medium size of the family ranging from 6 to 8 members followed by almost equal per cent (33) of the farmers having small (<5) and large (>8) family size. Majority of the livestock farmers (47.5%) belonged to the middle age group, whereas 39.5 per cent belonged to old age and 13 per cent to young age group in Ganderbal district of Jammu and Kashmir.

Dhaka *et al.* (2011) observed that 56.4 per cent of the respondents belonged to middle age group followed by old age (28.8%) and young age (14.8%) group. Majority of respondents (58.0%) were literate up to middle class followed by high school (26.0%), illiterate (9.2%) and only 6.8 per cent respondents had education higher than the high school level. 42.8 per cent had a low exposure to the mass media followed by 38.4 and 18.8 per cent had medium and high exposure to the mass media, respectively.

## 2.3 ECONOMIC CHARACTERS OF BUFFALOES

### 2.3.1 Age at first calving

Shah and Sharma (1994) reported that age at first calving was lower for cross bred cows (35 months) than Murrah buffaloes (39 months), local buffaloes (42 months) and local cows (45 months) in Bulandshahr district of Uttar Pradesh.

Rao *et al.* (1995) found that the least squares mean for age at first calving in Murrah graded buffaloes was 1530 days and the period of calving had significant effect on age at first calving.

Prasad and Prasad (1998) reported that the average age at first calving in buffaloes was 52.49 ± 0.34 months in the villages around Meerut.

Sasidhar *et al.* (2000) observed that the average age at first calving in Murrah buffaloes was 43.86 ± 0.50 months at Hyderabad in Andhra Pradesh.

Suresh *et al.* (2004) found that the average age at first calving in Murrah buffaloes was 46.63 ± 1.30 months in Dairy Experimental Station, Rajendranagar, Hyderabad.

Kumaravelu *et al.* (2006) reported that the mean age at first calving in Murrah buffaloes was 1515 ± 32.61 days in Livestock Research Station, Kattupakkam, Tamil Nadu.

Sunil *et al.* (2007) observed that the least square mean for age at first calving was 40.73 ± 0.64 months in Murrah, 41.27 ± 0.36 months in Graded Murrah and 41.35 ± 0.43months in Nili-ravi buffaloes.

Barman *et al.* (2009) found that the overall least square mean for age at first calving in Murrah buffaloes was 1451.32 ± 6.76 days in Buffalo Research Station, Hissar.

Sinha *et al.* (2009a) observed that the average age at first calving in buffaloes was 56.53 ± 1.20, 54.08 ± 1.37 and 53.13 ± 0.91 months in rural, semi-urban and urban areas, respectively, in Bareilly district of Utter Pradesh.

Sharma *et al.* (2010) reported that the overall least square mean for age at first calving in Murrah buffaloes was 1602.82 ± 8.53 days at Central Institute for Research on Buffaloes, Hissar.

### 2.3.2 Service period

Prasad (1993) reported that the least square mean for service period in non-descript, graded and Murrah breed groups were 214.54 ± 7.89, 153.74 ± 6.33 and 123.81 ± 7.45 days, respectively, in and around Hyderabad.

Rao *et al.* (1995) found that the service period in Graded Murrah buffaloes was 258 days at Dairy Experimental Station, Rajendranagar, Hyderabad.

Suresh *et al.* (2004) observed that the mean for service period in Murrah buffaloes was 161.10 days and the season of calving has significant effect in buffaloes.

Barman *et al.* (2009) reported that the mean for first service period in Murrah buffaloes was 196.38 ± 6.40 days at Buffalo Research Station, Hissar.

Gandhi *et al.* (2009) observed that the overall least squares population mean for service period was 112.25 ± 2.87 days in Murrah buffaloes at NDRI, Karnal.

Sinha *et al.* (2009a) reported that the average service period in buffaloes was 6.27 ± 0.50, 6.0 ± 0.57 and 4.81 ± 0.27 months in rural, semi-urban and urban areas, respectively, in Bareilly district of Utter Pradesh.

Sharma *et al.* (2010) found that the overall least square means for first service period was 291.85 ± 70.14 days in Murrah buffaloes at Central Institute for Research on Buffaloes, Hissar.

Thiruvenkadan and Panneerselvam (2010) observed that the overall least-squares mean for service period in Murrah buffaloes was 225.0 ± 5.5 days at Central Cattle Breeding Farm, Alamadhi, Tamil Nadu.

### 2.3.3 Calving interval

Agarwal *et al.* (1987) found an average calving interval of 16.13 ± 0.45 months in Murrah buffaloes in the villages around Karnal.

Prasad (1993) reported that the least square mean for calving interval were found to be 17.77 ± 0.43 15.42 ± 0.35 14.03 ± 0.41 months in Nondescript, Graded and Murrah buffaloes, respectively, in and around Hyderabad.

Narasimharao and Sreemannarayana (1994) observed that the mean calving interval was 560 days in Murrah buffaloes at Progeny Testing Unit, Banavasi, Andhra Pradesh.

Shah and Sharma (1994) reported that the average inter calving period was 456 and 444 days in Murrah and local buffaloes, respectively, in Bulandshahr district of Utter Pradesh.

Rao *et al.* (1995) observed that the least square mean for calving interval was 566 days in Murrah graded buffaloes at Dairy Experimental Station, Rajendranagar, Hyderabad.

Rao *et al.* (2000) found that the overall least square mean for calving interval in graded Murrah and local buffaloes were 544.99 ± 6.74 and 634 ± 5.08 days, respectively, under village conditions of Visakhapatnam district, Andhra Pradesh.

Suresh *et al.* (2004) observed that the calving interval in Murrah buffaloes was 461.10 ± 13.54 days in Dairy Experimental Station, Rajendranagar, Hyderabad.

Sunil *et al.* (2007) reported that the least square mean for first calving interval in Murrah was 476.31 ± 11.38 days and 476.58 ± 5.93 days in graded Murrah buffaloes of six military dairy farms of northern India.

Barman *et al.* (2009) found that the least square mean for first calving interval was 502.20 ± 6.84 days in Murrah buffaloes at Central Institute for Research on Buffaloes, Hissar.

Shashishankar *et al.* (2009a) reported that the means for calving interval were 424.32 ± 2.60 and 462.19 ± 2.55 days in graded Murrah and non descript buffaloes, respectively, in and around Patna.

Sinha *et al.* (2009a) observed that the average calving interval in buffaloes was 16.24 ± 0.53, 16.24 ± 0.64 and 15.05 ± 0.26 months in rural, semi-urban and urban areas, respectively, under field conditions in Bareilly district of Utter Pradesh.

Modi and Patel (2010) found that majority of cows (82.18%) and buffaloes (90.00%) had 15 months and 18 months of calving intervals, respectively, in rural area under milk shed of north Gujarat.

Thiruvenkadan and Panneerselvam (2010) observed that the average calving interval in Murrah buffaloes was 532.8 ± .5 days at Central Cattle Breeding Farm, Alamadhi, Tamil Nadu.

### 2.3.4 Peak yield

Anand and Tripathi (1987) reported that the average peak yield was 11.21 ± 0.19 kg in Murrah buffaloes at NDRI, Karnal.

Prasad (1993) found that the mean peak yield was 6.10 ± 0.21, 9.03 ± 0.16 and 10.68 ± 0.19kg in Non descriptive, Graded and Murrah buffaloes, respectively, in and around Hyderabad.

Shrivastava *et al.* (1998) observed that the mean peak yield was 9.87 ± 0.09kg in Murrah type buffaloes under field conditions in and around Ranchi.

Suresh *et al.* (2004) reported that the mean for peak yield was 10.17 ± 0.22kg in Murrah buffaloes at Dairy Experimental Station, Rajendranagar, Hyderabad.

Kumaravelu *et al.* (2006) found that the mean peak yield was 7.24 ± 0.20 kg in Murrah buffaloes at Livestock Research Station, Kattupakkam, Tamil Nadu.

Shashishankar *et al.* (2009a) observed that average peak yield was 8.45 ± 0.11 kg and 6.80 ± 0.11 kg in Graded Murrah and nondescript buffaloes, respectively, in and around Patna.

Thiruvenkadan and Panneerselvam (2010) reported that the overall least-squares means for peak milk yield was 8.87 ± 0.05 kg in Murrah buffaloes at Central Cattle Breeding Farm, Alamadhi, Tamil Nadu.

### 2.3.5 Lactation milk yield

Prasad (1993) found that the least square mean for total milk yield was 1117.32 ± 53.56, 1705.95 ± 42.99 and 2078.601 ± 50.57 kg in Non descriptive, Graded Murrah and Murrah buffaloes, respectively, in and around Hyderabad.

Narasimharao and Sreemannarayana (1994) reported that mean lactation milk yield was 1890.5 ± 25.68 kg in Murrah buffaloes at Progeny Testing Unit, Banavasi, Andhra Pradesh.

Rao *et al.* (1995) observed that the least square mean for first lactation milk yield was 1528 kg in Murrah graded buffaloes at Dairy Experimental Station, Rajendranagar, Hyderabad.

Shrivastava *et al.* (1998) reported that the least square mean for lactation milk yield was 1659.37 ± 2.99 kg in Murrah type buffaloes in and around Patna.

Rao *et al.* (2000) found that the least square mean for lactation milk yield was 1719.02 ± 35.65 and 1155 ± 13.93 litres in Graded Murrah and local buffaloes, respectively, under village conditions of Visakhapatnam district, Andhra Pradesh.

Sasidhar *et al.* (2000) observed that the average life time lactation yield was 1820.3 kg in Murrah buffaloes in Hyderabad.

Suresh *et al.* (2004) reported that least square mean for 300 days lactation milk yield and total lactation milk yield were 1351.70 kg and 1429.17 kg, respectively, at Dairy Experimental Station, Rajendranagar, Hyderabad.

Kumaravelu *et al.* (2006) found that the mean first lactation milk yield was 1615 ± 63.32 kg in Murrah buffaloes at Livestock Research Station, Kattupakkam, Tamil Nadu.

Sunil *et al.* (2007) studies on buffaloes present in six military dairy farms of northern India observed that first lactation milk yield was 1898.66 ± 41.31 kg in Murrah and 1789.00 ± 21.95 kg in graded Murrah buffaloes.

Gandhi *et al.* (2009) reported that the overall least squares population means for lactation total milk yield (LTMY) and lactation 305-day or less yield (L305DMY) were 1841.90 ± 32.62 kg and 1775.79 ± 31.93 kg, respectively, in Murrah buffaloes at NDRI, Karnal.

Gobade *et al.* (2009) found that the average lactation yield in buffaloes was 2176.25 ± 99.25 kg in beneficiaries group and 1143.9 ± 32.29kg in non beneficiaries group in western zone of Vidarbha region of Maharashtra.

Kishan (2009) observed that the overall mean for lactation milk yield was 1538.69 ± 32.14 litres in graded Murrah buffaloes at Dairy Experimental Station, Rajendranagar, Hyderabad.

Shashishankar *et al.* (2009a) reported that the least square mean for lactation milk yield was 1395.82 ± 9.13 and 1106.85 ± 8.79 kg in graded Murrah and Non descriptive buffaloes, respectively, in and around Patna.

Sharma *et al.* (2010) found that the overall least square mean for first lactation milk yield was 1631.52 kg in Murrah buffaloes at Central Institute for Research on Buffaloes, Hissar.

### 2.3.6 Lactation length

Prasad (1993) reported that the least square mean for lactation period was 284.10 ± 4.84, 273.21 ± 3.88 and 282.19 ± 8.68 days in Non descriptive, Graded and Murrah buffaloes, respectively.

Narasimharao and Sreemannarayana (1994) observed that the overall lactation length in Murrah buffaloes was 316.2 days at Progeny Testing Unit, Banavasi, Andhra Pradesh.

Shah and Sharma (1994) found that the lactation length was longer for Murrah buffaloes (358 days) than crossbred cows (355 days), local buffaloes (338 days) and local cows (327 days) in Bareilly district of Utter Pradesh.

Rao *et al.* (1995) observed that the least square mean for lactation period was 341 days in Murrah graded buffaloes at Dairy Experimental Station, Rajendranagar, Hyderabad.

Shrivastava *et al.* (1998) reported that the least square mean for lactation length was 290.26 ± 0.42 days in buffaloes in un-organized farming system in and around Ranchi, Bihar.

Rao *et al.* (2000) found that the least square mean for lactation period was 374.83 ± 3.31 and 391.67 ± 3.37 days in graded Murrah buffaloes and local buffaloes, respectively, under village conditions of Visakhapatnam district, Andhra Pradesh.

Kumaravelu *et al.* (2006) observed that the average lactation length in Murrah buffaloes was 284 ± 9.00 days in Livestock Research Station, Kattupakkam, Tamil Nadu.

Sunil *et al.* (2007) found that least square mean for first lactation period in Murrah buffaloes was 301.42 ± 5.29 days and in graded Murrah buffaloes was 299.95 ± 2.72 days.

Gandhi *et al.* (2009) reported that the overall least squares population mean for lactation length was 273.54 ± 2.64 days in Murrah buffaloes at NDRI, Karnal.

Gobade *et al.* (2009) found that the average lactation length of buffaloes maintained by beneficiaries and non beneficiaries was 298.81 ± 3.72 days and 297.2 ± 3.5 days, respectively, in western zone of Vidarbha in Maharashtra.

Shashishankar *et al.* (2009a) observed that the least square mean of lactation length was 293.92 ± 2.19 and 312.11 ± 2.15 days in Non descriptive and graded Murrah group, respectively, in and around Patna.

Sinha *et al.* (2009a) reported that the average lactation length in buffaloes was 8.81 ± 0.41, 8.61 ± 0.45 and 8.67 ± 0.30 months in rural, semi-urban and urban areas, respectively, in Bareilly district of Utter Pradesh.

Sharma *et al.* (2010) found that the overall least square mean for first lactation length was 331.30 days in Murrah buffaloes at Central Institute for Research on Buffaloes, Hissar.

### 2.3.7 Dry period

Shah and Sharma (1994) observed that the dry period was the least for cross bred cows (85 days) followed by Murrah buffaloes (97 days), local buffaloes (106 days) and local cows (132 days) in Bareilly district of Utter Pradesh.

Rao *et al.* (1995) reported that the least square mean for dry period was 194 days in Murrah buffaloes at Dairy Experimental Station, Rajendranagar, Hyderabad.

Rao *et al.* (2000) found that the least square mean for dry period was 170.00 ± 5.47 and 242.84 ± 4.43 days in graded Murrah buffaloes and local buffaloes, respectively, under village conditions of Visakhapatnam district, Andhra Pradesh.

Gobade *et al.* (2009) reported that the average dry period in buffaloes was found to be 94.68 ± 3.64 and 94.40 ± 2.01 days for beneficiaries and non beneficiaries, respectively, in western zone of Vidarbha region of Maharashtra.

Shashishankar *et al.* (2009a) observed that the least square mean for dry period was 130.48 ± 1.32 and 150.93 ± 1.30 days in graded Murrah and non descript buffaloes, respectively, in and around Patna.

Sharma *et al.* (2010) found that that the overall least square mean of first dry period was 265.12 days at Central Institute for Research on Buffaloes, Hissar.

## 2.4 BUFFALO PRODUCTION AND MANAGENT PRACTICES

### 2.4.1 Breeding management practices

Jagdale *et al.* (2000) reported that pregnancy diagnosis in time was followed by 71.34 respondents in Satara district of Western Maharashtra.

Pundir *et al.* (2000) found that 51 per cent of farmers adopted artificial insemination, 9 per cent natural service and 40 per cent both at Banaskantha and Sabarkantha districts of north Gujarat.

Malik (2005) observed that natural service in buffaloes was the choice of breeding practice as indicated by majority of farmers. 75, 23 and 2 per cent of farmers consult veterinarian, stockman and quack, respectively, for treatment of infertile dairy animals in Uttar Pradesh.

Vinodkumar and Dahiyal (2005) reported that the artificial insemination was practiced only by 30 per cent of farmers for breeding buffaloes. Two-third of the farmers still preferred natural service for breeding of buffaloes under field conditions in Haryana.

Gupta *et al.* (2008) observed that the natural service was adopted by 97 and 96 per cent of the buffalo and cattle farmers, respectively. The mid heat period for insemination was adopted by 82 per cent of the buffalo farmers. Pregnancy diagnosis was practiced by 73 per cent buffalo and 51 per cent cattle farmers in different agro-climatic zones of Rajasthan.

Meena *et al.* (2008) found that the breeding of animals was mainly by natural service (77%) with available bulls and the artificial insemination service was at primitive level (21%) at high altitude of Kumaon Himalaya.

Bidwe *et al.* (2009) observed that about 95.67 per cent dairy farmers adopted the natural service for breeding their buffaloes. However, few farmers (4.33%) made effort to adopt the artificial insemination technique for breeding the animals in Buldana district of Maharashtra.

Muhammad *et al.* (2009) reported that breeding of buffaloes by natural mating (83.9%), AI (14.1%) and using both AI and natural (2.0%). The breeding bulls owned by the farmers themselves (32.5%), neighbours (43.3%), relatives (5.4%) and service

providers (18.8%) were the common source of natural breeding in Punjab Province of Pakistan.

Rathore and Kachwaha (2009) found that majority (62.25%) of the respondents' resorted to natural service and 52.50 per cent respondents' inseminated buffaloes at mid-heat stage. About one fourth (23.75%) of buffalo owners tested their pregnant buffaloes to pregnancy diagnosis in Jhunjhunu district of Rajasthan.

Ahirwar *et al.* (2010) observed that both rural (90.33%) and urban (86%) buffalo farmers preferred natural service as system of breeding. In urban areas the farmers crossed animals with proven sire breeding bulls but in rural areas farmers preferred breeding through bull of the grazing herd in Indore district of Madhya Pradesh.

Modi and Patel (2010) reported that 100 per cent farmers observed only mucus discharge and bellowing as a sole symptom of heat detection. All farmers practiced AI for breeding cross bred cows, while for buffaloes 13 and 5 per cent farmers followed AI and natural breeding, respectively, and the remaining 82 per cent farmers opted for both AI and natural service in rural area under milk shed of north Gujarat.

Sinha *et al.* (2010b) found that main symptom for identification of animal in heat was bellowing for 62.2, 51.1 and 43.3 per cent dairy farmers in rural, semi-urban and urban areas, respectively. As far as time of breeding is concerned, 52.2 per cent farmers in rural areas were bred animals just after onset of heat, 31.1 per cent after 6 hrs and 16.7 per cent after 12 hrs of onset of heat. Method of breeding followed by majority of farmers in all the areas was natural service. Only 2.2, 13.3 and 17.8 per cent of farmers from rural, semi-urban and urban areas, respectively, practiced AI in Bareilly district of Utter Pradesh.

Sunil *et al.* (2011) observed that higher (89.17%) percentage of the respondents practiced natural service and only 10.83 per cent adopted artificial insemination in cattle and buffaloes. Majority of animal owners were able to detect heat in their animals, only 10.83 per cent farmers could not detect heat only in buffaloes. He also reported 37.38, 51.67 and 11.25 per cent of the respondents followed insemination in early, mid and late heat, respectively. Only 7.50 per cent of farmers of the study area practiced pregnancy diagnosis of their animals after two to three months of service. Only 5 per cent of farmers of the study area treated their milch animals for anestrous and repeat breeding problem in mid hills of Uttarakhand.

### 2.4.2 Feeding management practices

Pundir *et al.* (2000) reported that more than half (58%) of farmers did not take animals for grazing. Concentrate feed was provided separately by 83 per cent of farmers while 17 per cent of farmers provided it along with fodder. The concentrate was fed at the time of milking by 88 per cent of farmers and the rest of famers fed concentrate at any time in north Gujarat.

Sah *et al.* (2003) found that the source of water for dairy animals was open well (61.11%), bore well (22.22%), village pond (20.00%) and canal water (8.89%) in Banka district of Bihar.

Deoras *et al.* (2004b) observed that higher (26%) number of farmers provide green fodder throughout the year in urban area in comparison to rural farmers (2.33%). Majority of the farmers (99.66%) did not prefer chaffing of fodder in rural areas, whereas in urban area only 6 per cent preferred it. Almost all farmers of rural (100%) and urban area (93%) sent animals out for grazing. Farmers in rural (73%) and urban (67%) area fed their livestock with crop residues like paddy straw, wheat straw and

lakhdin (Lathyrus) straw. In rural area (96%) farmers fed livestock with only brans and chunnies as a substitute of concentrate mixture. In urban area higher number of farmers provided balanced cattle feed to animals and 100 per cent farmers purchased it from local market. Higher number (97.33%) of farmers of rural area provided common salt to dairy animals in comparison to 27 per cent urban farmers. Majority of farmers provided mineral mixture in urban area as compared to none of the farmer in rural area in Rajnandgaon of Chhatisgarh plain.

Malik *et al.* (2005) reported that 15 and 88 per cent farmers fed mineral mixture and salt, respectively, to the dairy animals. Majority of farmers (98%) used bore well/pump as a source of drinking water in Utter Pradesh.

Munishkumar *et al.* (2005) observed that majority (80%) of buffalo farmers cultivated the fodder for their animals. 93.05 per cent were fed concentrate at the time of milking. Majority (63.89%) of respondents used home prepared concentrate like barley, wheat bran etc, whereas 36.11 per cent respondents purchased readymade concentrates from local market. Feeding of Mineral mixture was practiced by only 25.00 per cent of the farmers. Grazing of animals was practiced by only 15 per cent farmers. Preservation of green fodder in the form of either hay or silage was practiced by only 6.25 per cent of farmers in Ferozpur district of Punjab.

Vij and Tantia (2005) reported that most of the farmers (73%) cultivated fodder for feeding to their buffaloes and on an average a farmer had 0.50 ha of land under fodder production. Most of the farmers chaffed the fodder and fed the animals in groups in Ferozepur, Amritsar and Gurdaspur districts of Punjab.

Gupta *et al.* (2008) observed that majority of farmers fed chaffed green and dry fodder to their animals in groups in stall. Lactating animals were offered concentrate

and mineral mixture/ common salt on individual basis in different agro-climatic zones of Rajasthan.

Meena *et al.* (2008) found that chaffing of grasses or other fodder was not practiced by the farmers. Less number (24%) of livestock farmers were aware of supplementing salt and mineral mixture to their animals. 81 per cent of farmers provided cooked barley (jai) before 2 months of calving and 45 per cent farmers provided extra ration to advanced pregnant animals at high altitude Kumaon Himalaya.

Rathore and Kachwaha (2009) reported that majority of respondents (60.00%) fed wheat/barely straw and bajra stover as dry fodder to buffaloes. About one third (34.25%) of the buffalo owners cultivated and fed green fodder to their buffaloes round the year, while 42.50 per cent of the respondents chaffed green fodder. None of the farmer prepared hay and silage and did not follow chemical treatment of low grade roughages to improve its nutritive value. More than half (57.50%) of the buffalo owners fed common salt to their buffaloes while only 29.75 per cent of respondents incorporated mineral mixture in the ration in Jhunjhunu district of Rajasthan.

Sinha *et al.* (2009b) found that wheat straw was used as dry fodder by 86-98 per cent of farmers in rural, semi urban and urban areas. Majority of farmers in urban area (97.8%) fed concentrate round the year whereas only 66.7 and 75.6 per cent of farmers in rural and semi urban areas, respectively, followed this practice. None of the farmers used silage, hay making or urea treated straw in Bareilly district of Utter Pradesh.

Ahirwar *et al.* (2010) observed that majority of farmers in both urban and rural areas provided green fodder to buffaloes thorough out the year. Majority of farmers (69.33%) in rural area sent buffaloes for grazing. Most of the farmers (75.33%) in rural

areas provided homemade concentrate like wheat bran, gram / chunie etc, whereas urban farmers (100%) purchased concentrate from the market. Common salt was provided by 6 and 41 per cent of farmers in rural and urban areas, respectively. 11 and 92 per cent of farmers provided mineral mixture in rural and urban areas, respectively. Majority of the rural farmers (80.33%) provided drinking water from a tube well but in urban areas 74 per cent farmers supplied drinking water to buffaloes with a hand pump or by using tap water in Indore district of Madhya Pradesh.

Sabapara *et al.* (2010) reported that paddy straw was used as dry fodder by 98 per cent of farmers. All the farmers provided green natural border grass of cultivated plots and grasses from fallow land. In addition to this, 75 per cent of farmers cultivated fodder crops. None of the farmers practiced silage making. Concentrates was fed to the animals after milking by 91 per cent of farmers. Mineral supplements were provided by only 30.5 per cent of farmers to milch animals in the tribal area of south Gujarat.

Singh *et al.* (2010) found that majority of the dairy owners (63%) provided green forage throughout the year. Contrary to this 61 per cent farmers did not prefer chaffing of fodder, 82 per cent farmers offered wheat straw to buffaloes as sole source of roughage. 64 per cent of farmers provided common salt but 93 per cent did not supply mineral mixture to their buffaloes. Most of the farmers (94%) offered soaked concentrate with roughages. Major proportion of (73%) the farmers fed concentrate to buffaloes daily before milking, 16.0 per cent at milking time and 11 per cent buffalo owners offered concentrate to their buffaloes after milking in Agra district of Utter Pradesh.

### 2.3.3 Housing management

Pundir *et al.* (2000) reported that the majority of farmers (87%) tied buffaloes throughout the day and night. In about 75 per cent of cases, the farmer and animal houses were separate and in the rest of the cases animal houses were part of the farmers own house. Proper drainage facilities were available in only 23 per cent of byres in Banaskantha and Sabarkantha district of north Gujarat in India.

Kalyankar *et al.* (2004) observed that most of the farmers (75.30%) preferred economical housing *i.e.* kaccha shed (practically thatched roof). Only some (24.57%) farmers provided pucca shed. Separate housing from farmers' residence was found in 41.57 per cent cases, whereas 58.43 per cent animals were housed in part of owners' residence. The kuccha flooring was most common (91.56%) in animal houses. Sanitary conditions in majority of animal houses (94%) were clean, but pucca drain for urine was available only in 10.24 per cent of animal houses in Parbhani district of Maharashtra.

Deoras *et al.* (2004b) found that higher number (42%) of farmers had pucca house in urban areas as compared to the rural areas (1.33%). In urban areas 13 per cent farmers kept their animals in open areas throughout the year as they did not have shed for animals. Higher number (98%) of animal sheds had mud floor in rural area. Majority of animal sheds in rural areas had improper drainage (98%) due to mud floor in Rajnandgaon of Chhatisgarh plain.

Munishkumar *et al.* (2005) observed that majority (87.5%) of respondents had semi- close type of sheds with one or two sides open, followed by close type (96.25%) and loose type (6.25%) of sheds. Majority (56.25%) of respondents kept buffaloes inside their dwellings, followed by 33.75 per cent kept near to their dwellings. Only 10.00 per cent farmers kept their buffaloes in separately located sheds. Majority of respondents (60%) had mud/ kuccha floor and 23.75 per cent had brick paved floor in

the animal shed. Majority of (84%) farmers had pucca feed manager for buffaloes followed by 10.00 and 6.25 per cent had kuccha and others, respectively, under field conditions in the Ferozpur district of Punjab.

Vij and Tantia (2005) reported that most of the farmers (98%) tied buffaloes all the time. Separate animal houses were located in the same premises of the residence in most of the cases (86%). The animal houses were usually open (57%), made up of mud (49%), and bricks (46%), full walled (54%) and had mud floors (66%). These houses were well ventilated (91%) and clean (88%). Drainage was provided in 51 per cent of the houses. Some of the farmers dug ponds for buffaloes wallowing in Ferozepur, Amritsar and Gurdaspur districts of Punjab.

Bainwad *et al.* (2007) found that owners allowed buffaloes for grazing during day time and tie at night (100%). Farmers provided kaccha shed (77.50%) with kaccha flooring (92.00%) and part of residence (59.50%) in watershed area of Parbhani district of Maharashtra.

Mahendra *et al*. (2007) reported that 100 per cent dairy animal houses had kaccha floor, thatched roof (57.5%) and wooden (43.75%) manger. Majority of farmers were dependent on ponds and wells as source of drinking water (73.61%). They had no provision for water troughs in sheds (85.41%) in Tonk and Jhunjhunu districts of Rajasthan.

Rathore and Kachwaha (2009) observed that only 34.25 per cent of respondents had pucca and optimum size manger. More than one-thrid of (39.50%) the respondents followed buffalo wallowing practice in village water tank in Jhunjhunu district of Rajasthan.

Sinha *et al.* (2009b) found that 63.3 per cent of the rural farmers shared their residence with the animals, while this percentage was higher in semi-urban areas (83.3%). Brick floor was observed in 85.6, 72.2 and 80 per cent houses in rural, semi–urban and urban areas, respectively. Distantly located manure pit was observed in 86.7, 73.3 and 57.8 per cent of farmers in rural, semi-urban and urban areas, respectively. In urban (22.2%) and semi-urban (13.3%) areas farmers were not having manure pit. They were simply putting dung at selected places in study area of Uttar Pradesh.

Ahirwar *et al.* (2010) observed that majority of rural farmers number (59.33%) had mud houses according to their economic status, whereas in urban areas 68 per cent of farmers had pucca house with concrete floor in Indore district of Madhya Pradesh.

Modi *et al.* (2010) found that 63.00 per cent of farmers kept dairy animals in loose house, separately from their own dwelling (89.0%), with a pucca manger (64.0%) and floor (82.0%). About 34.0 per cent of farmers preferred iron sheets for roof of animal housing in rural milk shed of Gujarat.

### 2.3.4 Calf rearing practices

Sah *et al.* (2003) reported that 33.33, 38.33, 18.89 and 8.89 per cent respondents allowed newly born calves to suck milk within one hour of birth, after one hour, between 2-4 hours and after 4 hours, respectively. Dairy farmers generally did not practice naval cutting and left to fall off naturally in Banka district of Bihar.

Kalyankar *et al.* (2004) observed that feeding of colostrum after parturition was followed by 100 per cent of the farmers in Parbhani district of Maharashtra.

Deoras *et al.* (2004a) observed that about 41 per cent rural and 45 per cent urban farmers provided colostrum to the newly born calf with in 2 hrs after birth, whereas 31 and 40 per cent rural and urban farmers provided colostrum with in 2-4 hrs, and remaining 28 and 15 per cent rural and urban farmers, respectively, fed colostrum 4 to 8 hrs after the birth of calf. Higher number of (27.66%) rural farmers allowed one quarter for calves in comparison to 14 per cent urban farmers. Higher number of urban farmers practiced regular deworming of calf in Rajnandgaon district of Chhattisgarh plain.

Gupta *et al.* (2008) reported that nearly 96 per cent farmers allowed their calf to suckle a limited quantity of milk. Almost one-third farmers adopted deworming of calves in different agro-climatic zones of Rajasthan.

Manivannan *et al.* (2009) found that all the respondents (100%) adopted colostrum feeding and feeding of good quantity (1.5 - 2 litres per day) of milk to young calf (92%), deworming of calf (90%),vaccination of calf (48%), and concentrate feeding (84%) in village conditions of Namakkal district.

Rathore and Kachwaha (2009) reported that 32.50, 39.75 and 27.75 per cent of the respondents fed colostrum to newborn calves in one hour, within two hours and after drop of placenta, respectively. 37.50 per cent of the respondents cut and disinfected the naval cord of calf. Only 18.75 and 22.25 per cent of the respondents followed vaccination and deworming practices regularly in Jhunjhunu district of Rajasthan.

Sreedhar (2009) observed that about 43 per cent of rural and 5 per cent of urban farmers provided colostrums to the new born calves within 2 hours after birth, whereas 31 and 35 per cent of rural and urban farmers provided colostrums within 2 to 4 hours, respectively, and remaining 26 per cent of rural and 20 per cent of urban farmers provided colostrums within 4 to 8 hours after birth of calf. Higher number of urban

(65%) allowed one quarter for calves as compared to 29 per cent in rural farmers. About 30 per cent of urban and 15 per cent of rural farmers followed deworming practice in Anantapur district of Andhra Pradesh.

Sinha *et al.* (2010a) found that only 5.6 per cent of rural farmers practiced ligation/ cutting and disinfection of the navel cord, this was higher in semi-urban (14.4%) and urban areas (11.1%). 90, 96.7 and 95.6 per cent farmers from rural, semi-urban and urban areas fed colostrum to animals after falling of placenta. Only 7.8 1.1 and 3.3 per cent of milk producers from rural, semi-urban and urban areas , respectively fed colostrum within 2 h of birth. In rural areas majority of the farmers (77.8%) fed milk to their calf till lactation ceased whereas, only 11.1 per cent in semi-urban and 5.6 per cent of the farmers in urban areas followed this practice. Less number of respondents in urban (3.3%), semi-urban (5.6%) and in rural areas (15.6%) practiced weaning of calves in Bareilly district of Utter Pradesh.

Singh *et al.* (2011) observed that most of the farmers did not ligate or apply antiseptic to navel cord on birth. Only about 35.7 per cent farmers fed colostrums to the new born calf within one hour. Most of the farmers did not feed any concentrate to calves. About 93 per cent of farmers were found to be adopted deworming their female calves however deworming was not being done in male calves in Patiala district of Punjab.

### 2.3.5 Milking management practices

Tomar and Thakur (2002) reported that milk disposal system revealed that 15.83 and 7.64 per cent of small and large farmers sold milk to co-operative societies, 6.67 and 4.34 per cent to private milk plants and rest 77.50 and 88.02 per cent to vendors with an overall average of 10.03, 5.02 and 84.95 per cent farmers selling milk to co-

operative societies, private milk plants and vendors, respectively, in Karanal district, Haryana.

Sah *et al.* (2003) found that majority of the respondent (68.89%) followed knuckling method of milking and only 13.33 per cent respondents followed full hand method of milking in Banka district of Bihar.

Kalyankar *et al.* (2004) reported that washing of teats, udder and utensils with clean water before milking was followed by 100 per cent of farmers. None of the farmer followed cleaning of whole animal before milking in Parabhani district of Maharashtra.

Gupta *et al.* (2008) observed that nearly 97 per cent households adopted the practice of washing the udder before milking the animals. More than 89 per cent households milked their animals twice a day in different agro-climatic zones of Rajasthan.

Meena *et al.* (2008) found that milking of cows and buffaloes was done by hand and many of the farmers practiced stripping (48%). 80.33 per cent of milk producers washed the udder with clean water. Majority of the farmers (91%) allowed the calf to suckle for milk let down. 56.33 per cent farmers sold milk directly to the milk dairy co-operatives at high altitude of Kumaon Himalaya.

Rathore and Kachwaha (2009) observed that majority (86.50%) of the respondents followed knuckling method of milking. 21.50 per cent of respondents used oxytocin injection for letdown of milk. None of the buffalo owners followed sealing of teat canal at the end of lactation in Jhunjhunu district of Rajasthan.

Shitole *et al.* (2009) reported that before milking washing of udder, milk utensils and cleaning of hands were adopted by cent per cent farmers in Parbhani district.

Ahirwar *et al.* (2010) found that washing of udder before milking was practiced by 30.33 and 94 per cent respondents in rural and urban areas, respectively. 11.33 and 8 per cent farmers followed full hand method in rural and urban areas, respectively, and 100 per cent of farmers in rural and urban areas followed twice a day milking in Indore district of Madhya Pradesh.

Sinha *et al.* (2010a) reported that cleaning of animals before milking was not much in practice in urban areas, but higher in semi-urban and rural areas. Udder washing was followed by 90.0, 93.3 and 100 per cent farmers in rural, semi- urban and urban areas, respectively. In semi-urban area, 87.8, 10 and 2.2 per cent farmers practiced calf suckling, hand massage and injection, respectively, for the milk let down whereas in urban areas only 50 per cent farmers practiced calf suckling as milk let down process and remaining 40 and 10 per cent were used hand massage and injection, respectively. In rural areas 55.4 per cent farmers milked once and only 41.4 per cent twice a day. In semi- urban and urban areas 73.3 and 97.8 per cent farmers, respectively, were milking animals twice because of highest milk yield. In rural and semi-urban areas knuckling method was followed by 74.4 and 73.3 per cent farmers, respectively, but in urban areas it was 46.7 per cent. Full hand method milking was followed by 18.9, 16.7 and 46.7 per cent of farmers in rural, semi-urban and urban areas, respectively. Most of the farmers in all the areas were not using any drying off procedure and animals got self dried in 96.7 per cent cases in rural and 98.9 per cent each in semi-urban and urban areas in Bareilly district of Utter Pradesh.

Kumar and Mehla (2011) found that majority (62.50%) of farmers adopted full hand method of milking and knuckling was followed only by 15 per cent farmers. No one practiced machine milking. All farmers practiced two times milking and none of

the farmers practiced three times milking. 30 per cent of respondents used oxytocin injection for letdown of milk. 96.5 per cent of farmers washed udder and teats before milking however no one used dip or wipe the teats after milking in the rural areas of Ferozepur district of Punjab.

### 2.3.6 Health care practices

Malik *et al.* (2005) observed that 29 and 22 per cent of respondents vaccinated dairy animals against haemorrhagic septicaemia and foot and mouth disease in Utter Pradesh.

Mahendra *et al.* (2007) reported that majority of the respondents (53%) approached veterinarians for the treatment of sick animals, 46 per cent farmers vaccinated animals against haemorrhagic septicaemia, 43 per cent of respondents practiced control of ectoparasites manually in combination with insecticides. Only 8.8, 2.2 and 1.5 per cent of the respondents dewormed adult animals, isolated sick animals and vaccinated against foot and mouth disease, respectively, in Tonk and Jhunjhunu district of Rajasthan.

Meena *et al.* (2008) found that 11.7 per cent of farmers practiced deworming. Only 6 per cent of farmers isolated the sick animal from healthy animals and only 17.11 per cent of farmers approached veterinary doctor when animals fall sick at high altitude Kumaon Himalaya.

Raquib *et al.* (2009) observed that almost all the farmers vaccinated animals against foot and mouth disease, whereas 74, 81 and 40 per cent farmers vaccinated animals against haemorrhagic septicaemia, black quarter and anthrax, respectively, in Gandherbal district.

Rathore and Kachwaha (2009) reported that only 18.75 and 22.25 per cent of the respondents followed vaccination and deworming regularly. 39.50 per cent of the respondents controlled lice and ticks by dusting insecticide/spraying. Majority (59.75%) of the respondents isolated their sick buffalo from healthy animals. 9.50 and 18.75 per cent of respondents approached veterinary doctor and livestock assistant for treatment of sick buffaloes, respectively. 69.00 per cent of the buffalo owners were unsatisfied with the available veterinary facilities in Jhunjhunu district of Rajasthan.

Sinha *et al.* (2010b) found that deworming was done at regular interval by 2.2, 3.3 and 2.2 per cent of dairy farmers in rural, semi-urban and urban areas, respectively. However animals were seldom dewormed by 51.1, 53.3 and 48.9 per cent farmers in rural, semi-urban and urban areas, respectively. The prophylactic measures adopted by dairy farmers against contagious diseases were hemorrhagic septicaemia (67.8%) and foot and mouth disease (51.1%) in rural areas, but it was 37.8, 37.8 and 33.3, 35.6 per cent for HS and FMD in semi-urban and urban areas, respectively. 68.9, 77.8 and 66.7 per cent farmers used insecticide to control ectoparasites in rural, semi-urban and urban areas, respectively. Only 44.4 per cent of the rural farmers availed the advice from veterinary doctor but in semi-urban and urban areas it was 58.9 and 77.1 per cent, respectively, in Bareilly district of Utter Pradesh.

Singh *et al.* (2011) observed that 46.2, 46.5 and 70.6 per cent of small, medium and large farmers practiced deworming, respectively, to dairy animals. 48.7, 76.7 and 68.8 per cent of small, medium and large farmers control of ectoparasites through application of chemicals in animal houses. Only 15.4, 37.2 and 52.9 per cent of small, medium and large farmers isolated sick animals from the rest of the herd, respectively. 94.7, 83.7 and 64.7 per cent of small, medium and large farmers treated animals by

veterinary doctor, respectively. 97.3, 100 and 100 per cent of small, medium and large farmers satisfied with the veterinary facilities available in Patiala district of Punjab.

Sunil *et al.* (2011) reported that majority of farmers (92.08%) consulted the veterinary doctor/stock man for treatment of sick animals. Only 9.58 per cent of the respondents isolated their sick animals from healthy ones. Regarding vaccination against HS, FMD and BQ, only 14.17 per cent of the respondents got their animals vaccinated and majority (95.00%) of the dairy animal keepers did not follow deworming practice. Majority (90.83%) of the animal owners followed dusting of insecticide to control lice/ ticks. The percentage of respondents rating veterinary facilities as good, satisfactory and poor were 8.33, 25.67 and 66.67 per cent, respectively in mid hills of Uttarakhand.

## 2.5 CONSTRAINTS PERCEIVED BY THE MILK PRODUCERS AND FIELD VETERINARIANS IN BUFFALO PRODUCTION

### 2.5.1 Constraints perceived by milk producers

Chauhan *et al.* (1994) reported that the poor financial position of small farmers, high cost of fodder and concentrates, scarcity of fodder, poor quality of agricultural land, illiteracy, scattered and fragmented holdings, lack of grazing lands and infestation of weeds and poisonous grasses were reported to be the major problems for dairy development in Kangra district of Himachal Pradesh.

Ulmek *et al.* (1998) found that major problem in buffalo rearing was shortage of green fodder throughout the year, followed by the high cost of concentrates in Kolhpur and Satara district of Maharashtra.

Yedukondalu *et al.* (2000) observed that majority of the farmers strongly felt that non-remunerative price for milk (90%), non availability of good dairy animals

(70%), high cost of concentrate and non availability of green fodder (68%), high cost of dairy animals (57%), distant location of AI centres (48%) and lack of credit facilities (37%) were the main constraints faced by the dairy farmers in Medak district of Andhra Pradesh.

Subhash and Dhaka (2001) found that socioeconomic status, fodder deficiency, insufficient infrastructure and repeat breeding were the highest constraints, while breeding, feeding and health care and management ranked lowest in Kurukshetra district of Haryana.

Ulmek and Patil (2001) reported that intensity of financial constraints was very high followed by shortage of resources, technical problems and the lower price offered per kg of milk produced in Kolhapur, Sangli and Solapur district of Maharashtra.

Uma *et al.* (2003) observed that the major constraints perceived by dairy farmers and farm women in adopting improved dairy farming practices in the area were distant location of veterinary institutions for treating the animals and absence of veterinary staff and lack of technical inputs like medicines, vaccines and other essential inputs at the time of need. The other constraints perceived by the respondents were lack of resources to maintain either milch animals of good breed or providing costly green fodder round the year to the dairy animals. Lack of awareness about important aspects of improved dairy farming practices like right time of serving animal after onset of heat, getting pregnancy diagnosis done after service and proper time of serving animal after calving, identification of symptoms and use of prophylactic measures for the common contagious diseases, colostrum feeding and quantity of concentrate to be fed to the pregnant animals were also identified as the important constraints.

Natchimuthu and Ramkumar (2004) found that economic constraints, especially low price for milk and high cost of feed, were the most serious constraints. In addition, lack of awareness about the availability of government services, poor conception through artificial insemination and inadequate incentives from the government were other important constraints perceived by the dairy farmers in the study area of Pondicherry.

Dwaipayan *et al.* (2005) reported that the non-remunerative price of milk, testing of milk only on the basis of fat percentage, reproductive problems, distant location of artificial insemination (AI) centres and high cost of feeds were the major constraints faced by the dairy farmers of the Udham Singh Nagar district in Uttaranchal.

Yadav *et al.* (2007) observed that the economical constraints for the adoption of dairy technology included credit availability, high interest rate, bank loan problems, and unawareness regarding loans, commissions to middlemen and agents and illiteracy. The technical constraints included lack of training, unawareness regarding the recommended cattle rearing practices, non-availability of veterinary services and medicines, non-availability of semen and desired breeds and fiscal problems on purchasing exotic breeds in Kanpur Nagar district of Uttar Pradesh.

Patil *et al.* (2009) reported that majority of the respondents (72.44%) stated their constraint as low milk production from the local breeds, 45.33 per cent as shortage of green fodder and 41.33 per cent as lack of clean water, 78.22 per cent respondents stated their constraint as delay in milk payment, 63.11 per cent as inadequate money and lack of loan facility whereas high cost of concentrates as the constraint by 56.44 per cent of the respondents. As regards technical constraints, majority of the respondents (68.00%) stated their constraint as inadequate knowledge of diseases, their prevention and control

while 56.89 per cent have referred their constraint as non-availability of veterinary services in Nagpur district.

Sanjeeva *et al.* (2009) observed that non functional of AI centre, timely and non-availability of vaccine & veterinary medicine in government hospital, repeat breeding, preferences to cash or food crops rather than fodder crops, unawareness about recommended feeding practices, non-availability of high yielding varieties of fodder seeds, poor availability and high cost of compound feed, mineral mixture, lack of veterinary doctors and lack of knowledge of about scientific management and health care of dairy animals practices were perceived as the major feeding constraints whose rank first was non adoption of improved feeding practices of dairy animals (81.66%) whereas high cost of ingredients of concentrate mixture (79.16%) also hurdle in adoption of improve dairy farming practices by majority of respondents. Other constraints were none of the villages were attached to dairy cooperative societies either private or Government in Banka district of Bihar.

Shashishankar *et al.* (2009b) observed that farmers of dairy units recorded 11 constraints, of which high cost of buffaloes ranked first, followed by lack of proper housing due to high cost of land, non availability of high yielding buffaloes, high incidences of repeat breeding, non availability of green fodders and feed supplements, high cost of veterinary medicines, poor results of artificial insemination (AI), lack of finance/credit facilities, uneconomical male calves and non-remunerative price of milk which required proper attention on priority basis in and around Patna.

Karamjit *et al.* (2010) found that amongst the very serious constraints lack of knowledge regarding silent heat, high cost of dry fodder, feeding practices, milk record keeping and high cost of treatment rated high. On the other hand poor conception rate

of AI, non availability of AI, lack of irrigation facilities for green fodder production, non availability of high yielding varieties of fodder seeds, in adequate housing system, non availability of veterinary hospital were considered as “somewhat serious” by the buffalo rearing respondents of all categories in the study area of Haryana.

Modi and Patel (2010) reported that poor result of AI and higher incidences of repeat breeding in buffaloes were the main constraints faced by the farmers in rural area under milk shed of North Gujarat.

Kathiravan and Selvam (2011) found that lack of fodder and grazing facilities was the prime constraint in buffalo farming (72.13%) followed by labour shortage (70.24%), infertility problems (69.44%) and low productivity (67.58%), excessive feed cost (65.76%), inadequate price for milk (65.18%). Inadequate veterinary coverage and lack of awareness on insurance cover for buffaloes were considered as constraints to little extent in different agro-climatic zones of Tamil Nadu.

### 2.5.2 Constraints perceived by field Veterinarians

Sharma and Makhija (1991) were observed that field veterinarians were facing problem of inadequate facilities for diagnostic purpose and specialized treatment (26.7%), anestrous/silent estrous in buffaloes (23.3%), repeat breeding (20%), not getting right time for insemination(20%), lack of knowledge about scientific breeding (13.3%), and lack of maintenance of proper records by farmers (10%) and lack of subsidy on animals feeds (3.3%) in implementation of ICDP in Hissar district.

Rajput and Hema (2010) reported that inadequate infrastructure facilities available at hospital were reported as most serious constraint by veterinary officers in delivering effective animal health services. Lack of transport facilities in villages was considered as second most serious constraint. Inadequate supply of medicines in

hospital was considered as third most serious constraint. Remote and larger area for coverage, more targets of AI, deworming and castration, late reporting of cases at hospital etc. were reported as other common constraints in remote areas of rural Rajasthan.

# MATERIALS

# AND METHODS

# CHAPTER III

# MATERIALS AND METHODS

In order to study the buffalo production and management practices in a particular district, it is essential to have comprehensive idea about the general profile of the district. The procedures and techniques to collect and analyse the information are presented in this chapter.

## 3.1 GEOGRAPHICAL AND AGRO - CLIMATIC FEATURES OF KRISHNA DISTRICT

Krishna district with head quarters at Machilipatnam is one of the south coastal districts of Andhra Pradesh and is located between $15^0$-$43^/$ and $17^0$-$10^/$of the northern latitude and $80^0$ and $81^/$-$33^/$ eastern longitude which extends over an area of 8,727 square kilometres. It is surrounded on the east partly by Bay of Bengal and West Godavari district of Andhra Pradesh, on the west partly by Guntur and Nalgonda districts of Andhra Pradesh, on the north by Khammam district of Andhra Pradesh and on the south by Bay of Bengal. A map of Andhra Pradesh state showing the districts is presented in Figure 1. The altitude is 125 meters above mean sea level.

The district is divided into 50 mandals under four revenue divisions namely Machilipatnam, Gudiwada, Nuzvid and Vijayawada. The district has human population of 4,187,841. Out of this population, most of the people in the district are rural based. Density of population in the district is as high as 479 persons per square kilometre. The literacy rate in the region is around 70.03 per cent.

### 3.1.1 Climate and rainfall

The climate of Krishna district is of extreme type with severely hot summers and immensely cold winters. The hottest period experienced in the region is from April to June. The district receives annual rainfall of 1028.1 mm of which south-west monsoon accounts for 76 per cent of the normal rainfall while north-east monsoon contributes to 15 per cent of the normal rainfall. The rest is shared by summer showers and winter rains.

### 3.1.2 Agriculture

Agriculture is the most important occupation in the district. The most common type of soil in Krishna district is black cotton (57.6%) followed by sandy clay loam (22.3%) and red loam (19.4%). The important rivers in the district are Krishna, Muneru, Budameru and Tammileru. Net area sown for agricultural crops was 5, 18,664 ha in which 2, 70,870 ha was sown twice in a year. Forests occupied 76,186 ha, while barren and uncultivable land was 37,790 ha. Available permanent pastures and other grazing lands were 10,668 ha. (Statistical Abstract of Andhra Pradesh, 2009). Paddy is the main food crop of the district followed by sugarcane, maize and black gram.

### 3.1.3 Animal husbandry

As per 2007 census, the district has 1,04,459 Cattle, 9,19,509 Buffaloes, 4,88,657 Sheep, 1,56,043 Goats, 19,232 Pigs and 65,03,763 Poultry. The infra structural facilities available for dairy development in the district are presented in Table 1.

**Table: 1 Institutions involved in dairy development in Krishna district**

| S.No. | Name of institute | Number |
|---|---|---|
| 1. | Veterinary College | 1 |
| 2. | Super Speciality Veterinary Hospital (SSVH) | 1 |
| 3. | Veterinary Poly Clinic(VPC) | 1 |
| 4. | Veterinary Hospital(VH) | 15 |
| 5. | Veterinary Dispensary(VD) | 92 |
| 6. | Rural livestock units (RLU) | 213 |
| 7. | Mobile Veterinary Clinic(MVC) | 1 |
| 8. | Animal Health centre (AHC) | 1 |
| 9. | Frozen Semen Banks | 1 |
| 10. | Frozen Semen Depots | 1 |
| 11. | Cryo station ($LN_2$ Plants) | 1 |
| 12. | Animal husbandry Department AI Centers | 245 |
| 13. | Mobile AI Centers | 77 |
| 14. | Gopalamitra AI centers | 112 |
| 15. | Dairy union AI Centers | 34 |
| 16. | Milk processing plants (milk powder plants) | 2 |
| 17. | Liquid milk plants (milk chilling centers) | 8 |
| 18. | Feed mixing plants | 3 |
| 19. | Livestock shandies | 8 |
| 20. | Goshalas | 5 |

## 3.2 LOCALE OF THE STUDY

The Krishna district was purposively selected for this study since the district stands third place in buffalo population in Andhra Pradesh. It was one of the earliest areas of Andhra Pradesh in implementing dairy development programmes with good infrastructural facilities.

### 3.2.1 Selection of respondents

The district was divided into rural, semi-urban and urban areas. The rural area of the district had four revenue divisions namely Machilipatnam, Gudiwada, Nuzvid and Vijayawada. Five mandals were selected randomly from each revenue division and a total of 20 mandals were selected. One village was randomly selected from each mandal. Five buffalo milk producers were selected from each village at random. A total number of 100 buffalo milk producers were selected from 20 villages in the rural area of the district. The villages included in the study area are presented in Table 2.

The district had five Municipalities namely Machilipatnam, Gudiwada, Nuzvid, Pedana and Jaggaipeta which were considered as semi-urban areas. 20 buffalo milk producers were selected from each Municipality at random. A total of 100 semi-urban buffalo milk producers were selected from five municipal areas. Similarly 50 urban buffalo milk producers were selected from Vijayawada Municipal Corporation which are presented in Table 3 and 4. Thus 100 buffalo milk producers from rural, 100 buffalo milk producers from semi-urban and 50 buffalo milk producers from urban areas constituted the total sample size for this study. The location of the rural, semi-urban and urban areas selected for this study in the district is shown in Figure 2.

**Table 2 : Number of buffalo milk producers selected from rural area of Krishna district**

| S.No. | Revenue division | Mandal | Village | Respondents |
|---|---|---|---|---|
| 1. | Nuzvid | Bapulapadu | Bapulapadu | 5 |
| | | Tiruvuru | Akkapalem | 5 |
| | | Gannavaram | Maralapalem | 5 |
| | | Agripalli | Agripalli | 5 |
| | | Nuzvid | Sitaramapuram | 5 |
| 2. | Gudiwada | Gudlavallere | Gudlavallere | 5 |
| | | Pamarru | Komaravolu | 5 |
| | | Gudiwada | Moturu | 5 |
| | | Mudinepalli | Mudinepalli | 5 |
| | | Kaikaluru | Kaikaluru | 5 |
| 3. | Vijayawada | Kanchikacharla | Paritala | 5 |
| | | Jaggayyapeta | Chilakallu | 5 |
| | | Kankipadu | Mantena | 5 |
| | | Thotlavalluru | Thotlavalluru | 5 |
| | | Mylavaram | Velvadam | 5 |
| 4. | Machilipatnam | Gudur | Gudur | 5 |
| | | Challapalli | Challapalli | 5 |
| | | Avanigadda | Avanigadda | 5 |
| | | Ghantasala | Ghantasalapalem | 5 |
| | | Mopidevi | Mopidevilanka | 5 |
| | Total | 20 | 20 | 100 |

**Table 3 : Number of buffalo milk producers selected from semi-urban area of Krishna district**

| S. No. | Municipality | No.of.Wards | No. of Respondent |
|---|---|---|---|
| 1. | Machilipatnam | 4 | 20 |
| 2. | Gudivada | 4 | 20 |
| 3. | Nuzvid | 4 | 20 |
| 4 | Pedana | 4 | 20 |
| 5. | Jaggayyapeta | 4 | 20 |
| | Total | 20 | 100 |

**Table 4: Number of buffalo milk producers selected from Vijayawada urban area**

| **S. No.** | **Name of the division** | **Number of respondents** |
|---|---|---|
| 1. | Ramavarapadu | 5 |
| 2. | Gunadala | 5 |
| 3. | Currency nagar | 5 |
| 4. | Patamata | 5 |
| 5. | Nunna | 5 |
| 6. | Kandrika | 5 |
| 7. | Singhnagar | 5 |
| 8. | Yanamalakuduru | 5 |
| 9. | Durgapuram | 5 |
| 10. | Chittinagar | 5 |
| | Total | 50 |

**Figure 1: Map showing the districts in Andhra Pradesh**

Fifty veterinarians working in the Animal Husbandry department in Krishna district were selected at random. The data pertaining to constraints perceived by the field veterinarians in buffalo production programme were collected in the pretested interview schedule which is presented in appendix.

### 3.3. DATA COLLECTION PROCEDURES

The data pertaining to the bovine population, institutions involved in dairy development and milk production in Krishna district were collected from the records of Directorate of Animal Husbandry, Government of Andhra Pradesh, Hyderabad and Office of the Joint Director (A.H), Vijayawada.

Primary data were collected from the respondents on composition of buffalo herd size, socio-economic characters of the milk producers, economic characters of buffaloes, existing breeding, feeding, management and health care practices in buffaloes and constraints perceived in buffalo production management by the milk producers. For this an interview schedule was prepared and pretested in non sample area. The pretested and final refined interview schedule is presented in appendix.

Prior to the data collection, sufficient rapport was established with the respondents well before field investigation through the paid secretaries of milk producers cooperative societies, Veterinary Assistant Surgeons and local farmers. The respondents were conceived about the purpose of the study. It was also made clear to them that the study was purely academic in nature, thereby any misconceptions about the investigations were cleared and smooth going was ensured. Thus all the steps were taken to obtain unbiased opinions.

The data were collected by administering the final refined interview schedule to the respondents. The questions and statements were asked in vernacular language *i.e.* Telugu. The buffalo milk producers were personally interviewed by the investigator which enabled her to get first hand information personally. It was made sure that the questions were correctly understood by the respondents. Every effort was made to check and cross check the data collected from all the respondents. Friendly atmosphere was maintained during the interview to see that the respondents were at ease to express their opinion fairly and frankly and mutual trust and confidence.

## 3.4 ANALYSIS OF DATA

The data collected during the period of study were scrutinized and tabulated. The data were subjected to frequency, percentages, arithmetic mean, standard error and analysis of variance following the statistical methods according to Snedecor and Cochran (1994). The information obtained was analysed and interpreted.

# RESULTS

# CHAPTER IV

# RESULTS

## 4.1 POPULATION, MILK PRODUCTION AND DISTRIBUTION OF BUFFALOES

### 4.1.1 Buffalo population in Krishna district

The changing structure of bovine population in Krishna district from 1993 to 2007 is presented in Table 5.

It was observed from the Table 5 that the total bovine population in Krishna district increased from 8.80 lakhs to 10.21 lakhs during the period from 1993 to 2007 with 31.52 per cent increase in buffalo population and 43.01 per cent decrease in cattle population during the same period.

It was also found that the adult females over three years and young stock of buffaloes increased by 27.91 and 38.46 per cent, respectively, whereas males over three years of buffaloes decreased by 37.34 per cent. Over all buffalo population was increased by 31.52 per cent in the district during the same period.

Regarding cattle, it was observed that the adult females over 3 years, males over 3 years and young stock and total cattle population decreased by 33.33, 60.00, 23.25 and 43.01 per cent, respectively, during the same period.

The bovine density per square kilometre of Krishna district is presented in Table 6 indicated that buffalo density increased by 31.52 per cent, whereas cattle density decreased by 43.41 per cent in the district during the period from 1993 to 2007.

**Table 5 : Changing structure of bovine population in Krishna district from 1993 to 2007 (in lakhs)**

| Category | 1993 | 1999 | 2003 | 2007 | Per cent change from1993 to 1999 | Per cent change from1993 to 2003 | Per cent change from1993 to 2007 |
|---|---|---|---|---|---|---|---|
| **Buffaloes** | | | | | | | |
| Females over 3 years | 3.87 (43.94) | 4.13 (46.93) | 4.79 (50.37) | 4.95 (48.39) | **6.63** | **23.55** | **27.74** |
| Males over 3 years | 0.13 (1.48) | 0.16 (1.82) | 0.14 (1.48) | 0.08 (0.80) | **22.24** | **7.354** | **-37.34** |
| Young stock | 2.98 (33.79) | 2.97 (33.76) | 3.55 (37.39) | 4.15 (40.59) | **-0.229** | **19.284** | **39.35** |
| Total buffaloes | 6.99 (79.22) | 7.27 (82.51) | 8.49 (89.24) | 9.19 (89.79) | **4.00** | **21.43** | **31.47** |
| **Cattle** | | | | | | | |
| Females over 3 years | 0.54 (6.16) | 0.52 (5.97) | 0.30 (3.24) | 0.36 (3.56) | **-3.24** | **-43.3** | **-33.03** |
| Males over 3 years | 0.85 (9.67) | 0.62 (7.13) | 0.38 (4.05) | 0.34 (3.35) | **-26.32** | **-54.85** | **-59.81** |
| Young stock | 0.43 (4.93) | 0.38 (4.36) | 0.32 (3.45) | 0.33 (3.28) | **-11.55** | **-24.5** | **-22.65** |
| Total cattle | 1.83 (20.77) | 1.54 (17.48) | 1.02 (10.75) | 1.04 (10.20) | **-15.96** | **-44.22** | **-43.04** |
| Total bovines | 8.82 (100.00) | 8.81 (100.00) | 9.51 (100.00) | 10.23 (100.00) | **-0.14** | **7.22** | **13.78** |

Figures in parentheses are percentages of total bovine population

**Table 6: Bovine density in Krishna district during 1993-2007 (Number per Sq.km)**

| Category | 1993 | 1999 | 2003 | 2007 | Per cent change from1993 to 2007 |
|---|---|---|---|---|---|
| Cattle | 21.08 | 17.72 | 11.76 | 12.00 | **-75.66** |
| Buffalo | 80.39 | 83.61 | 97.62 | 105.69 | **23.94** |
| Bovines | 122.55 | 119.04 | 121.13 | 129.70 | **5.51** |

**Table 7: AI done and Calf births in Krishna District from 2003-04 to 2010-11**

| Year | AI Done | | | | Calf births | | | |
|---|---|---|---|---|---|---|---|---|
| | **Cross bred cattle** | **Indigenous cattle** | **Murrah buffalo** | **Total** | **Cross bred cattle** | **Indigenous cattle** | **Murrah buffalo** | **Total** |
| 2003-04 | 12025 (4.21) | 10382 (3.64) | **262916 (92.15)** | 285323 (100.00) | 4553 (4.11) | 4806 (4.34) | **101428 (91.55)** | 110787 (100.00) |
| 2004-05 | 13937 (4.39) | 12598 (3.97) | **290818 (91.64)** | 317353 (100.00) | 4519 (4.06) | 4458 (4.00) | **102352 (91.94)** | 111329 (100.00) |
| 2005-06 | 14217 (4.35 | 13901 (4.25) | **298929 (91.40)** | 327047 (100.00) | 4773 (3.93) | 5017 (4.14) | **111470 (91.93)** | 121260 (100.00) |
| 2006-07 | 14433 (4.03 | 15151 (4.23) | **328837 (91.74)** | 358421 (100.00) | 5546 (3.77) | 17305 (11.76) | **124310 (84.47)** | 145622 (100.00) |
| 2007-08 | 14142 (3.86 | 16563 (4.52) | **335816 (91.62)** | 366521 (100.00) | 4805 (3.47) | 5566 (4.03) | **127995 (92.50)** | 138366 (100.00) |
| 2008-09 | 14034 (3.54) | 18133 (4.57) | **364526 (91.89)** | 396693 (100.00) | 3447 (2.48) | 4950 (3.56) | **130472 (93.96)** | 138869 (100.00) |
| 2009-10 | 15036 (3.54) | 24241 (5.70) | **385646 (90.76)** | 424923 100.00) | 5250 (3.18) | 8932 (5.42) | **150677 (91.40)** | 164859 (100.00) |

Figures in parenthesis are percentages of total AI done/calf births.

Population density of buffaloes was observed to be 105.19 per square kilometre as compared to 11.80 for cattle in the year 2007.

AI done and calf births in Krishna district from 2003-04 to 2009-10 are presented in Table 7. It was observed that number of AI done with Murrah semen in buffaloes in the district ranged from 90.76 to 92.15 per cent of the total AI done in cattle and buffaloes during the period of seven years. It was also found from the Table 7 that the number of Murrah and Murrah graded buffalo calves born through AI in the district ranged from 84.47 to 93.96 per cent of the total cattle and buffalo calves born through AI during the period of seven years.

### 4.1.2 Milk production

Table 8 shows that Krishna district contributed 7.34 per cent of total milk production in Andhra Pradesh state during the year 2009-10. The contribution of buffalo milk to total milk production was found to be 91.25 per cent in the district during the year 2009-10. The particulars of annual milk production in Krishna district from 2000-01 to 2009-10 are presented in Table 9. They revealed that the annual total milk production increased by 114.57 per cent in the year 2009-10 over 2000-01. Further, it could be observed that the annual buffalo milk production was increased from 344000 to 699000 MT's, whereas cow milk production was increased from 23000 to 67000MT's during the period from 2000-01 to 2009-10. The contribution of buffalo milk to total milk production ranged from 73.97 to 96.81 per cent in the district during the 10 years period under study.

**Table 8: Milk production in Andhra Pradesh during the year 2009-10 ('000 MTs)**

| District | Cow milk | Buffalo milk | Total | % Contribution to A.P State milk production |
|---|---|---|---|---|
| Srikakulam | 202 (64.95) | 109 (35.05) | 311 | 2.98 |
| Vizianagaram | 166 (52.20) | 152 (47.80) | 318 | 3.04 |
| Visakhapatnam | 181 (36.35) | 317 (63.65) | 498 | 4.77 |
| East godavari | 189 (24.20) | 592 (75.80) | 781 | 7.48 |
| West godavari | 101 (16.34) | 517 (83.66) | 618 | 5.92 |
| **Krishna** | **67 (8.75)** | **699 (91.25)** | **766** | **7.34** |
| Guntur | 98 (11.79) | 733 (88.31) | 831 | 7.95 |
| Prakasam | 103 (12.34) | 732 (87.66) | 835 | 8.00 |
| SPS Nellore | 47 (12.21) | 338 (87.79) | 385 | 3.69 |
| Chittoor | 646 (86.03) | 104 (13.87) | 750 | 7.20 |
| Kadapa | 43(15.52) | 234 (84.48) | 277 | 2.65 |
| Ananthapur | 135( 35.16) | 249 (64.84) | 384 | 3.68 |
| Kurnool | 97 (20.04) | 387 (79.96) | 484 | 4.64 |
| Mahaboobnagar | 80 (22.04) | 283 (77.96) | 363 | 3.48 |
| Ranga reddy | 43 (19.82) | 174 (80.18) | 217 | 2.08 |
| Hyderabad | 17 (24.29) | 53 (75.71) | 70 | 0.67 |
| Medak | 87 (24.03) | 275 (75.97) | 362 | 3.47 |
| Nizamabad | 58 (26.98) | 157 (73.02) | 215 | 2.06 |
| Adilabad | 90 (39.65) | 137 (60.35) | 227 | 2.17 |
| Karimnagar | 96 (18.32) | 428 (81.68) | 524 | 5.02 |
| Warangal | 59 (21.00) | 222 (79.00) | 281 | 2.69 |
| Khammam | 112 (26.11) | 317 (73.89) | 429 | 4.11 |
| Nalgonda | 112 (22.22) | 392 (77.78) | 504 | 4.83 |
| Total | 2828 (27.11) | 7602 (72.89) | 10430 | 100 |

Figures in parentheses indicating the per cent of milk production from cows and buffaloes with in district.

**Table 9 : Milk production in Krishna district from 2000-01 to 2009-10 (IN '000 MTs)**

| | **Cow milk** | | | **Buffalo milk** | | | Total milk (cow +buffalo**)** | **Contribution of buffalo milk (%)** |
|---|---|---|---|---|---|---|---|---|
| | Local | Cross bred | Total | Local | Graded Murrah | Total | | |
| 2000-2001 | 19 | 4 | 23 | 204 | 130 | 334 | 357 | **93.55** |
| 2001-2002 | 37 (94.74) | 22 (450.00) | 59 (156.52) | 222 (8.82) | 147 (13.08) | 369 (10.48) | 428 (19.89) | **86.21** |
| 2002-2003 | 48 (152.63) | 40 (900.00) | 89 (286.96) | 236 (15.69) | 162 (24.62) | 398 (19.16) | 487 (36.41) | **81.72** |
| 2003-2004 | 35 (84.21) | 42 (950.00) | 77 (234.78) | 240 (17.64) | 217 (66.92) | 457 (36.83) | 534 (49.57) | **85.39** |
| 2004-2005 | 12 (-36.84) | 9 (125.00) | 21 (-8.70) | 105 (-48.52) | 533 (310.0) | 638 (91.01) | 659 (84.59) | **96.81** |
| 2005-2006 | 62 (226.31) | 77 (1825.0) | 139 (504.34) | 219) (7.35) | 203 (56.15) | 422 (26.35) | 561 (57.14) | **75.22** |
| 2006-2007 | 69 (263.15) | 83 (1975.0) | 152 (560.86) | 229 (12.25) | 203 (56.15) | 432 (29.34) | 584 (63.59) | **73.97** |
| 2007-2008 | 78 (310.53) | 93 (2225.0) | 171 (643.48) | 258 (26.47) | 228 (75.38) | 486 (45.51) | 657 (84.03) | **73.97** |
| 2008-2009 | 43 (126.31) | 8 (100.0) | 51 (121.73) | 343 (68.14) | 309 (137.69) | 652 (95.21) | 703 (96.92) | **92.74** |
| 2009-2010 | 47 (147.37) | 20 (400.0) | 67 (191.30) | 539 (164.21) | 160 (23.07) | 699 (109.28) | 766 (114.57) | **91.25** |

Figures in parentheses indicating the per cent of increase or decrease from the base year 2000-2001

### 4.1.3 Distribution of buffaloes in the study area

The means with standard errors of buffaloes and cattle distributed in the study area is presented in Table 10. The analysis of variance of distribution of buffaloes is presented in Table 11.

The overall mean number of lactating buffaloes, dry buffaloes, heifers, calves and total buffaloes possessed by milk producers in the study area was found to be 4.28 ± 0.54, 3.3 ± 0.26, 1.93 ± 0.11, 4.04 ± 0.27 and 13.6 ± 1.10, respectively. It was observed that the mean number of lactating buffaloes, dry buffaloes, heifers, calves and total buffaloes in urban area was found to be significantly ($P \leq 0.01$) higher than that in semi-urban and rural areas. It was also noticed that the mean number of buffaloes possessed by the milk producers was higher than that of cattle in the study area.

The means with standard errors of the distribution of buffalo breeds in the study area are presented in Table 12. The analysis of variance of distribution of buffalo breeds in the study area is presented in Table 13.

The overall mean number of Murrah, Murrah graded and local buffaloes possessed by the milk producers in the study area were observed to be 4.06 ± 0.93, 9.03 ± 0.58 and 1.10 ± 0.10, respectively. It was also observed that the mean number of Murrah, Murrah graded and local buffaloes in urban area were found to be significantly ($P \leq 0.01$) higher than that in semi-urban and urban areas.

**Table 10 : Distribution of buffaloes and cattle in the study area (Mean ± SE)**

| S.No. | Particulars | Rural (N=100) | Semi-urban (N=100) | Urban (N=50) | Overall (N=250) |
|---|---|---|---|---|---|
| **Buffaloes** | | | | | |
| 1. | Lactating buffaloes | 3.53±0.88[a] | 3.65±0.61[a] | 7.02±1.62[b] | 4.28±0.54 |
| 2. | Dry buffaloes | 2.38±0.34[a] | 3.13±0.29[a] | 5.48±0.97[b] | 3.3±0.26 |
| 3. | Buffalo heifers | 1.41±0.12[a] | 2.24±0.14[b] | 2.34±0.38[b] | 1.93±0.11 |
| 4. | Buffalo calves | 3.2±0.19[a] | 3.37±0.14[a] | 7.06±1.19[b] | 4.04±0.27 |
| 5. | Buffalo bullocks | 0.08±0.04 | 0.05±0.02 | 0.00±0.00 | 0.05±0.02 |
| 6. | Total buffaloes | 10.6±1.28[a] | 12.44±1.47[a] | 21.9±3.67[b] | 13.6±1.10 |
| **Cattle** | | | | | |
| 1. | Lactating cattle | 0.15±0.07 | 0.38±0.17 | 1.12±0.7 | 0.43±0.16 |
| 2. | Dry cattle | 0.11±0.06 | 0.32±0.3 | 0.66±0.41 | 0.30±0.15 |
| 3. | Cattle heifers | 0.3±0.14 | 0.46±0.25 | 0.48±0.25 | 0.4±0.13 |
| 4. | Cattle calves | 0.41±0.18 | 0.35±0.12 | 0.88±0.06 | 0.48±0.13 |
| 5. | Cattle bullocks | 0.29±0.1 | 0.00±0.00 | 0.16±0.10 | 0.15±0.05 |
| 6. | Total cattle | 1.26±0.49 | 1.51±0.55 | 3.3±1.67 | 1.76±0.39 |

Means with different superscripts row wise under each character differ significantly

($P \leq 0.01$)

**Table 11: Analysis of variance for distribution of buffaloes in the study area**

| Source of Variation | Degrees of freedom | Sum of squares | Mean squares | F ratio |
|---|---|---|---|---|
| **Lactating buffaloes** | | | | |
| Between Groups | 2 | 631.534 | 315.767 | 7.47* |
| Within Groups | 247 | 10441.89 | 42.27486 | |
| Total | 249 | 11073.42 | | |
| **Dry buffaloes** | | | | |
| Between Groups | 2 | 325.15 | 162.575 | 10.50* |
| Within Groups | 247 | 3825.35 | 15.48725 | |
| Total | 249 | 4150.5 | | |
| **Buffalo heifers** | | | | |
| Between Groups | 2 | 45.054 | 22.527 | 7.50* |
| Within Groups | 247 | 741.65 | 3.002632 | |
| Total | 249 | 786.704 | | |
| **Buffalo calves** | | | | |
| Between Groups | 2 | 571.47 | 285.735 | 17.37* |
| Within Groups | 247 | 4062.13 | 16.44587 | |
| Total | 249 | 4633.6 | | |
| **Buffalo bullocks** | | | | |
| Between Groups | 2 | 0.211285 | 0.105643 | 0.86 |
| Within Groups | 247 | 30.11 | 0.122398 | |
| Total | 249 | 30.32129 | | |
| **Total buffalo** | | | | |
| Between Groups | 2 | 4185.374 | 2092.69 | 5.26* |
| Within Groups | 247 | 97011.43 | 397.59 | |
| Total | 249 | 101196.8 | | |

*Significant ($P \leq 0.01$)

**Table 12: Distribution of buffalo breeds in the study area (Mean ± SE)**

| Breed | Rural (N=100) | Semi-urban (N=100) | Urban (N=50) | Overall (N=250) |
|---|---|---|---|---|
| Murrah | $1.98 \pm 0.20^{a}$ | $4.63 \pm 1.30^{b}$ | $7.06 \pm 3.84^{b}$ | $4.06 \pm 0.93$ |
| Graded Murrah | $7.6 \pm 0.37^{a}$ | $8.02 \pm 1.18^{a}$ | $13.9 \pm 1.28^{b}$ | $9.03 \pm 0.58$ |
| Local | $1.46 \pm 0.18^{a}$ | $0.71 \pm 0.104^{b}$ | $1.14 \pm 0.30^{a}$ | $1.10 \pm 0.10$ |
| Total | $11.04 \pm 0.59^{a}$ | $13.36 \pm 2.48^{a}$ | $22.1 \pm 3.82^{b}$ | $14.19 \pm 1.28$ |

Means with different superscripts row wise under each character differ significantly ($P \leq 0.01$)

**Table 13: Analysis of variance for distribution of buffalo breeds in the study area**

| Source of Variation | Degrees of freedom | Sum of squares | Mean squares | F ratio |
|---|---|---|---|---|
| **Murrah** | | | | |
| Between Groups | 2 | 1253.684 | 626.842 | 5.19* |
| Within Groups | 247 | 29849.36 | 120.8476 | |
| Total | 249 | 31103.04 | | |
| **Graded Murrah** | | | | |
| Between Groups | 2 | 1461.59 | 730.79 | 9.29* |
| Within Groups | 247 | 19181.41 | 78.61 | |
| Total | 249 | 20643 | | |
| **Local** | | | | |
| Between Groups | 2 | 28.246 | 14.12 | 5.33* |
| Within Groups | 247 | 653.45 | 2.65 | |
| Total | 249 | 681.69 | | |
| **Total buffaloes** | | | | |
| Between Groups | 2 | 4185.374 | 2092.69 | 5.26* |
| Within Groups | 247 | 97011.43 | 397.59 | |
| Total | 249 | 101196.8 | | |

*Significant ($P \leq 0.01$)

## 4.2 SOCIO-ECONOMIC CHARACTERISTICS OF BUFFALO MILK PRODUCERS IN THE STUDY AREA

The socio-economic characteristic of buffalo milk producers in the study area is presented in Table 14.

### 4.2.1 Age

It was observed that 16, 9 and 14 per cent of respondents belonged to young age group in rural, semi-urban and urban areas, respectively. 76, 83 and 84 per cent of respondents belonged to middle age in rural, semi-urban and urban areas, respectively. 8, 8 and 2 per cent of respondents belonged to old age in rural, semi-urban and urban areas, respectively. Overall 12.8, 80.4 and 6.8 per cent of respondents were found to be young age, middle age and old age, respectively, in the study area.

### 4.2.2 Caste

It was found that 14, 20 and 24 per cent of respondents belonged to scheduled caste in rural, semi-urban and urban areas, respectively. 23, 13 and 16 per cent belonged to scheduled tribe in rural, semi-urban and urban areas, respectively. 27, 34 and 36 per cent belonged to backward caste in rural, semi-urban and urban areas, respectively. 36, 33 and 24 per cent belonged to other caste in rural, semi-urban and urban areas, respectively. Overall 18.4, 17.6, 31.6 and 32.4 per cent belonged to scheduled caste, scheduled tribe, backward caste and other caste, respectively, in the study area.

### 4.2.3 Education

It was noticed that 22 and 8 per cent of respondents were illiterate in rural and semi-urban areas, respectively, whereas all the respondents were literates in the urban area. 26, 31 and 22 per cent of respondents had primary education in rural, semi-urban and urban areas, respectively. 32, 35 and 46 per cent of respondents had high school education in rural, semi-urban and urban areas, respectively. 20, 26 and 32 per cent of respondents had college education in rural, semi-urban and urban areas, respectively. 27.2, 36.0 and 24.8 per cent respondents had primary, high school and college education, respectively, in the study area. Only 12 per cent of the respondents were found to be illiterates.

### 4.2.4 Main occupation

It was observed that agriculture was the main occupation for 61, 45 and 38 per cent of respondents in rural, semi-urban and urban areas, respectively. Dairying was the main occupation for 29, 32 and 38 per cent of respondents in rural, semi-urban and urban areas, respectively. Business was the main occupation for 7, 14 and 6 per cent respondents in rural, semi-urban and urban areas, respectively. Service was the main occupation for 3, 9 and 18 per cent respondents in rural, semi-urban and urban areas, respectively. Overall 50.00, 32.0, 9.60 and 8.40 per cent of respondents had agriculture, dairying, business and service as main occupation, respectively, in the study area.

### 4.2.5 Land holding

It was found that 22, 38 and 36 per cent of respondents were landless in rural, semi-urban and urban areas, respectively. 42, 27 and 24 per cent of respondents were marginal farmers in rural, semi-urban and urban areas, respectively. 17, 15 and 18 per

**Table 14: Socio-Economic characteristics of buffalo milk producers**

| S.No. | Category | Rural (N=100) % | Semi-urban (N=100) % | Urban (N=50) % | Overall (N=250) % |
|---|---|---|---|---|---|
| **AGE** | | | | | |
| 1. | Young age (upto 30 years) | 16 | 09 | 14 | 12.8 |
| 2. | Middle age (31-55 years) | 76 | 83 | 84 | 80.4 |
| 3. | Old age (above 55 years) | 08 | 08 | 02 | 6.8 |
| **CASTE** | | | | | |
| 1. | Scheduled caste | 14 | 20 | 24 | 18.4 |
| 2. | Scheduled tribe | 23 | 13 | 16 | 17.6 |
| 3. | Backward caste | 27 | 34 | 36 | 31.6 |
| 4. | Other caste | 36 | 33 | 24 | 32.4 |
| **EDUCATION** | | | | | |
| 1. | Illiterate | 22 | 8 | 0 | 12.0 |
| 2. | Primary | 26 | 31 | 22 | 27.2 |
| 3. | High school | 32 | 35 | 46 | 36.0 |
| 4. | College | 20 | 26 | 32 | 24.8 |
| **MAIN OCCUPATION** | | | | | |
| 1. | Agriculture | 61 | 45 | 38 | 50.0 |
| 2. | Dairying | 29 | 32 | 38 | 32.0 |
| 3. | Business | 7 | 14 | 6 | 9.6 |
| 4. | Service | 3 | 9 | 18 | 8.40 |

Contd…

Continuation of Table 14

| S.No. | Category | Rural (N=100) % | Semi-urban (N=100) % | Urban (N=50) % | Overall (N=250) % |
|---|---|---|---|---|---|
| **LAND HOLDING** | | | | | |
| 1. | Land less | 22 | 38 | 36 | 31.2 |
| 2. | Marginal (up to 2.5acre) | 42 | 27 | 24 | 32.4 |
| 3. | Small (2.5-5acre) | 17 | 15 | 18 | 16.4 |
| 4. | Medium (5-10acr) | 15 | 12 | 12 | 13.2 |
| 5. | Large (above 10acre) | 4 | 8 | 10 | 6.8 |
| **FAMILY SIZE** | | | | | |
| 1. | Up to 5 members ( small ) | 59 | 68 | 66 | 64.0 |
| 2. | Above 5 members (large) | 41 | 32 | 34 | 36.0 |
| **EXTENSION CONTACT** | | | | | |
| 1. | Para veterinarian | 40 | 25 | 10 | 28.0 |
| 2. | Veterinarian | 55 | 69 | 90 | 67.6 |
| 3. | Others | 5 | 6 | 0 | 4.40 |
| **MASS MEDIA EXPOSURE** | | | | | |
| 1. | Radio | 4 | 2 | 0 | 2.4 |
| 2. | Television | 13 | 19 | 34 | 19.6 |
| 3. | Farm magazine | 2 | 2 | 8 | 3.2 |
| 4. | No exposure | 81 | 77 | 58 | 74.8 |

cent of respondents were small farmers in rural, semi-urban and urban areas, respectively. 15, 12 and 12 per cent of respondents were medium farmers in rural, semi-urban and urban areas, respectively. 4, 8 and 10 per cent of respondents were large farmers in rural, semi-urban and urban areas, respectively. Overall 31.2, 32.4, 16.4, 13.2 and 6.80 per cent of respondents were found to be landless, marginal, small, medium and large farmers, respectively, in the study area.

### 4.2.6 Family size

It was observed that 59, 68 and 66 per cent of respondents had small family size in rural, semi-urban and urban areas, respectively, whereas 41, 32 and 34 per cent of respondents had large family size in rural, semi-urban and urban areas, respectively. Overall 64.0 and 36.0 per cent of respondents had small and large family size, respectively, in the study area.

### 4.2.7 Extension contact

It was found that 55, 69 and 90 per cent of respondents had extension contact with veterinarians in rural, semi-urban and urban areas, respectively, whereas 40, 25 and 10 per cent of respondents had extension contact with para veterinarians in rural, semi-urban and urban areas, respectively. Overall 67.6, 28.0 and 4.40 per cent of respondents had extension contact with veterinarians, para veterinarians and others, respectively, in the study area.

### 4.2.8 Mass media exposure

It was observed that 4 and 2 per cent of respondents had mass media exposure with radio in rural and semi-urban areas, respectively, whereas 13, 19 and 34 per cent of

**Table 15: Contribution of dairy, agriculture and other activities to family gross income (in Rupees/annum)**

| Enterprise | Rural | Semi-urban | Urban |
|---|---|---|---|
| Agriculture | 82,550 (61.87) | 76,450 (54.67) | 63,960 (32.94) |
| Dairying | 40,070 (30.03) | 47,580 (34.03) | 74,340 (38.28) |
| Other activities | 10,800 (8.10) | 15,800 (11.30) | 55,900 (28.78) |
| Total family gross income | 1,33,420 (100.00) | 1,39,830 (100.00) | 1,94,200 (100.00) |

Figures in parentheses indicate percentages to total family gross income

respondents had mass media exposure with television in rural, semi-urban and urban areas, respectively. 2, 2 and 8 per cent of respondents had exposure to farm magazine in rural, semi-urban and urban areas, respectively. Overall 74.80 per cent of respondents did not have exposure with radio, television and farm magazine in the study area.

The contribution of dairying, agriculture and other activities to family gross income is presented in Table 15. The per cent contribution of agriculture, dairying and other activities to the total family income in rural area was found to be 61.87, 30.03 and 8.10per cent, respectively. The corresponding values in semi-urban area were 54.67, 34.03 and 11.30 per cent, respectively, and those of urban area were 32.94, 38.28 and 28.78 per cent, respectively.

### 4.2.9 Availment of technical services and inputs by the respondents

The information about availment of technical services and inputs by the respondents is presented in Table 16. It was observed that 88, 93 and 100 per cent of respondents availed artificial insemination in rural, semi-urban and urban areas, respectively. Overall 92.4 per cent of respondents availed artificial insemination in the study area.

It was found that 76, 74 and 100 per cent of respondents availed treatment for infertility in rural, semi-urban and urban areas, respectively. Overall 80.0 per cent of respondents availed treatment for infertility in the study area. It was observed that 73, 74 and 100 per cent of respondents availed treatment for sick animals in rural, semi-urban and urban areas, respectively. Overall 78.8 per cent of respondents availed treatment for sick animals in the study area.

**Table 16 : Availment of technical services and inputs by the respondents**

| S.No. | Technical service/input | | Rural (N=100) % | Semi-urban (N=100) % | Urban (N=50) % | Overall (N=250) % |
|---|---|---|---|---|---|---|
| 1. | Artificial insemination | Availed | 88 | 93 | 100 | 92.4 |
| | | Not availed | 12 | 7 | 0 | 7.6 |
| 2. | Treatment for infertility | Availed | 76 | 74 | 100 | 80.0 |
| | | Not availed | 24 | 26 | 0 | 20.0 |
| 3. | Treatment for sick animals | Availed | 73 | 74 | 100 | 78.8 |
| | | Not availed | 27 | 26 | 0 | 21.2 |
| 4. | Subsidised fodder seeds/ slips | Availed | 34 | 26 | 30 | 30.0 |
| | | Not availed | 66 | 74 | 70 | 70.0 |
| 5. | Subsidised concentrate feed | Availed | 36 | 21 | 24 | 27.6 |
| | | Not availed | 64 | 79 | 76 | 72.4 |
| 6. | Subsidised mineral mixture | Availed | 22 | 15 | 20 | 18.8 |
| | | Not availed | 78 | 85 | 80 | 81.2 |
| 7. | Subsidised chaff cutters | Availed | 0 | 0 | 0 | 0 |
| | | Not availed | 100 | 100 | 100 | 100 |
| 8. | Subsidised milch buffalo insurance | Availed | 39 | 23 | 58 | 36.4 |
| | | Not availed | 61 | 77 | 42 | 63.6 |
| 9. | Supply of milch animals | Availed | 4 | 3 | 24 | 7.6 |
| | | Not availed | 96 | 97 | 76 | 92.4 |
| 10. | Credit facility from bank | Availed | 2 | 1 | 14 | 4.0 |
| | | Not availed | 98 | 99 | 86 | 96.0 |

It was observed that 34, 26 and 30 per cent of respondents availed subsidised fodder seeds/ slips in rural, semi-urban and urban areas, respectively. Overall 30.0 per cent of respondents availed subsidised fodder seeds/slips in the study area. 36, 21 and 24 per cent of respondents' availed subsidised concentrate feed in rural, semi-urban and urban areas, respectively. Overall 27.6 per cent of respondents availed subsidised concentrate feed in the study area. It was found that only 22, 15 and 20 per cent of respondents availed subsidised mineral mixture in rural, semi-urban and urban areas, respectively. Overall 18.8 per cent of respondents availed subsidised mineral mixture in the study area.

It was found that none of the respondents availed subsidised chaff cutter in the study area of the district. 39, 23 and 58 per cent of respondents availed subsidised milch buffalo insurance in rural, semi-urban and urban areas, respectively. Overall 36.4 per cent of respondents availed subsidised milch buffalo insurance in the study area. It was observed that 4, 3 and 24 per cent of respondents availed supply of milch animals in rural, semi-urban and urban areas, respectively. Overall 7.6 per cent of respondents availed supply of milch animals in the study district. Only 2, 1 and 14 per cent of respondents availed credit facility from bank in rural, semi-urban and urban area, respectively. Only 4 per cent of respondents availed credit facility from bank in the study area.

## 4.3 ECONOMIC CHARACTERS OF BUFFALOES IN THE STUDY AREA

### 4.3.1 Economic characters of Murrah buffaloes

The means with standard error of economic characters of Murrah buffaloes of sample households and the results of analysis of variance for economic characters are presented in Tables 17 and 18, respectively.

The overall mean age at first calving of Murrah buffalo was found to be 40.39 ± 0.09 months. The mean age at first calving of Murrah buffaloes was found to be 40.29 ± 0.89, 40.57 ± 0.66 and 40.30 ± 0.57 months in rural, semi-urban and urban areas, respectively. But the difference was found to be statistically not significant ($P \leq 0.05$).

The overall mean service period of Murrah buffaloes was observed to be 136.28 ± 6.91 days. The mean service period of Murrah buffaloes in semi-urban area of 127.89 ± 8.48 days was lower than that of 130.96 ± 7.60 days in urban area and 150.0 ± 12.87 days in rural area but the difference was not statistically significant ($P \leq 0.05$).

The overall mean calving interval of Murrah buffaloes was found to be 443.96 ± 4.47 days. The mean calving interval of Murrah buffaloes in semi-urban area of 435.0 ± 7.11 days was lower than that of 448.23 ± 14.44 days in rural area and 448.65 ± 8.91 days in urban area but the difference was not statistically significant ($P \leq 0.05$).

The overall mean peak yield of Murrah buffaloes was observed to be 13.58 ± 0.42 litres. The mean peak yield of Murrah buffaloes in semi-urban area was 14.36 ± 0.39 litres and it was higher than that of 13.46 ± 0.30 litres in urban area and 12.91 ± 0.59 litres in rural area but the difference was not statistically significant ($P \leq 0.05$).

**Table 17: Economic characters of Murrah buffaloes of sample households in rural, semi-urban and urban areas of Krishna district (Mean ± SE)**

| Economic character | Rural (N=25) | Semi-urban (N=38) | Urban (N= 26) | Overall mean (N=89) |
|---|---|---|---|---|
| Age at first calving (Months) | 40.29 ± 0.89 | 40.57 ± 0.66 | 40.30 ± 0.57 | 40.39 ± 0.09 |
| Service period (Days) | 150 ± 12.87 | 127.89 ± 8.48 | 130.96 ± 7.60 | 136.28 ± 6.91 |
| Calving interval (Days) | 448.23 ± 14.44 | 435.0 ± 7.11 | 448.65 ± 8.91 | 443.96 ± 4.47 |
| Peak yield (Liters) | 12.91 ± 0.59 | 14.36 ± 0.39 | 13.46 ± 0.30 | 13.58 ± 0.42 |
| Lactation milk yield (Liters) | 2582.35 ± 118.67 | 2873.68 ± 79.71 | 2700 ± 64.68 | 2718.67 ± 84.61 |
| Lactation period (Days) | 325.58 ± 7.80 | 319.34 ± 6.43 | 320.76 ± 4.66 | 321.89 ± 1.88 |
| Dry period (Days) | 117.35 ± 9.12 | 104.21 ± 5.45 | 106.73 ± 6.67 | 109.43 ± 4.02 |

**Table 18: Analysis of variance for economic characters of Murrah breed in rural, semi-urban and urban areas of Krishna district**

| Source of Variation | Degrees of freedom | Sum of squares | Mean squares | F ratio |
|---|---|---|---|---|
| Age at first calving | | | | |
| Between Groups | 2 | 1.545512 | 0.772756 | 0.0662 |
| Within Groups | 85 | 1052.331 | 12.38035 | |
| Total | 87 | 1053.877 | | |
| Service period | | | | |
| Between Groups | 2 | 5989.682 | 2994.841 | 1.38550 |
| Within Groups | 85 | 183732.5 | 2161.558 | |
| Total | 87 | 189722.2 | | |
| Calving interval | | | | |
| Between Groups | 2 | 3671.97 | 1835.985 | 0.8690 |
| Within Groups | 85 | 179574.9 | 2112.645 | |
| Total | 87 | 183246.9 | | |
| Peak yield | | | | |
| Between Groups | 2 | 26.6034 | 13.3017 | 2.9682 |
| Within Groups | 85 | 380.9213 | 4.481423 | |
| Total | 87 | 409.5247 | | |
| Lactation milk yield | | | | |
| Between Groups | 2 | 1120375 | 560187.7 | 3.07628 |
| Within Groups | 85 | 15478390 | 182098.70 | |
| Total | 87 | 16598765 | | |
| Lactation length | | | | |
| Between Groups | 2 | 462.7143 | 231.3572 | 0.22099 |
| Within Groups | 85 | 88987.29 | 1046.909 | |
| Total | 87 | 89450 | | |
| Dry period | | | | |
| Between Groups | 2 | 2070.686 | 1035.343 | 0.942437 |
| Within Groups | 85 | 93379.31 | 1098.580 | |
| Total | 87 | 95450 | | |

The overall mean lactation yield of Murrah buffaloes was found to be 2718.67 ± 84.61 litres. The mean lactation milk yield of Murrah buffaloes in semi-urban area of 2873.68 ± 79.71 litres was higher than that of 2700.0 ± 64.68 litres in urban area and 2582.35 ± 118.67 litres in the rural area but the difference was not statistically significant (P≤0.05).

The overall mean lactation period of Murrah buffaloes was observed to be 321.89 ± 1.88 days. The mean lactation period of Murrah buffaloes in rural area of 325.58 ± 7.80 days was higher than that of 320.76 ± 4.66 days in urban area and 319.34 ± 6.43 days in semi-urban area but the difference was not statistically significant (P≤0.05).

The overall mean dry period of Murrah buffaloes was found to be 109.43 ± 4.02 days. The mean dry period of Murrah buffaloes in semi-urban area of 104.21 ± 5.45 days was lower than that of 106.73 ± 6.67 days in urban area and 117.35 ± 9.12 days in rural area but the difference was not statistically significant (P≤0.05).

### 4.3.2 Economic characters of graded Murrah buffaloes

The means with standard error of economic characters of graded Murrah buffaloes of sample households and the results of analysis of variance for economic characters are presented in Tables 19 and 20, respectively.

The overall mean age at first calving of graded Murrah buffaloes was found to be 47.08 ± 1.36 months. The mean age at first calving of graded Murrah buffaloes in urban area of 44.50 ± 0.48 months was found to be significantly (P≤0.05) lower than that of 47.59 ± 0.44 months in semi-urban and 49.15 ± 0.50 months in rural area.

**Table 19 : Economic characters of graded Murrah buffaloes of sample households in rural, semi-urban and urban areas of Krishna district (Mean ± S.E)**

| Economic character | Rural (N=194) | Semi-urban (N=146) | Urban (N=106) | Overall mean (N=446) |
|---|---|---|---|---|
| Age at first calving (Months) | 49.15 ± 0.50[a] | 47.59 ± 0.44[b] | 44.50 ± 0.48[c] | 47.08 ± 1.36 |
| Service period (Days) | 184.63 ± 4.01[a] | 156.57 ± 4.08[b] | 131.74 ± 3.84[c] | 157.65 ± 15.27 |
| Calving interval (Days) | 492.08 ± 4.15[a] | 465.13 ± 4.07[b] | 441.74 ± 3.84[c] | 466.32 ± 14.54 |
| Peak yield (Liters) | 10.17 ± 0.14[c] | 11.74 ± 0.16[b] | 12.47 ± 0.14[a] | 11.46 ± 0.67 |
| Lactation milk yield (Liters) | 2031.95 ± 27.78[c] | 2341.78 ± 33.14[b] | 2503.7 ± 31.07[a] | 2292.50 ± 138.41 |
| Lactation length (Days) | 336.21 ± 1.99[a] | 329.86 ± 2.17[a] | 331.69 ± 2.43[a] | 332.59 ± 1.88 |
| Dry period (Days) | 155.28 ± 3.84[a] | 124.72 ± 3.51[b] | 105.58 ± 3.83[c] | 128.53 ± 14.47 |

Means with different superscripts row wise under each character differ significantly ($P \leq 0.05$)

**Table 20: Analysis of variance for economic characters of graded Murrah buffaloes in rural, semi-urban and urban areas of Krishna district**

| Source of Variation | Degrees of freedom | Sum of squares | Mean squares | F ratio |
|---|---|---|---|---|
| Age at first calving | | | | |
| Between Groups | 2 | 1479.765 | 739.8823 | 20.29144* |
| Within Groups | 443 | 16153.01 | 36.46277 | |
| Total | 445 | 17632.77 | | |
| Service period | | | | |
| Between Groups | 2 | 200408.2 | 100204.1 | 39.87767* |
| Within Groups | 443 | 1113165 | 2512.787 | |
| Total | 445 | 1313573 | | |
| Calving interval | | | | |
| Between Groups | 2 | 181966.8 | 90983.42 | 34.87617* |
| Within Groups | 443 | 1155679 | 2608.756 | |
| Total | 445 | 1337646 | | |
| Peak yield | | | | |
| Between Groups | 2 | 419.8117 | 209.9058 | 62.09901* |
| Within Groups | 443 | 1497.42 | 3.38018 | |
| Total | 445 | 1917.232 | | |
| Lactation milk yield | | | | |
| Between Groups | 2 | 17270548 | 8635274 | 61.36836* |
| Within Groups | 443 | 62335483 | 140712.2 | |
| Total | 445 | 79606031 | | |
| Lactation length | | | | |
| Between Groups | 2 | 3615.431 | 1807.715 | 2.575127 |
| Within Groups | 443 | 310981.9 | 701.9908 | |
| Total | 445 | 314597.4 | | |
| Dry period | | | | |
| Between Groups | 2 | 185940.5 | 92970.25 | 42.39027* |
| Within Groups | 443 | 971586.6 | 2193.198 | |
| Total | 445 | 1157527 | | |

*Significant ($P \leq 0.05$)

The overall mean service period of graded Murrah buffaloes was observed to be 157.65 ± 15.27 days. The mean service period of graded Murrah buffaloes in urban area of 131.74 ± 3.84 days was found to be significantly (P≤0.05) lower than that of 156.57 ± 4.08 days in semi-urban area and 184.63 ± 4.01 days in rural area.

The overall calving interval of graded Murrah buffaloes was found to be 466.32 ± 14.54 days. The mean calving interval of graded Murrah buffaloes in urban area of 441.74 ± 3.84 days was observed to be significantly (P≤0.05) lower than that of 465.13 ± 4.07 days in semi-urban area and 492.08 ± 4.15 days in rural area.

The overall mean peak yield of graded Murrah buffaloes was observed to be 11.46 ± 0.67 litres. The mean peak yield of graded Murrah buffaloes in urban area of 12.47 ± 0.14 litres was found to be significantly (P≤0.05) higher than that of 11.74 ± 0.16 litres in semi-urban area and 10.17 ± 0.14 litres in rural area.

The overall mean lactation milk yield of graded Murrah buffaloes was observed to be 2292.50 ± 138.41 litres. The mean lactation milk yield of graded Murrah buffaloes in urban area of 2503.7 ± 31.07 litres was observed to be significantly (P≤0.05) higher than that 2341.78 ± 33.14 litre in semi-urban area and 2031.95 ± 27.78 litres in rural area.

The overall mean lactation period of graded Murrah buffaloes was observed to be 332.59 ± 1.88 days. The mean lactation period of graded Murrah buffaloes in rural area of 336.21 ± 1.99 days was higher than that of 331.69 ± 2.43 days in urban area and 329.86 ± 2.17 days in semi-urban area but the difference was not statistically significant (P≤0.05).

The overall mean dry period of graded Murrah buffaloes was found to be 128.53 ± 14.47 days. The mean dry period of graded Murrah buffaloes in rural area of 155.28

± 3.84 days was significantly (P≤0.05) higher than that of 124.72 ± 3.51 days in semi-urban and 105.58 ± 3.83 days in urban area.

### 4.3.3 Economic characters of local buffaloes

The means with standard error of economic characters of local buffaloes of sample households and the results of analysis of variance for economic characters are presented in Tables 21 and 22, respectively.

The overall mean age at first calving of local buffaloes was observed to be 55.24 ± 3.45 months. The mean age at first calving of local buffaloes in urban area of 48.37 ± 0.67 months was significantly (P≤0.05) lower than that of 58.0 ± 0.77 months in semi-urban and 59.34 ± 1.01 months in rural area.

The overall mean service period of local buffaloes was found to be 210.62 ± 12.34 days. The mean service period of local buffaloes in urban area of 229.65 ± 9.93 days was higher than that of 214.73 ± 7.52 days in semi-urban and 187.5 ± 14.73 days in urban area but the difference was not statistically significant (P≤0.05).

The overall mean calving interval of local buffaloes was observed to be 520.08 ± 11.92 days. The mean calving interval of local buffaloes of 538.02 ± 10.04 days in rural area was higher than that of 524.73 ± 7.52 days in semi-urban area and 497.5 ± 14.73 days in urban area but the difference was not statistically significant (P≤0.05).

The overall mean peak yield of local buffaloes was found to be 8.87 ± 0.55 litres. The mean peak yield of local buffaloes of 7.77 ± 0.22 litres in rural area was

**Table 21: Economic characters of Local buffaloes of sample households in rural, semi-urban and urban areas of Krishna district (Mean ± SE)**

| Economic character | Rural (N=43) | Semi-urban (N=38) | Urban (N=21) | Overall mean (N=102) |
|---|---|---|---|---|
| Age at first calving (months) | 59.34 ± 1.01[a] | 58 ± 0.77[a] | 48.37 ± 0.67[b] | 55.24 ± 3.45 |
| Service period (Days) | 229.65 ± 9.93[a] | 214.73 ± 7.52[a] | 187.5 ± 14.73[a] | 210.62 ± 12.34 |
| Calving interval (Days) | 538.02 ± 10.04[a] | 524.73 ± 7.52[a] | 497.5 ± 14.73[a] | 520.08 ± 11.92 |
| Peak yield (liters) | 7.77 ± 0.22[b] | 9.27 ± 0.22[a] | 9.56 ± 0.31[a] | 8.87 ± 0.55 |
| Lactation milk yield (liters) | 1555.81 ± 44.32[b] | 1855.26 ± 45.21[a] | 1912.5 ± 63.92[a] | 1774.52 ± 110.60 |
| Lactation length (Days) | 347.32 ± 4.70[a] | 343.55 ± 5.78[a] | 361.25 ± 2.45[a] | 350.70 ± 5.38 |
| Dry period (Days) | 205.81 ± 8.48[a] | 171.31 ± 5.81[b] | 144.37 ± 12.65[b] | 173.83 ± 17.78 |

Means with different superscripts row wise under each character differ significantly ($P \leq 0.05$)

**Table 22: Analysis of variance for economic characters of local buffaloes in rural, semi-urban and urban areas of Krishna district**

| Source of Variation | Degrees of freedom | Sum of squares | Mean squares | F ratio |
|---|---|---|---|---|
| Age at first calving | | | | |
| Between Groups | 2 | 815.3014 | 407.6507 | 14.02475* |
| Within Groups | 99 | 2691.642 | 27.18828 | |
| Total | 101 | 3506.944 | | |
| Service period | | | | |
| Between Groups | 2 | 13485.11 | 6742.556 | 2.51023 |
| Within Groups | 99 | 265917.1 | 2686.031 | |
| Total | 101 | 279402.2 | | |
| Calving interval | | | | |
| Between Groups | 2 | 12122.06 | 6061.03 | 2.22357 |
| Within Groups | 99 | 269854.3 | 2725.801 | |
| Total | 101 | 281976.4 | | |
| Peak yield | | | | |
| Between Groups | 2 | 53.87052 | 26.93526 | 16.2922* |
| Within Groups | 99 | 163.6731 | 1.65326 | |
| Total | 101 | 217.5436 | | |
| Lactation milk yield | | | | |
| Between Groups | 2 | 2149234 | 1074617 | 16.19595* |
| Within Groups | 99 | 6568744 | 66350.94 | |
| Total | 101 | 8717978 | | |
| Lactation length | | | | |
| Between Groups | 2 | 2080.562 | 1040.281 | 1.19060 |
| Within Groups | 99 | 86500.34 | 873.740 | |
| Total | 101 | 88580.9 | | |
| Dry period | | | | |
| Between Groups | 2 | 38919.31 | 19459.66 | 10.49566* |
| Within Groups | 99 | 183552.6 | 1854.066 | |
| Total | 101 | 222471.9 | | |

*Significant ($P \leq 0.05$)

found to be significantly (P≤0.05) lower than that of 9.27 ± 0.22 litres in semi-urban area and 9.56 ± 0.31 litres in urban area.

The overall mean of lactation milk yield of local buffaloes was observed to be 1774.52 ± 110.60 litres. The mean lactation milk yield of local buffaloes in rural area of 1555.81 ± 44.32 litres was observed to be significantly (P≤0.05) lower than that 1855.26 ± 45.12 litre in semi-urban area and 1912.5 ± 63.92 litres in urban area.

The overall mean lactation period of local buffaloes was observed to be 350.70 ± 5.38 days. The mean lactation period of local buffaloes in semi-urban area of 343.55 ± 5.78 days was lower than that of 361.25 ± 2.45 days in urban and 347.32 ± 4.70 days in rural area but the difference was not statistically significant (P≤0.05).

The overall mean dry period of local buffaloes was found to be 173.83 ± 17.78 days. The mean dry period of local buffaloes in rural area of 205.81 ± 8.48 days was significantly (P≤0.05) higher than that of 171.31 ± 5.81 days in semi-urban and 144.37 ± 12.65 days in urban area.

### 4.3.4 Economic characters of Murrah, graded Murrah and local buffaloes under field conditions of Krishna district

The means with standard errors of economic characters of Murrah, graded Murrah and local buffaloes of sample households and the result of analysis of variance for economic characters are presented in Tables 23 and 24, respectively.

The mean age at first calving in Murrah, graded Murrah and local buffaloes was found to be 40.39 ± 0.09, 47.08 ± 1.36 and 55.24 ± 3.45 months, respectively. The

**Table 23: Economic characters of Murrah, Graded Murrah and Local buffaloes of sample households in Krishna district (Mean ± SE)**

| Economic character | Murrah (N=81) | Graded Murrah (N=446) | Local (N= 89) |
|---|---|---|---|
| Age at first calving (months) | $40.39 \pm 0.09^{c}$ | $47.08 \pm 1.36^{b}$ | $55.24 \pm 3.45^{a}$ |
| Service period (Days) | $136.28 \pm 6.91^{c}$ | $157.65 \pm 15.27^{b}$ | $210.62 \pm 12.34^{a}$ |
| Calving interval (Days) | $443.96 \pm 4.47^{c}$ | $466.32 \pm 14.54^{b}$ | $520.08 \pm 11.92^{a}$ |
| Peak yield (liters) | $13.58 \pm 0.42^{a}$ | $11.46 \pm 0.67^{b}$ | $8.87 \pm 0.55^{c}$ |
| Lactation milk yield (liters) | $2718.67 \pm 84.61^{a}$ | $2292.50 \pm 138.41^{b}$ | $1774.52 \pm 110.60^{c}$ |
| Lactation length (Days) | $321.89 \pm 1.88^{c}$ | $332.59 \pm 1.88^{b}$ | $350.70 \pm 5.38^{a}$ |
| Dry period (Days) | $109.43 \pm 4.02^{c}$ | $128.53 \pm 14.47^{b}$ | $173.83 \pm 17.78^{a}$ |

Means with different superscripts row wise under each character differ significantly ($P \leq 0.05$)

**Table 24: Analysis of variance for economic characters of Murrah, graded Murrah and local buffalo in Krishna district**

| Source of Variation | Degrees of freedom | Sum of squares | Mean squares | F ratio |
|---|---|---|---|---|
| Age at first calving | | | | |
| Between Groups | 2 | 13252.85 | 6626.423 | 183.0257* |
| Within Groups | 613 | 22193.59 | 36.20488 | |
| Total | 615 | 35446.44 | | |
| Service period | | | | |
| Between Groups | 2 | 343597.3 | 171798.6 | 59.07485* |
| Within Groups | 613 | 1782697 | 2908.152 | |
| Total | 615 | 2126294 | | |
| Calving interval | | | | |
| Between Groups | 2 | 349822.3 | 174911.2 | 59.47218* |
| Within Groups | 613 | 1802869 | 2941.059 | |
| Total | 615 | 2152691 | | |
| Peak yield | | | | |
| Between Groups | 2 | 1146.978 | 573.4889 | 138.1711* |
| Within Groups | 613 | 2544.3 | 4.150571 | |
| Total | 615 | 3691.278 | | |
| Lactation milk yield | | | | |
| Between Groups | 2 | 46099937 | 23049968 | 134.667* |
| Within Groups | 613 | 151000000 | 171162.8 | |
| Total | 615 | 197099937 | | |
| Lactation period | | | | |
| Between Groups | 2 | 28657.73 | 14328.87 | 17.83007* |
| Within Groups | 613 | 492628.3 | 803.635 | |
| Total | 615 | 521286 | | |
| Dry period | | | | |
| Between Groups | 2 | 284372.3 | 142186.2 | 59.07362* |
| Within Groups | 613 | 1475449 | 2406.932 | |
| Total | 615 | 1759821 | | |

* Significant ($P \leq 0.05$)

average age at first calving was significantly ($P \leq 0.05$) lower in Murrah than that in graded Murrah and local buffaloes in the study area.

The average service period in Murrah, graded Murrah and local buffaloes was observed to be 136.28 ± 6.9, 157.65 ± 15.27 and 210.62 ± 12.34 days, respectively. The mean service period was significantly (P≤0.05) lower in Murrah than that in graded Murrah and local buffaloes in the study area.

The mean calving interval of Murrah, graded Murrah and local buffaloes was found to be 443.96 ± 4.47, 466.32 ± 14.54 and 520.08 ± 11.92 days, respectively. The average calving interval was significantly (P≤0.05) lower in Murrah than that in graded Murrah and local buffaloes.

The average peak yield in Murrah, graded Murrah and local buffaloes was observed to be 13.58 ± 0.42, 11.46 ± 0.66 and 8.87 ± 0.55 litres in the study area, respectively. The mean peak yield in Murrah was significantly (P≤0.05) higher than that in graded Murrah and local buffaloes in the study area.

The mean lactation milk yield in Murrah, graded Murrah and local buffaloes was found to be 2718.67 ± 84.61, 2292.50 ± 138.41 and 1774.52 ± 110.60 litres, respectively. The average lactation milk yield was significantly (P≤0.05) higher in Murrah than that in graded Murrah and local buffaloes in the study area of Krishna district.

The average lactation length in Murrah, graded Murrah and local buffaloes was observed to be 321.89 ± 1.88, 332.59 ± 1.88 and 350.70 ± 5.38 days, respectively. The mean lactation length was significantly (P≤0.05) lower in Murrah than that in graded Murrah and local buffaloes in the study area of the district.

The mean dry period in Murrah, graded Murrah and local buffaloes was found to be 109.43 ± 4.02, 128.53 ± 14.47 and 173.83 ± 17.78 days, respectively. The average

dry period in Murrah was significantly (P≤0.05) lower than that in graded Murrah and local buffaloes in the study area.

## 4.4 BUFFALO PRODUCTION AND MANAGEMENT PRACTICES ADOPTED BY MILK PRODUCERS

### 4.4.1 Breeding management practices

Breeding management practices adopted by the milk producers is presented in Table 25. It was found that rearing of high milk producing buffalo breeds like Murrah and graded Murrah was adopted by 93, 99 and 100 per cent of milk producers in rural, semi-urban and urban areas, respectively. Overall 96.8 per cent of respondents practiced rearing of high milk producing buffalo breeds in the study area. It was observed that heat detection by observing estrous symptoms like bellowing, frequent urination and mucus discharge from vulva in buffaloes was practiced by 98, 99 and 96 per cent of respondents in rural, semi urban and urban area, respectively. Overall 98 per cent of respondents practiced the heat detection only by observing the estrous signs in the study area. Only 2, 1 and 4 per cent of respondents followed heat detection by bulls in rural, semi urban and urban area, respectively. Overall 2 per cent of respondents used bulls for heat detection in the study area.

Time of breeding of buffaloes during early to mid heat was practiced by 10, 36 and 70 per cent of respondents in rural, semi urban and urban area, respectively. Time of breeding of buffaloes by following AM-PM method was practiced by 90, 64 and 30 per cent of respondents in rural, semi urban and urban area, respectively. Overall, 32.4 per cent of respondents adopted the time of breeding during early to mid heat, whereas 67.6 per cent of respondents adopted AM-PM method in the study area.

It was found that natural service was followed by 33, 21 and 22 per cent of respondents for breeding of buffaloes in rural, semi urban and urban area, respectively, whereas artificial insemination was adopted by 67, 79 and 78 per cent of respondents in rural, semi urban and urban areas, respectively. Overall 26.00 and 74.00 per cent of respondents practiced natural service and artificial insemination for breeding of buffaloes in the study area, respectively.

It was observed that 65, 87 and 96 per cent of respondents served buffaloes 3-5 months after calving in rural, semi urban and urban area, respectively. 35, 13 and 4 per cent of respondents served buffaloes 5 months after calving in rural, semi urban and urban area, respectively. Overall 80.0 and 20.0 per cent of respondents served the buffaloes 3-5 months and after 5 months of calving, respectively, in the study area.

Pregnancy diagnosis in buffaloes was adopted by 76, 92 and 94 per cent of respondents in rural, semi urban and urban areas, respectively. Overall 86.00 per cent of respondents practiced pregnancy diagnosis in buffaloes in the study area.

It was found that 54, 58 and 52 per cent of respondents in rural, semi urban and urban areas, respectively, reported that buffaloes calved in rainy season in their herd. 42, 35 and 42 per cent of respondents in rural, semi urban and urban area noticed that buffaloes calved in winter season in their herd, respectively. Overall 55.2, 39.2 and 5.6 per cent of respondents reported that buffaloes calved in rainy, winter and summer season, respectively, in the study area.

**Table 25 : Breeding management practices adopted by respondents in buffaloes**

| S.No. | Breeding practices | | Rural (N=100) % | Semi-urban (N=100) % | Urban (N=50) % | Overall (N=250) % |
|---|---|---|---|---|---|---|
| 1. | Rearing of high milk producing buffalo breeds like Murrah and graded Murrah | Adopted | 93 | 99 | 100 | 96.8 |
| | | Not adopted | 7 | 1 | 0 | 3.2 |
| 2. | Heat detection by | Estrous symptoms like bellowing, frequent urination & mucus discharge | 98 | 99 | 96 | 98.00 |
| | | Bulls | 2 | 1 | 4 | 2.00 |
| 3. | Time of breeding of buffaloes | Early to mid heat | 10 | 36 | 70 | 32.40 |
| | | AM-PM method | 90 | 64 | 30 | 67.60 |
| 4. | Method of breeding | Natural service | 33 | 21 | 22 | 26.00 |
| | | Artificial insemination | 67 | 79 | 78 | 74.00 |
| 5. | Service after calving | 3-5 months | 65 | 87 | 96 | 80.00 |
| | | After 5 months | 35 | 13 | 4 | 20.00 |
| 6. | Pregnancy diagnosis | Adopted | 76 | 92 | 94 | 86.00 |
| | | Not adopted | 24 | 8 | 6 | 14.00 |
| 7. | Season of calving | Rainy | 54 | 58 | 52 | 55.20 |
| | | Winter | 42 | 35 | 42 | 39.20 |
| | | Summer | 4 | 7 | 6 | 5.60 |
| 8. | Treatment of anestrous/ repeaters | Adopted | 60 | 67 | 86 | 68.00 |
| | | Not adopted | 40 | 33 | 14 | 32.00 |

Treatment of anestrous/repeaters was followed by 60, 67 and 86 per cent of respondents in rural, semi urban and urban area, respectively. Overall 68 per cent of respondents adopted treatment of anestrous/repeaters in buffaloes in the study area.

### 4.4.2 Feeding management practices

Feeding management practices adopted by buffalo milk producers is presented in Table 26. It was found that green fodder production was practiced by 84, 79 and 84 per cent of respondents in rural, semi urban and urban area, respectively. Overall 82 per cent of respondents practiced green fodder production in the study area. The average area under fodder production was observed to be 1.98, 1.20 and 1.16 acre in rural, semi urban and urban areas, respectively. Overall area under fodder production was found to be 1.44 acres in the study area. It was also observed that 98.4 per cent of respondents did not practice chaffing of fodder in the study area.

It was found that all the milk producers fed their animals with paddy straw as dry fodder in rural, semi urban and urban areas of the study district. Green and dry fodder was fed as group feeding by 50, 55 and 54 per cent of respondents in rural, semi urban and urban areas, respectively, whereas 50, 45 and 46 per cent of respondents followed individual feeding in rural, semi urban and urban areas, respectively. Overall 52.8 and 47.2 per cent of respondents practiced group and individual feeding of green and dry fodder to the animals, respectively, in the study area.

It was observed that 23 and 4 per cent of respondents practiced hay making in rural and urban areas, respectively, whereas none of the respondent practiced hay making in the semi-urban area. It was found that 91.2, 99.6 and 99.6 per cent of milk producers did not practice hay, silage making and urea treatment of paddy straw in the rural, semi-urban and urban areas, respectively, in the study area. It was found that

grazing of buffaloes was practiced by 90, 68 and 46 per cent of milk producers in rural, semi urban and urban area, respectively. Overall 72.4 per cent of milk producers practiced grazing of animals in the study area.

It was observed that homemade concentrate mixture was fed to the buffaloes by 74, 58 and 32 per cent of milk producers in rural, semi urban and urban areas, respectively. Purchased concentrate mixture was fed to the animals by 26, 42 and 68 per cent of milk producers in rural, semi urban and urban areas, respectively. Overall 59.2 and 40.8 per cent of milk producers fed their animals with homemade and purchased concentrate, respectively, in the study area.

Concentrate feed was fed to animals in mash form by 9, 6 and 12 per cent of milk producers in rural, semi urban and urban area, respectively. It was fed in soaked form by 80, 94 and 88 per cent of milk producers in rural, semi urban and urban area, respectively, whereas in boiled by 11 and 1 per cent of milk producers in rural and semi-urban areas, respectively. Overall 8.4, 87.2 and 4.8 per cent of milk producers fed the concentrate mixture to the buffaloes in mash, soaked and boiled form, respectively, in the study area.

It was found that supplementation of mineral mixture was practiced by 21, 28 and 54 per cent of milk producers in rural, semi urban and urban areas, respectively. Overall 30.4 per cent of milk producers practiced supplementation of mineral mixture in the feed in the study area. Supplementation of common salt in the feed was adopted by 30, 22 and 42 per cent of milk producers in rural, semi urban and urban areas,

**Table 26 : Feeding management practices adopted by respondents in buffaloes**

| S.No. | Feeding practices | | Rural (N=100) % | Semi-urban (N=100) % | Urban (N=50) % | Overall (N=250) % |
|---|---|---|---|---|---|---|
| 1. | Green fodder production | Practiced | 84 | 79 | 84 | 82.00 |
| | | Not practiced | 16 | 21 | 16 | 18.00 |
| | | Extent of area (acre) | 1.98 | 1.20 | 1.16 | 1.44 |
| 2. | Chaffing of fodder | Practiced | 2 | 2 | 0 | 1.60 |
| | | Not practiced | 98 | 98 | 100 | 98.40 |
| 3. | Feeding dry fodder | Paddy straw | 100 | 100 | 100 | 100 |
| | | Others | 0 | 0 | 0 | 0 |
| 4. | Method of feeding green/dry fodder | Group | 50 | 55 | 54 | 52.80 |
| | | Individual | 50 | 45 | 46 | 47.20 |
| 5. | Hay making | Practiced | 23 | 0 | 4 | 10.80 |
| | | Not practiced | 80 | 100 | 96 | 91.20 |
| 6. | Silage making | Practiced | 1 | 0 | 0 | 0.40 |
| | | Not practiced | 99 | 100 | 100 | 99.60 |
| 7. | Urea treatment of paddy straw | Practiced | 1 | 0 | 0 | 0.40 |
| | | Not practiced | 99 | 100 | 100 | 99.60 |
| 8. | Grazing of buffaloes | Practiced | 90 | 68 | 46 | 72.40 |
| | | Not practiced | 10 | 32 | 54 | 27.60 |

Contd…

Continuation of Table 26

| | | | | | | |
|---|---|---|---|---|---|---|
| 9. | Concentrate mixture | Home made | 74 | 58 | 32 | 59.20 |
| | | Purchased | 26 | 42 | 68 | 40.80 |
| 10. | Type of feeding concentrate mixture | Mash | 9 | 6 | 12 | 8.40 |
| | | Soaked | 80 | 94 | 88 | 87.20 |
| | | Boiled | 11 | 1 | 0 | 4.80 |
| 11. | Supplementation of mineral mixture to the feed | Practiced | 21 | 28 | 54 | 30.40 |
| | | Not practiced | 79 | 72 | 46 | 69.6 |
| 12. | Supplementation of common salt in the feed | Practiced | 30 | 22 | 42 | 29.20 |
| | | Not practiced | 70 | 78 | 58 | 70.80 |
| 13. | Time of concentrate feeding | Before milking | 45 | 37 | 40 | 40.80 |
| | | At milking time | 55 | 63 | 60 | 59.20 |
| 14. | Extra concentrate feeding during advanced pregnancy | Practiced | 8 | 11 | 22 | 12.00 |
| | | Not practiced | 92 | 89 | 78 | 88.00 |
| 15. | Extra concentrate during early lactation | Practiced | 9 | 12 | 20 | 12.40 |
| | | Not practiced | 91 | 88 | 80 | 87.60 |
| 16. | Source of drinking water | Tube well | 14 | 37 | 56 | 31.60 |
| | | Canal | 25 | 12 | 4 | 15.60 |
| | | Tank | 61 | 51 | 40 | 52.80 |

respectively. Overall 29.2 per cent of milk producers followed supplementation of common salt in the feed in the study area.

It was observed that feeding of concentrate feed to the animals before milking was practiced by 45, 37 and 40 per cent of respondents in rural, semi urban and urban areas, respectively. Feeding of concentrate at the time of milking was followed by 55, 63 and 60 per cent of respondents in rural, semi urban and urban areas, respectively. Overall 40.8 and 59.8 per cent of respondents fed concentrates to buffaloes before milking and at the time of milking in the study area, respectively.

It was found that 8, 11 and 22 per cent of milk producers followed extra concentrate feeding during advanced pregnancy in rural, semi urban and urban area, respectively. 9, 12 and 20 per cent of milk producers practiced feeding of extra concentrate during early lactation in rural, semi urban and urban areas, respectively. Overall 12.0 and 12.4 per cent of milk producers practiced extra concentrate feeding during advanced pregnancy and early lactation, respectively, in the study area of the district.

It was observed that 14, 37 and 56 per cent of respondents were dependent on tube well as source of drinking water in rural, semi urban and urban areas, respectively. Canal was source of drinking water for buffaloes in 25, 12 and 4 per cent of respondents in rural, semi urban and urban areas, respectively. Tank was source of drinking water for buffaloes in 61, 51 and 40 per cent of respondents in rural, semi urban and urban areas, respectively. Overall 31.6, 15.6 and 52.8 per cent of respondents used tube well, canal and tank as source of drinking water for buffaloes, respectively, in the study area.

### 4.4.3 Housing management practices

Housing management practices adopted by buffalo milk producers is presented in Table 27. It was observed that location of buffalo shed was nearer to farmers dwelling in 63, 62 and 60 per cent of respondents of rural, semi urban and urban areas, respectively. Location of buffaloes shed was found far away from farmers dwelling in 37, 38 and 40 per cent of respondents in rural, semi urban and urban areas, respectively. Overall 62.00 and 38.00 per cent of buffalo milk producers had location of buffaloes shed nearer and far away from farmers dwellings, respectively, in the study area.

It was found that 83, 67 and 56 per cent of respondents maintained buffaloes in loose housing system in rural, semi urban and urban areas, respectively. 17, 33 and 44 per cent of respondents had conventional housing system for buffaloes in rural, semi urban and urban areas, respectively. Overall 71.2 and 28.8 per cent of respondents maintained buffaloes in loose and conventional housing system, respectively, in the study area.

Kutcha type of flooring in animal houses was observed in 62, 49 and 32 per cent of respondents in rural, semi urban and urban areas, respectively. Pucca type of flooring was observed in 38, 51 and 68 per cent of respondents in rural, semi urban and urban areas, respectively. Overall 50.8 and 49.2 per cent of respondents had kutcha and pucca type of floor in animal houses, respectively, in study area.

Thatched roof animal houses were found with 59, 47 and 56 per cent of respondents in rural, semi urban and urban areas, respectively. Asbestos roof was observed in 41, 54 and 44 per cent of respondents' animal house in rural, semi urban

**Table 27 : Housing management practices adopted by respondents in buffaloes**

| S.No. | Housing practices | | Rural (N=100) % | Semi-urban (N=100) % | Urban (N=50) % | Overall (N=250) % |
|---|---|---|---|---|---|---|
| 1. | Location of buffalo shed | Nearer to farmer dwelling | 63 | 62 | 60 | 62.00 |
| | | Far away from farmer dwelling | 37 | 38 | 40 | 38.00 |
| 2. | Housing system | Loose | 83 | 67 | 56 | 71.20 |
| | | Conventional | 17 | 33 | 44 | 28.80 |
| 3. | Floor | Kutcha | 62 | 49 | 32 | 50.80 |
| | | Pucca | 38 | 51 | 68 | 49.20 |
| 4. | Roof | Thatched | 59 | 47 | 56 | 53.60 |
| | | Asbestos | 41 | 54 | 44 | 46.40 |
| 5. | Manger | Kutcha | 71 | 51 | 42 | 57.20 |
| | | Pucca | 29 | 49 | 58 | 42.80 |
| 6. | Water trough | Kutcha | 13 | 14 | 10 | 12.8 |
| | | Pucca | 87 | 86 | 90 | 87.2 |
| 7. | Drainage | Kutcha | 77 | 64 | 40 | 64.40 |
| | | Pucca | 23 | 36 | 60 | 35.60 |
| 8. | Location of Manure pit | Beside the shed | 52 | 47 | 80 | 55.60 |
| | | Far away from animal shed | 48 | 53 | 20 | 44.40 |
| 9. | Calf Shed | Nearer by mother | 93 | 98 | 94 | 95.20 |
| | | Separate calf shed | 7 | 2 | 6 | 4.80 |
| 10. | Cooling devices like fan | Practiced | 0 | 2 | 20 | 4.80 |
| | | Not practiced | 100 | 98 | 80 | 95.20 |
| 11. | Wallowing of buffaloes | Practiced | 98 | 83 | 46 | 81.60 |
| | | Not practiced | 2 | 17 | 54 | 18.40 |

and urban areas, respectively. Overall 53.6 and 46.4 per cent of respondents animal house had thatched and asbestos roof, respectively, in study area.

It was found that kutcha type manger was provided by 71, 51 and 42 per cent of respondents in rural, semi-urban and urban areas, respectively. 29, 49 and 58 per cent of respondents provided pucca type manger in rural, semi-urban and urban areas, respectively. Overall 57.2 and 42.8 per cent of respondents provided kutcha and pucca type manger, respectively, in the study area.

Kutcha water trough in animal house was found in 13, 14 and 10 per cent of respondent in rural, semi-urban and urban areas, respectively. Pucca water trough was observed in 87, 86 and 90 per cent of respondents in rural, semi-urban and urban areas, respectively. Overall 12.8 and 87.2 per cent of respondents provided kutcha and pucca type water trough in the study area, respectively.

It was observed that 77, 64 and 40 per cent of buffalo milk producers had kutcha drainage facilities in rural, semi-urban and urban areas, respectively. 23, 36 and 60 per cent of milk producers had pucca drainage facilities in rural, semi-urban and urban area, respectively. Overall 64.4 and 35.6 per cent of buffalo milk producers had kutcha and pucca drainage facilities, respectively, in the study area.

It was observed that 52, 47 and 80 per cent of respondents had manure pit beside the animal shed in rural, semi-urban and urban areas, respectively. 48, 53 and 20 per cent of respondents had manure pit away from animal shed in rural, semi-urban and urban areas, respectively. Overall 55.6 and 44.4 per cent of respondents had manure pit near the animal shed and far away from animal shed, respectively, in the study area.

Calf shed nearby mother was provided by 93, 98 and 94 per cent of respondents in rural, semi-urban and urban areas, respectively. 7, 2 and 6 per cent of respondents

provided separate calf shed in rural, semi-urban and urban areas, respectively. Overall 95.2 and 4.8 per cent of respondents provided nearby mother and separate calf shed in the study area, respectively.

It was found that cooling devices like fan was provided by 2 and 20 per cent of respondents in semi-urban and urban areas, respectively. Overall 4.8 per cent of respondents provided cooling devices like fan in the study area. Wallowing of buffaloes was practiced by 98, 83 and 46 per cent of respondents in rural, semi-urban and urban areas, respectively. Overall 81.6 per cent of respondents practiced wallowing of buffaloes in the study area.

### 4.4.4 Calf rearing practices

Buffalo calf rearing practices adopted by buffalo milk producers is presented in Table 28. It was observed that cutting of navel cord was practiced by 37, 60 and 66 per cent of respondents in rural, semi-urban and urban areas, respectively. Overall 52.0 per cent of respondents followed cutting of navel cord in the study area. No respondent practiced application of tincture iodine to navel in the rural, semi-urban and urban area.

It was found that 76, 68 and 94 per cent of respondents practiced feeding colostrum to new born calf within 1-2 hour of birth in rural, semi-urban and urban areas, respectively. Overall 76.4 per cent of respondents followed feeding of colostrum to new born calf within one hour of birth in study area.

Feeding of 1-2 litres of milk to calves per day was practiced by 33, 40 and 54 per cent of respondents in rural, semi-urban and urban areas, respectively. 67, 60 and

**Table 28 : Buffalo calf rearing practices adopted by respondents**

| S.No. | Calf rearing practices | | Rural (N=100) % | Semi-urban (N=100) % | Urban (N=50) % | Overall (N=250) % |
|---|---|---|---|---|---|---|
| 1. | Cutting of navel cord | Practiced | 37 | 60 | 66 | 52.00 |
| | | Not practiced | 63 | 40 | 34 | 48.00 |
| 2. | Application of tincture iodine to navel | Practiced | 0 | 0 | 0 | 0 |
| | | Not practiced | 100 | 100 | 100 | 100 |
| 3. | Colostrum Feeding to new born calf within 1-2 hours | Practiced | 76 | 68 | 94 | 76.4 |
| | | Not practiced | 24 | 32 | 6 | 23.6 |
| 4. | Feeding of milk to calves per day | 1-2 lit | 33 | 40 | 54 | 40.00 |
| | | One quarter | 67 | 60 | 46 | 60.00 |
| 5. | Weaning of calves | Practiced | 0 | 16 | 20 | 10.40 |
| | | Not practiced | 100 | 84 | 80 | 89.60 |
| 6. | Feeding of calf starter | Practiced | 7 | 14 | 24 | 13.20 |
| | | Not practiced | 93 | 86 | 76 | 86.80 |
| 7. | Regular deworming of calves | Practiced | 62 | 65 | 76 | 66.00 |
| | | Not practiced | 38 | 35 | 24 | 34.00 |
| 8. | HS vaccination of calves | Practiced | 96 | 98 | 90 | 95.60 |
| | | Not practiced | 4 | 2 | 10 | 4.40 |
| 9. | FMD vaccination of calves | Practiced | 96 | 97 | 90 | 95.20 |
| | | Not practiced | 4 | 3 | 10 | 4.80 |

46 per cent of respondents were feeding one quarter of milk to calves per day in rural, semi-urban and urban area, respectively. Overall 40.0 and 60.0 per cent of respondents were feeding 1-2 litres and one quarter of milk per day to calves in the study area, respectively.

Weaning of calves was practiced by 16 and 20 per cent of respondents in the semi-urban and urban areas, respectively. Overall 10.4 per cent of respondents practiced weaning of calves in the study area. It was observed that 7, 14 and 24 per cent of respondents practiced feeding of calf starter to calves in rural, semi-urban and urban areas, respectively. Overall 13.2 per cent of respondents practiced feeding of calf starter to calves in the study area of district.

It was found that 62, 65 and 76 per cent of respondents followed regular deworming of calves in rural, semi-urban and urban areas, respectively. Overall 66.0 per cent of respondents practiced regular deworming of calves in the study area. HS vaccination of calves was practiced by 96, 98 and 90 per cent of respondents in rural, semi-urban and urban areas, respectively. It was observed that 96, 97 and 90 per cent of respondents followed FMD vaccination of calves in rural, semi-urban and urban areas, respectively. Overall 95.6 and 95.2 per cent of respondents adopted HS and FMD vaccination of calves, respectively, in the study area.

### 4.4.4 Milking management practices

Milking management practices adopted by buffalo milk producers is presented in Table 29. It was observed that 100 per cent of respondents practiced hand method of milking in rural, semi-urban and urban areas of the study area. No respondent adopted machine milking in buffaloes in rural, semi-urban and urban area. Full hand method of milking was practiced by 38, 45 and 60 per cent of respondents in rural, semi-urban and

urban areas, respectively. Knuckling method of milking was adopted by 25, 17 and 12 per cent of respondents in rural, semi-urban and urban areas, respectively. 37, 38 and 28 per cent of respondents followed stripping method of milking in buffaloes in rural, semi-urban and urban areas, respectively. Overall 45.2, 19.2 and 35.6 per cent of respondents practiced full hand, knuckling and stripping method of milking, respectively, in the study area.

It was found that 100 per cent of buffalo milk producers followed twice a day milking in rural, semi-urban and urban areas. No buffalo milk producer practiced three times milking in rural, semi-urban and urban areas. It was observed that 98, 85 and 78 per cent of buffalo milk producers milked buffaloes by family labour in rural, semi-urban and urban areas, respectively. 2, 15 and 22 per cent of buffalo milk producers milked buffaloes by hired labour in rural, semi-urban and urban areas, respectively. Overall 88.8 and 11.2 per cent of buffalo milk producers used family and hired labour for milking of buffaloes in the study area, respectively.

Oxytocin injection for letdown of milking was practiced by 10 and 20 per cent of respondents in semi-urban and urban areas, respectively. Overall 8.0 per cent of respondents practiced oxytocin injection for letdown of milk in the study area.

It was observed that washing of buffaloes before milking was adopted by 53, 50 and 66 per cent of respondents in rural, semi-urban and urban areas, respectively. Overall 54.4 per cent of respondents practiced washing of buffaloes before milking in the study area. It was found that 100 per cent of respondents followed washing of udder and utensils with water in rural, semi-urban and urban areas. No respondent practiced

**Table 29 : Milking management practices adopted by respondents in buffaloes**

| S.No. | Milking practices | | Rural (N=100) % | Semi-urban (N=100) % | Urban (N=50) % | Overall (N=250) % |
|---|---|---|---|---|---|---|
| 1. | Method of milking | Hand | 100 | 100 | 100 | 100 |
| | | Machine | 0 | 0 | 0 | 0 |
| 2. | Method of hand milking | Full hand | 38 | 45 | 60 | 45.20 |
| | | Knuckling | 25 | 17 | 12 | 19.20 |
| | | Stripping | 37 | 38 | 28 | 35.60 |
| 3. | Frequency of milking | Twice | 100 | 100 | 100 | 100 |
| | | Thrice | 0 | 0 | 0 | 0 |
| 4. | Labour for Milking of animal | Family labour | 98 | 85 | 78 | 88.80 |
| | | Hired labour | 2 | 15 | 22 | 11.2 |
| 5. | Oxytocin injection for letdown of milk | Practiced | 0 | 10 | 20 | 8.00 |
| | | Not practiced | 100 | 90 | 80 | 92.00 |
| 6. | Washing of animals before milking | Practiced | 53 | 50 | 66 | 54.40 |
| | | Not practiced | 47 | 50 | 34 | 45.6 |
| 7. | Washing of udder and utensils with water | Practiced | 100 | 100 | 100 | 100 |
| | | Not practiced | 0 | 0 | 0 | 0 |
| 8. | Strip cup test | Practiced | 0 | 0 | 0 | 0 |
| | | Not practiced | 100 | 100 | 100 | 100 |
| 9. | Dipping of teats in povidine iodine after milking | Practiced | 0 | 0 | 0 | 0 |
| | | Not practiced | 100 | 100 | 100 | 100 |
| 10. | Dry cow therapy | Practiced | 0 | 0 | 0 | 0 |
| | | Not practiced | 100 | 100 | 100 | 100 |
| 11. | Marketing of milk | Consumer | 12 | 42 | 50 | 31.60 |
| | | Middle man | 6 | 8 | 6 | 6.80 |
| | | Cooperative dairy | 62 | 37 | 24 | 44.40 |
| | | Private dairy | 20 | 13 | 20 | 17.2 |

strip cup test, dipping of teats in povidine iodine and dry cow therapy in buffaloes in rural, semi-urban and urban areas.

It was found that 12, 42 and 50 per cent of respondents sold milk directly to consumer in rural, semi-urban and urban areas, respectively. 6, 8 and 6 per cent of respondents sold milk to middle man in rural, semi-urban and urban areas, respectively. 62, 37 and 24 per cent of respondents sold milk to co-operative dairies in rural, semi-urban and urban areas, respectively. 20, 13 and 20 per cent of respondents sold to private dairies in rural, semi-urban and urban areas, respectively. Overall 31.6, 6.8, 44.4 and 17.2 per cent of respondents sold milk to consumer, middleman, dairy cooperatives and private dairy, respectively, in the study area.

### 4.4.6 Health care practices

Health care practices adopted by buffalo milk producers are presented in Table 30. It was observed that vaccination of FMD and HS in adult buffaloes practiced by 96, 98 and 98 per cent of respondents in rural, semi-urban and urban areas, respectively. Overall 97.20 per cent of respondents adopted vaccination of FMD and HS in buffaloes in the study area. Deworming of adult buffaloes was followed by 19, 13 and 22 per cent of respondents in rural, semi-urban and urban areas, respectively. Overall 17.2 per cent of respondents practiced deworming in adult buffaloes in the study area.

It was found that 2, 6 and 20 per cent of respondents practiced ectoparasites control in rural, semi-urban and urban areas, respectively. Overall 7.2 per cent of respondents adopted ectoparasites control in the study area.

It was observed that isolation of sick animals was practiced by 42, 44 and 70 per cent of respondents in rural, semi-urban and urban areas, respectively. Overall 48.4 per

**Table 30 : Health care practices adopted by respondents in buffaloes**

| S.No. | Health care practices | | Rural (N=100) % | Semi-urban (N=100) % | Urban (N=50) % | Overall (N=250) % |
|---|---|---|---|---|---|---|
| 1. | Vaccination for FMD &HS | Practiced | 96 | 98 | 98 | 97.20 |
| | | Not practiced | 4 | 2 | 2 | 2.80 |
| 2. | Deworming of adults buffaloes | Practiced | 19 | 13 | 22 | 17.20 |
| | | Not practiced | 81 | 87 | 78 | 82.80 |
| 3. | Control of ecto parasites | Practiced | 2 | 6 | 20 | 7.20 |
| | | Not practiced | 98 | 94 | 80 | 92.80 |
| 4. | Isolation of sick animals | Practiced | 42 | 44 | 70 | 48.40 |
| | | Not practiced | 58 | 56 | 30 | 51.60 |
| 5. | Treatment of sick animals | Veterinarian | 62 | 72 | 74 | 68.40 |
| | | Para veterinarian | 25 | 19 | 28 | 21.60 |
| | | Others | 13 | 9 | 6 | 10.00 |
| 6. | Veterinary facilities | Good | 15 | 24 | 32 | 22.00 |
| | | Satisfactory | 70 | 72 | 48 | 66.40 |
| | | Un satisfactory | 15 | 4 | 20 | 11.60 |

cent of respondents isolated sick animals from healthy animals in the study area. Treatment of sick animals by veterinarian was adopted by 62, 72 and 74 per cent of respondents in rural, semi-urban and urban areas, respectively. 25, 19 and 28 per cent of respondents practiced treatment of sick animals by para veterinarians in rural, semi-urban and urban areas, respectively. 13, 9 and 6 per cent of respondents followed treatment of sick animals by others in rural, semi-urban and urban areas, respectively. Overall 68.4, 21.6 and 10.0 per cent of respondents practiced treatment of sick animals by veterinarians, para veterinarians and others, respectively, in the study area.

Veterinary facility was found good for 15, 24 and 32 per cent of the respondents in rural, semi-urban and urban areas, respectively, and was observed satisfactory for 70, 72 and 48 per cent of the respondents in rural, semi-urban and urban areas, respectively. For 15, 4 and 20 per cent of respondents' veterinary facility was unsatisfactory in rural, semi-urban and urban areas, respectively. Overall 22.0, 66.4 and 11.6 per cent of the respondents indicated that veterinary facility was good, satisfactory and unsatisfactory, respectively, in the study area.

## 4.5. CONSTRAINTS PERCEIVED BY MILK PRODUCERS AND FIELD VETERINARIANS IN BUFFALO PRODUCTION

### 4.5.1 Constraints perceived by buffalo milk producers in Krishna district

The findings on the constraints as perceived by the milk producers in the enhancement of buffalo milk production are presented in Table 31.

High cost of purebred buffaloes was perceived as constraint by 99, 92 and 90 per cent of the milk producers in rural, semi-urban and urban areas, respectively. High cost of feed ingredients was perceived as constraint by 95, 90 and 92 per cent of the milk producers in rural, semi-urban and urban areas, respectively. High cost of hired labour

was viewed as constraint by 93, 94 and 96 per cent of the milk producers in rural, semi-urban and urban areas, respectively. Lack of financial assistance for purchase of high milk producing buffaloes and equipment like chaff cutter was felt as constraint by 91, 91 and 94 per cent of the milk producers in rural, semi-urban and urban areas, respectively.

Lack of extension activities was perceived as constraint by 88, 89 and 86 per cent of the milk producers in rural, semi-urban and urban areas, respectively. Non remunerative price for milk was viewed as constraint by 86, 81 and 68 per cent of the milk producers in rural, semi-urban and urban areas, respectively. Inadequate supply of concentrate mixture/mineral mixture on subsidised cost was felt as constraint by 85, 49 and 52 per cent of the milk producers in rural, semi-urban and urban areas, respectively.

Problem of favouritism in providing inputs and loans to the milk producers was expressed as a constraint by 72, 65 and 66 per cent of the milk producers in rural, semi-urban and urban areas, respectively. Distant location of veterinary hospital was viewed as a problem by 68, 32 and 32 per cent of the milk producers in rural, semi-urban and urban areas, respectively.

High incidence of repeat breeding in buffaloes was perceived as a constraint by 65, 62 and 48 per cent of the milk producers in rural, semi-urban and urban areas, respectively. Low conception rate with artificial insemination in buffaloes was viewed as a problem in 64, 53 and 56 per cent of the milk producers in rural, semi-urban and urban areas, respectively. High incidence of anestrous in buffaloes was felt as a

**Table 31: Constraints perceived by buffalo milk producers in Krishna district**

| S.No. | Constraint | Rural (N=100) | | Semi-urban (N=100) | | Urban (N=50) | | Overall (N=250) | |
|---|---|---|---|---|---|---|---|---|---|
| | | % | Rank | % | Rank | % | Rank | % | Rank |
| 1. | High cost of pure bred buffaloes | 99 | I | 92 | II | 90 | IV | **94.40** | **I** |
| 2. | High cost of hired labour | 93 | III | 94 | I | 96 | I | **94.00** | **II** |
| 3. | High cost of feed ingredients | 95 | II | 90 | IV | 92 | III | **92.40** | **III** |
| 4. | Lack of financial assistance for purchase of high milk producing buffaloes and equipment like chaffer cutter | 91 | IV | 91 | III | 94 | II | **91.60** | **IV** |
| 5. | Lack of extension activities | 88 | V | 89 | V | 86 | V | **88.00** | **V** |
| 6. | Non remunerative price for milk | 86 | VI | 81 | VII | 68 | VIII | **80.40** | **VI** |
| 7. | Non availability of fodder seeds/ slips | 59 | XIV | 82 | VI | 62 | X | **68.80** | **VII** |
| 8. | Problem of favouritism in providing inputs and loans to the milk producers | 72 | VIII | 65 | VIII | 66 | IX | **68.00** | **VIII** |

Contd…

Continuation of Table 31

| S.No. | Constraint | Rural (N=100) | | Semi-urban (N=100) | | Urban (N=50) | | Overall (N=250) | |
|---|---|---|---|---|---|---|---|---|---|
| | | % | Rank | % | Rank | % | Rank | % | Rank |
| 9. | Inadequate supply of concentrate mixture/mineral mixture on subsidized cost | 85 | VII | 49 | XIII | 52 | XII | **64.00** | **IX** |
| 10. | High incidence of repeat breeding | 65 | X | 62 | X | 48 | XII | **60.40** | **X** |
| 11. | Low conception rate with A.I | 64 | XI | 53 | XII | 56 | XI | **58.00** | **XI** |
| 12. | Feed and fodder shortage | 42 | XVI | 63 | IX | 78 | VI | **57.60** | **XII** |
| 13. | High incidence of anestrous | 63 | XII | 56 | XI | 34 | XV | **54.40** | **XIII** |
| 14. | Inadequate supply of medicines | 50 | XV | 46 | XIV | 70 | VII | **52.40** | **XIV** |
| 15. | Distant location of veterinary hospital | 68 | IX | 32 | XV | 32 | XVI | **46.40** | **XV** |
| 16. | Lack of adequate knowledge about scientific management of buffaloes | 62 | XIII | 25 | XVI | 8 | XVII | **36.4** | **XVI** |
| 17. | High incidence of prolapse of uterus | 18 | XVII | 21 | XVII | 36 | XIV | **22.80** | **XVII** |

problem in 63, 56 and 34 per cent of the milk producers in rural, semi-urban and urban areas, respectively.

Lack of adequate knowledge about scientific management of buffaloes was expressed as a constraint by 62, 25 and 8 per cent of the milk producers in rural, semi-urban and urban areas, respectively. Non availability of fodder seeds/slips was perceived as a constraint by 59, 82 and 62 per cent of the milk producers in rural, semi-urban and urban areas, respectively.

Inadequate supply of medicines in the veterinary hospital was viewed as a problem by 50, 46 and 70 per cent of the milk producers in rural, semi-urban and urban areas, respectively. Feed and fodder shortage was a problem observed in 42, 63 and 78 per cent of the milk producers in rural, semi-urban and urban areas, respectively. High incidence of prolapse of uterus was perceived as a constraint by 18, 21 and 36 per cent of the milk producers in rural, semi-urban and urban areas, respectively.

### 4.5.2 Constraints perceived by field veterinarians in buffalo production

The findings on the constraints perceived by field veterinarians in the buffalo production practices are presented in Table 32.

It was observed that 94 per cent of the veterinarians perceived that the problem of anestrous or silent heat in buffaloes was the major constraint in the buffalo improvement programme. This was followed by problem of mastitis in buffaloes as a constraint perceived by 78 per cent of veterinarians.

Larger area of operation for AI and treatment of livestock was viewed as a constraint by 74 per cent of veterinarians. Problem of calf mortality was also expressed as a constraint in buffalo improvement programme by 66 per cent of veterinarians.

**Table 32: Constraints perceived by field veterinarians in buffalo production in Krishna district**

**(N=50)**

| S.No. | Constraint | | Frequency | % | Rank |
|---|---|---|---|---|---|
| 1. | Problem of anestrous or silent heat in buffaloes | A | 47 | 94 | **I** |
| | | PA | 3 | 6 | |
| | | DA | 0 | 0 | |
| 2. | Problem of repeat breeding | A | 32 | 64 | **V** |
| | | PA | 18 | 36 | |
| | | DA | 0 | 0 | |
| 3. | Problem of mastitis | A | 39 | 78 | **II** |
| | | PA | 7 | 14 | |
| | | DA | 4 | 8 | |
| 4. | Problem of calf mortality | A | 33 | 66 | **IV** |
| | | PA | 10 | 20 | |
| | | DA | 9 | 18 | |
| 5. | Problem of prolapse of uterus | A | 20 | 40 | **X** |
| | | PA | 21 | 42 | |
| | | DA | 9 | 18 | |
| 6. | Problem of low conception rates with AI | A | 26 | 52 | **IX** |
| | | PA | 13 | 26 | |
| | | DA | 11 | 22 | |
| 7. | Animals are not brought in right time for AI | A | 28 | 56 | **VIII** |
| | | PA | 16 | 32 | |
| | | DA | 6 | 12 | |
| 8. | Presence of bulls in villages which are often used for natural service | A | 15 | 30 | **XIII** |
| | | PA | 16 | 32 | |
| | | DA | 19 | 38 | |
| 9. | Larger area is to be covered for A.I and treatment of livestock | A | 37 | 74 | **III** |
| | | PA | 13 | 26 | |
| | | DA | 0 | 0 | |
| 10. | Lack of subsidy on animal feeds | A | 30 | 60 | **VII** |
| | | PA | 11 | 22 | |
| | | DA | 9 | 18 | |
| 11. | Inadequate facilities for diagnostic purpose and specialized treatment | A | 19 | 38 | **XI** |
| | | PA | 20 | 40 | |
| | | DA | 11 | 22 | |
| 12. | Lack of sufficient knowledge of the farmers about the scientific feeding and management of buffaloes | A | 31 | 62 | **VI** |
| | | PA | 19 | 38 | |
| | | DA | 0 | 0 | |
| 13. | Sale of infertile buffaloes for slaughter | A | 18 | 36 | **XII** |
| | | PA | 12 | 24 | |
| | | DA | 20 | 40 | |

A: Agree PA: Partially agree DA: Disagree

Further, 64 per cent of veterinarians perceived problem of repeat breeding in buffaloes, 62 per cent perceived lack of sufficient knowledge among the farmers about the scientific feeding and management of buffaloes, 60 per cent perceived lack of subsidy on animals feeds, 56 per cent perceived that buffaloes were not brought in right time for artificial insemination and 52 per cent of veterinarians perceived that problem of low conception rate with artificial insemination as constraint for the buffalo production programmes.

The other constraints for buffalo production perceived by the veterinarians were problem of prolapse of uterus (40%), inadequate facilities for diagnostic purpose and specialized treatment (38%), sale of infertile buffaloes for slaughter (36%) and presence of bulls in villages which are often used for natural service (30%).

# DISCUSSION

# CHAPTER V

# DISCUSSION

## 5.1 POPULATION, MILK PRODUCTION AND DISTRIBUTION OF BUFFALOES

### 5.1.1 Buffalo population in Krishna district

Table 5 revealed that the total bovine population in Krishna district increased from 8.80 lakhs to 10.21 lakhs during the period from 1993 to 2007 with 31.52 per cent increase in buffalo population and 43.01 per cent decrease in cattle population during the same period. Jain *et al.* (1998) who observed that the average population growth rate for female buffaloes of breeding age and young buffaloes was 1.57 and 1.54 per cent respectively. Further Mudgal (2000) reported that the bovine population in India gone up by 3.5 per cent per annum indicating the relative importance of this species in India. Thammiraju *et al.* (2004) also found that female buffalo population recorded a positive growth rate in the three regions of the state and also observed higher buffalo density in coastal Andhra region. From Table 6, it could be inferred that the population density of buffaloes increased by 31.52 per cent, whereas population density of cattle decreased by 43.41 per cent in the district during the period from 1993-2007. Population density of buffaloes was 105.19 per square kilometre as compared to 11.80 for cattle in the district. Singh *et al.* (2011) reported that the population density of buffaloes in Punjab was 89.3 per square kilometre as compared to 38.2 for cattle. This indicated that buffaloes were preferred as dairy animals for milk production in Krishna district. From this it could be inferred that agro-climatic conditions and market demand

for buffalo milk equally played major role for growth and development of buffaloes in Krishna district.

### 5.1.2 Milk production

It could be seen from Table 8 that Krishna district contributed 7.34 per cent of total milk production in Andhra Pradesh during the year 2009-10. The contribution of buffalo milk was 91.25 per cent of the total milk production in the district. The results presented in Table 9 showed that the annual total milk production increased by 114.57 per cent in the year 2009-10 over that in 2000-01. It could also be observed that the annual buffalo milk production increased by 109.28 per cent during 10 years period (Figure 3). The contribution of buffalo milk to the total milk production ranged from 73.97 to 96.81 per cent in the district during the 10 years period. Yedukondalu *et al.* (2000) also reported that there was an increase of 29.99 per cent of buffalo milk production from 1991-1996 in Medak district of Andhra Pradesh. The increased buffalo milk production in Krishna district might be due to higher market demand for buffalo milk due to consumer preference for high fat per cent and viscosity of buffalo milk and remunerative price to milk producers.

### 5.1.3 Distribution of buffaloes in the study area

The results in Table 10 revealed that the mean number of lactating buffaloes, dry buffaloes, calves and total buffaloes in urban area was found to be significantly ($P \leq 0.01$) higher than that in semi-urban and rural areas. Table 12 showed that the mean number of Murrah and Murrah graded buffaloes in urban areas were found to be significantly ($P \leq 0.01$) higher than that in rural area. Sinha *et al.* (2009a) observed that

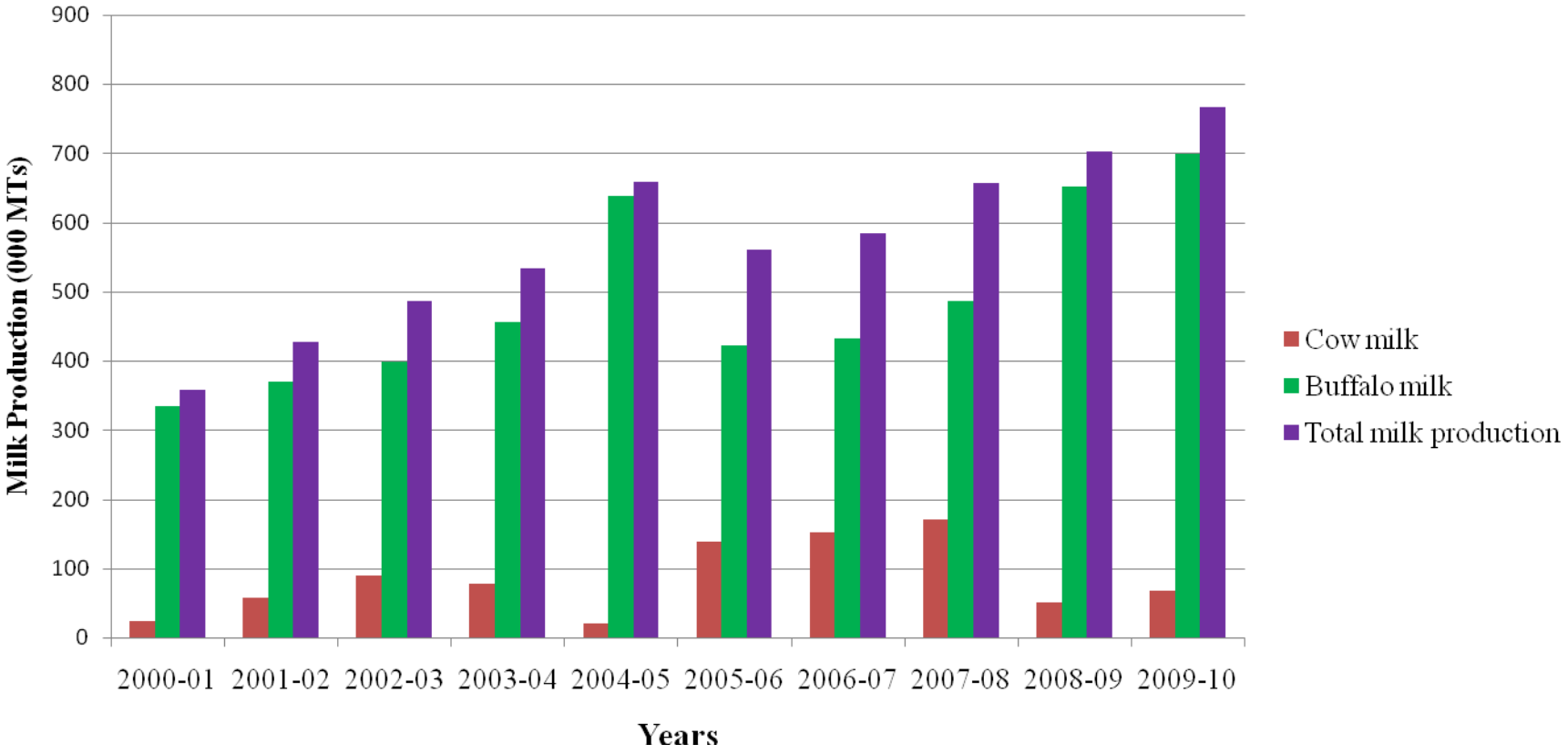


**Figure 3: Milk production in Krishna District from 2000 - 01 to 2009 - 2010 (in MT's)**

urban area had more Murrah buffaloes than desi buffaloes in Bareilly district of Uttar Pradesh.

## 5.2 SOCIO-ECONOMIC CHARACTERISTICS OF BUFFALO MILK PRODUCERS IN THE STUDY AREA

### 5.2.1 Age

On persual of Table 14, it could be inferred that majority of milk producers belonged to middle age group followed by young and old age groups in rural, semi-urban and urban areas. By this, it was obvious that middle aged were considered to be mature for undertaking innovations by virtue of their adequate experience. Still the potential young milk producers need to be encouraged in buffalo rearing. This result was similar to the findings reported by Rao (1993), Thammiraju *et al.* (1996), Islam *et al.* (2006) and Debasish *et al.* (2010).

### 5.2.2 Caste

From Table 14, it could be observed that majority of buffalo milk producers belonged to backward caste, scheduled caste and scheduled tribe than the other caste in rural, semi-urban and urban areas. It indicated that backward castes, scheduled caste and scheduled tribe caste group were actively involved in dairying as source of income and employment for their livelihood. This result was in conformity with the findings of Ahirwar *et al.* (2010) who reported that the majority of the buffalo farmers in both rural and urban areas belonged to other backward caste.

### 5.2.3 Education

It could also observed from the Table14 that majority of buffalo milk producers were literate ranging from primary to graduation level of education out of whom majority of them had high school education in rural, semi-urban and urban areas. The percentage of literate was higher in urban area followed by semi-urban and rural areas. It could be inferred that most of the milk producers had some educational back ground which might be helping them in obtaining information on buffalo rearing. These results were in agreement with the findings of Islam *et al.* (2006) and Ahirwar *et al.* (2010) who reported that majority of the respondents were literates in rural and urban areas, whereas the present results were contrary to the findings of Debasish *et al.* (2010) who stated that majority of the respondents were illiterate in their study area.

### 5.2.4 Main occupation

The results presented in Table 14 revealed that majority of milk producers in rural (61%) and semi-urban areas (45%) had agriculture as main occupation followed by dairying, whereas urban milk producers had agriculture (38%) and dairying (38%) as main occupation followed by service. The above results were similar with Prasad *et al.* (1991), Kumar (1992) and Islam *et al.* (2006) who reported that dairy farmers had agriculture as main occupation followed by dairying as subsidiary occupation in the rural areas. Prasad *et al.* (2001) reported that dairying was the main occupation for 64 per cent of milk producers in and around Hyderabad city.

### 5.2.5 Land holding

It could be seen from Table 14 that majority of milk producers were of marginal farmers category followed by land less, small and medium category in rural area, whereas in semi-urban and urban areas majority of milk producers were of land less

category followed by marginal, small and medium category farmers. The overall percentages indicated that majority of milk producers were marginal farmers followed by landless, small and medium farmers. In the study area buffalo farming was more prevalent in marginal, small farmers and land less milk producers compared to large farmers which indicated that dairying was considered as a source of income and employment to the family members of land less, marginal and small farmers. This finding was in agreement with the result of Vij and Tantia (2005) who reported that majority of buffalo farmers were land less, marginal and small farmers in their study area.

### 5.2.6 Family size

The results presented in Table 14 indicated that majority of families were of small size (up to 5 members) in rural, semi-urban and urban area of the district. The findings were similar to the result of Soysal *et al.* (2005) who reported that majority of the buffalo rearing farmers had small family size less than 5 members. In contrast to the present findings Islam *et al.* (2006) reported that majority of dairy farmers had family size above 5 members.

### 5.2.7 Extension contact

From the results in Table 14 it was evident that majority of respondents had extension contact with veterinarians followed by para veterinarians in urban, semi-urban and rural areas. Urban milk producers (90%) had extension contact with veterinarian as compared to semi-urban and rural areas. It might be due to more availability of technical staff of Department of Animal Husbandry as well as Dairy Union to the milk producers in the urban area followed by semi-urban and rural area in the district. This result was similar to the observations of Goswami *et al.* (2001) who reported that

majority of the livestock owners used B.L.D.O as an effective personal source of information for adoption of animal husbandry practices in West Bengal.

### 5.2.8 Mass media exposure

On perusal of Table 14, it was observed that majority of the respondents did not have mass media exposure in rural and semi-urban areas whereas 42 per cent of urban milk producers had mass media exposure with television and farm magazine to get the information about the dairy husbandry practices. Majority of the respondents considered that television and radio are the source of entertainment rather than source of technical information. They obtained technical information from the local progressive dairy farmers, veterinarians and para veterinarians of Department of Animal husbandry and Krishna District Cooperative Dairy Union. Goswami *et al.* (2001) reported that majority of the livestock owners used radio as effective mass media with respect to adoption sources of information about the animal husbandry practices whereas the farm publications were least used by the livestock owners in West Bengal.

From Table 15, the contribution of dairying to the total family income was higher in urban area (38.28%) than that of semi-urban (34.03%) and rural area (30.03%) (Figure 4). It might be due to large number of high milk yielding buffaloes possessed by the urban milk producers. This result was mostly in agreement with the findings of Ravikiran *et al*. (1994) who reported that the income derived from dairying was 36.14 per cent of total family income.

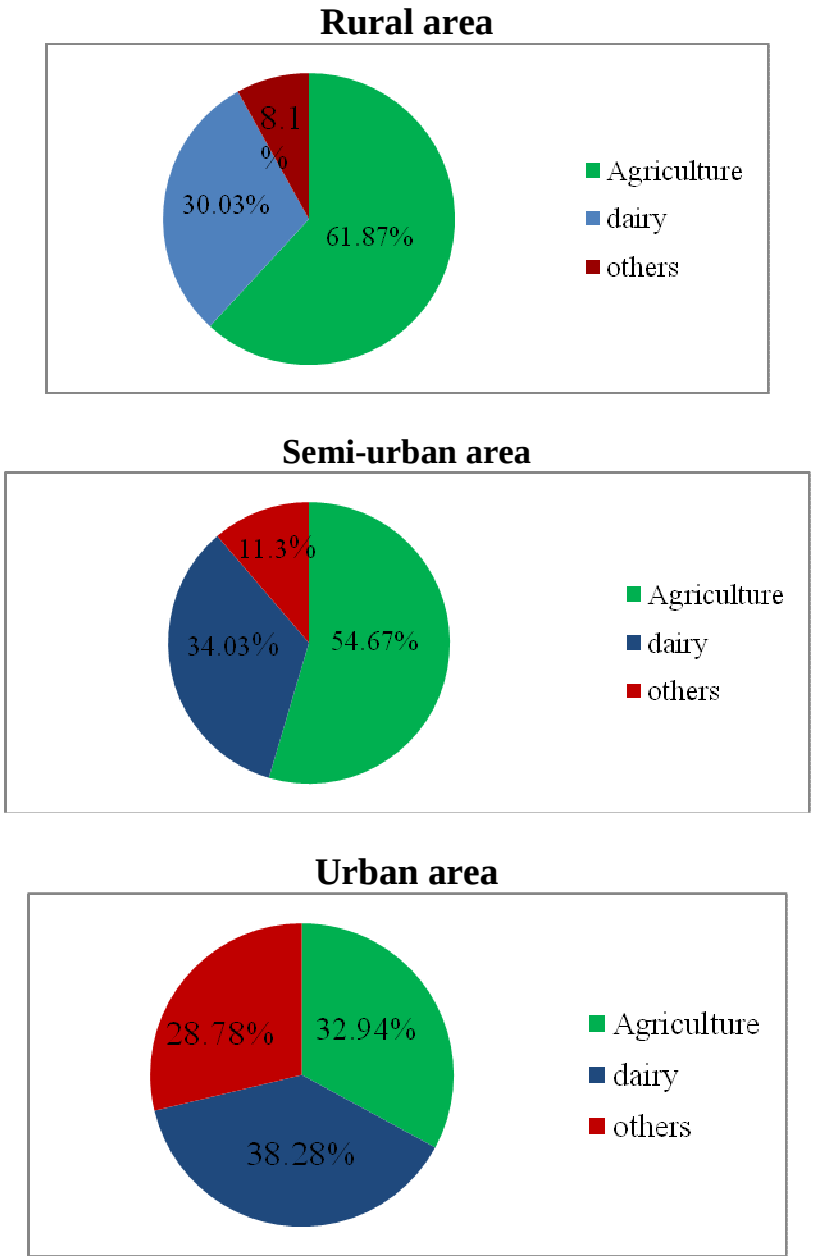


**Figure 4 : Contribution of dairying, agriculture and other activities to family gross income**

### 5.2.9 Availment of technical services and inputs by the respondents

On perusal of Table 16, it was evident that the availament of AI for breed improvement was higher in the urban area (100%) followed by semi-urban (93%) and rural (88%) area. The availament of treatment for infertility in buffaloes was higher in the urban area (100%) followed by rural (76%) and semi-urban (74%) area. Similarly the availment of treatment for sick animals was also higher in the urban area (100%) followed by semi-urban (74%) and rural (73%) area in the district. The higher rate of availment of AI service, treatment for infertility and sick animals in the study area might be due to availability of large number of AI centres, veterinary dispensaries of both A.H department and Cooperative Dairy union in the district.

The availament of subsidised fodder seeds/slips was slightly higher in the rural area (34%) followed by urban (30%) and semi-urban (26%) area. Overall 27.6 and 18.8 per cent of the milk producers availed subsidised concentrate feed and mineral mixture, respectively, for feeding of buffaloes in the study area. Milk producers in the study area did not avail any subsidised chaff cutters for chaffing of fodder. It indicated that sufficient funds were not allocated for the subsidised supply of fodder seed, concentrate feed, mineral mixture and chaff cutter by the A.H department and cooperative dairy union.

Overall 36.4 per cent of the milk producers availed subsidised milch buffaloes insurance in the study area. It was higher in the urban area (58%) followed by rural (39%) and semi-urban (23%) area. The low rate of availment of milch buffalo insurance might be due to lack of awareness among the milk producers about the importance of insurance and availability of insurance schemes implemented by the

government. Very few milk producers availed subsidised milch animals and credit facility from bank for the dairy units in the study area.

## 5.3 ECONOMIC CHARACTERS OF BUFFALOES IN THE STUDY AREA

### 5.3.1 Economic characters of Murrah buffaloes

Table 17 showed that the overall mean age at first calving of Murrah buffaloes in the study area was 40.39 ± 0.09 months. It was similar to the findings of Shah and Sharma (1994) and Sunil *et al.* (2007) who reported an average age at first calving of 39 and 40.73 ± 0.64 months, respectively, in Murrah buffaloes. This result was lower than the findings of Sasidhar *et al.* (2000), Suresh *et al.* (2004) and Sharma *et al.* (2010). It was found that there was no significant ($P \leq 0.05$) difference in the age at first calving of Murrah buffaloes in rural, semi-urban and urban area of the district.

The overall mean service period of Murrah buffaloes in the study area was 136.28 ± 6.91 days. It was nearer to the findings of Prasad (1993) and Suresh *et al.* (2004) who reported an average service period of 123.8 ± 7.45 and 161.10 days, respectively, in Murrah buffaloes. This result was lower than the observation of Barman *et al.* (2009) and Sharma *et al.* (2010). It was also observed that the service period was lower in urban and semi-urban area than that in rural area but the difference was not statistically significant ($P \leq 0.05$).

The overall mean calving interval of Murrah buffaloes in the study area was 443.96 ± 4.47 days. It was nearer to the findings of Prasad (1993), Shah and Sharma (1994), Suresh *et al.* (2004) and Sinha *et al.* (2009a). This result was lower than that of Barman *et al.* (2009) and Thiruvenkadan and Penneerselvam (2010). It was also found that the calving interval was lower in semi-urban area than that in rural and urban area

in Murrah buffaloes but the difference was not statistically (P≤0.05) significant. Sinha *et al.* (2009a) observed that the average calving interval in buffaloes was lower in urban area followed by semi-urban and rural area.

The overall mean peak yield of Murrah buffaloes in the study area was 13.58 ± 0.42 litres. It was higher than the findings of Suresh *et al.* (2004), Kumaravelu *et al.* (2006) and Thiruvenkadan and Penneerselvam (2010) who reported an average peak yield of 10.17 ± 0.22, 7.24 ± 0.20 and 8.87 ± 0.05 kg, respectively, in Murrah buffaloes. It was also observed that the peak yield was higher in semi-urban than that in urban and rural area in Murrah buffaloes but the difference was not statistically (P≤0.05) significant.

The overall mean lactation milk yield of Murrah buffaloes in the study area was 2718.16 ± 84.61 litres. It was higher than the findings of Sasidhar *et al.* (2000), Kumaravelu *et al.* (2006) and Sunil *et al*, (2007) who reported an average lactation milk yield of 1820.3, 1615 ± 63.32 and 1898.66 ± 41.31 kg, respectively, in Murrah buffaloes. The variations in the lactation milk yield might be due to the order of lactation in the buffaloes in different lactations. It was also found that the lactation milk yield was higher in semi-urban area than that in urban and rural area in Murrah buffaloes but the difference was not statistically (P≤0.05) significant.

The overall mean lactation period of Murrah buffaloes in the study area was 321.89 ± 1.88 days. It was nearer with the findings of Narasimharao and Sreemannarayana (1994) and Sharma *et al.* (2010) who reported an average lactation period of 316.2 and 331.30 days, respectively, in Murrah buffaloes. The average lactation period of Murrah buffaloes was almost similar in rural, semi-urban and urban areas of the district.

The overall mean dry period of Murrah buffaloes in the study area was 109.43 ± 4.02 days. It was lower than the findings of Sharma *et al.* (2010) who reported an average dry period of 265.12 days in Murrah buffaloes. It was also found that the average dry period of Murrah buffaloes was lower in semi-urban than that in urban and rural area in the district but the difference was not statistically ($P \leq 0.05$) significant.

### 5.3.2 Economic characters of graded Murrah buffaloes

Table 19 showed that the average age at first calving of graded Murrah buffaloes in the study area was 47.08 ± 1.36 months. It was higher than the findings of Sunil *et al.* (2007) who reported an average age at first calving of 41.27 ± 0.36 months in graded Murrah buffaloes. But it was lower than the observations of Rao *et al.* (1995) who reported an average age at first calving of 1530 days (51 months). It was also found that average age at first calving of graded Murrah buffaloes was significantly ($P \leq 0.05$) lower in urban area than that in semi-urban and rural areas.

The overall mean service period of graded Murrah buffaloes in the study area was 157.65 ± 15.27 days. It was almost similar to the findings of Prasad (1993) who reported an average service period of 153.74 ± 6.33 days in graded Murrah buffaloes, whereas it was higher than the observations of Rao *et al.* (1995) who reported the average service period of 258 days. It was also observed that the average service period of graded Murrah buffaloes was significantly lower in urban area than that in semi-urban and rural areas. It was similar to the findings of Sinha *et al.* (2009a) who reported lower service period in urban area than that in semi-urban and rural areas.

The overall mean calving interval of graded Murrah buffaloes in the study area was 466.32 ± 14.54 days. It was almost similar to the observations of Prasad (1993) and Sunil *et al.* (2007) who reported that the calving interval of 15.42 months (463

days) and 476.58 ± 5.93 days, respectively, whereas Shashishankar *et al.* (2009a) reported the calving interval of 424.32 ± 2.60 days. It was also found that the average calving interval of graded Murrah buffaloes was significantly (P≤0.05) lower in urban area than that in semi-urban and rural areas of the district. It was similar to the results of Sinha *et al.* (2009a) who reported lower calving interval in urban area than that in semi-urban and rural areas.

The overall mean peak yield of graded Murrah buffaloes in the study area was 11.46 ± 0.67 litres. It was slightly higher than the findings of Prasad (1993) and Shashishankar *et al.* (2009a) who reported an average peak yield of 9.03 ± 0.16 and 8.45 ± 0.11 kg, respectively. It was observed that the average peak yield of graded Murrah buffaloes was significantly (P≤0.05) higher in the urban area than that in the semi-urban and rural areas.

The overall mean lactation milk yield of graded Murrah buffaloes in the study area was 2292.50 ± 138.41 litres. It was higher than the findings of Prasad (1993) and Rao *et al.* (2000) who reported average lactation milk yield of 1705.95 ± 42.99 and 1719.02 ± 35.65 litres, respectively. It was also found that the average lactation milk yield of graded Murrah buffaloes was significantly (P≤0.05) higher in the urban area than that in semi-urban and rural areas.

The mean lactation period of graded Murrah buffaloes in the study area was 332.59 ± 1.88 days. It was almost nearer to the observations of Rao *et al.* (1995), Shashishankar *et al.* (2009a) and Sharma *et al.* (2010) who reported an average lactation period of 341, 312.11 and 331.30 days, respectively. It was also observed that there was no significant (P≤0.05) difference in the lactation period of graded Murrah buffaloes in the rural, semi-urban and urban areas of the district.

The overall mean dry period of graded Murrah buffaloes in the study area was 128.53 ± 14.47 days. It was mostly similar to the findings of Shashishankar *et al.* (2009a) who reported average dry period of 130.48 ± 1.32 days, whereas it was lower than the Rao *et al.* (1995) and Rao *et al.* (2000). It was also recorded that the average dry period of graded Murrah buffaloes was significantly (P≤0.05) lower in urban area than that in semi-urban and rural areas.

### 5.3.3 Economic characters of local buffaloes

Table 21 revealed that the overall mean age at first calving of local buffaloes in the study area was 55.24 ± 3.45 months. It was mostly similar to the findings of Prasad and Prasad (1998) who reported an average age at first calving of 52.49 ± 0.34 months. It was also found that the average age at first calving of local buffaloes was significantly (P≤0.05) lower in urban area than that in semi-urban and rural areas. This was in confirmation with the results of Sinha *et al.* (2009a).

The overall mean service period of local buffaloes in the study area was 210.62 ± 12.34 days. It was in agreement with the result of Prasad (1993). It was also observed that there was no statistically (P≤0.05) difference in the service period of local buffaloes in the rural, semi-urban and urban areas in the district.

The overall mean calving interval of local buffaloes in the study area was 520.08 ± 11.92 days. It was mostly similar to the findings of Prasad (1993) but it was lower than the observations of Rao *et al.* (2000). It was also found that no difference was found statistically (P≤0.05) in the rural, semi-urban and urban areas of the district.

The overall mean peak yield of local buffaloes in the study area was 8.87 ± 0.55 litres. It was higher than the findings of Prasad (1993) and Shashishankar *et al.* (2009a).

It was also observed that the average peak yield of local buffaloes was significantly (P≤0.05) higher in the urban and semi-urban areas than that in rural areas.

The overall mean lactation milk yield of local buffaloes in the study areas was 1774.52 ± 110.60 litres. It was higher than the findings of Prasad (1993), Rao *et al.* (2000) and Shashishankar *et al.* (2009a). It was also found that the lactation milk yield of local buffaloes was significantly (P≤0.05) higher in the urban and semi-urban areas than that in rural area.

The overall mean lactation period of local buffaloes was 350.70 ± 5.38 days. It was nearer to the findings of Shah and Sharma (1994) who reported an average lactation length of 338 days but lower than the results of Rao *et al.* (2000). It was also found that the lactation length of local buffaloes was higher in the urban area than that in semi-urban and rural area but it was not statistically (P≤0.05) significant.

The overall mean dry period of local buffaloes was 173.83 ± 17.78 days. It was nearer to the findings of Shashishankar *et al.* (2009a) who reported an average dry period of 150.93 days. It was also observed that the average dry period of local buffaloes was significantly (P≤0.05) lower in the urban and semi-urban area than that in rural area.

### 5.3.4 Economic characters of Murrah, graded Murrah and local buffaloes under field conditions of Krishna district

On perusal of Table 23, it was found that the mean age at first calving (months) was significantly lower in Murrah (40.39 ± 0.09) than that in graded Murrah (47.08 ± 1.36) and local (55.24 ± 3.45) buffaloes in the study area. It was mostly in agreement

with the findings of Sunil *et al*. (2007) who reported lower age at first calving in Murrah than that in graded Murrah buffaloes.

The mean service period (days) was significantly (P≤0.05) lower in Murrah (136.28 ± 6.91) than that in graded Murrah (157.65 ± 15.27) and local (210.62 ± 12.34) buffaloes in the study area. It was in agreement with the findings of Prasad (1993) who found lower service period in Murrah than that in graded Murrah and non - descript buffaloes in and around Hyderabad.

The mean calving interval (days) was significantly (P≤0.05) lower in Murrah (443.96 ± 4.47) than that in graded Murrah (466.32 ± 14.54) and local (520.08 ± 11.92) buffaloes in the study area. This observation was mostly similar to the findings of Prasad (1993) who reported lower calving interval in Murrah than that in graded Murrah and non - descript buffaloes. Rao *et al.* (2000) and Shashishankar *et al.* (2009a) observed lower calving interval in graded Murrah buffaloes than that in non - descript buffaloes. Sunil *et al.* (2007) reported similar calving interval in Murrah and graded Murrah buffaloes.

The mean peak yield (litres) was significantly (P≤0.05) higher in Murrah (13.58 ± 0.42) than that in graded Murrah (11.46 ± 0.66) and local (8.87 ± 0.55) buffaloes in the study area. This result was in agreement with the observations of Prasad (1993) who reported higher peak yield in Murrah than that in graded Murrah and non - descript buffaloes. Shashishankar *et al.* (2009a) also reported higher peak yield in graded Murrah than that in local buffaloes in and around Patna.

The mean lactation milk yield (litres) was significantly (P≤0.05) higher in Murrah (2718.67 ± 84.61) than that in graded Murrah (2292.50 ± 138.41) and local (1774.52 ± 110.60) buffaloes in the study area. It was in agreement with the findings of

Prasad (1993) who reported higher lactation milk yield in Murrah than that in graded Murrah and non - descript buffaloes. Rao *et al*. (2000) and Shashishankar *et al.* (2009a) also observed higher lactation milk yield in graded Murrah buffaloes than that in local buffaloes. Sunil *et al*. (2007) reported higher lactation milk yield in Murrah than that of in graded Murrah buffaloes.

The mean lactation length (days) was significantly ($P \leq 0.05$) lower in Murrah (321.89 ± 1.88) than that in graded Murrah (332.59 ± 1.88) and local (350.70 ± 5.38) buffaloes in the study area. This result was in agreement with the observations of Rao *et al*. (2000) who reported lower lactation length in graded Murrah than that in local buffaloes, while Shashishankar *et al.* (2009a) observed lower lactation length in non - descript than that in graded Murrah buffaloes.

The mean dry period (days) was significantly ($P \leq 0.05$) lower in Murrah (109.43 ± 4.02) than that in graded Murrah (128.53 ± 14.47) and local (173.83 ± 17.78) buffaloes in the study area. It was in agreement with the findings of Rao *et al*. (2000) reported lower dry period in graded Murrah than that in local buffaloes.

## 5.4 BUFFALO PRODUCTION AND MANAGEMENT PRACTICES ADOPTED BY MILK PRODUCERS

### 5.4.1 Breeding management practices

The results in Table 25 revealed that rearing of high milk producing buffalo breeds like Murrah and graded Murrah was adopted by overall 96.8 per cent of milk producers in the study area. It was also found to be higher in the urban (100%) area than that in semi-urban (99%) and rural (93%) areas. It indicated that the milk

producers realised the importance of high milk producing animals to get more income from dairying. The availability of large number of artificial insemination centres, assured market for milk in the district might have also resulted in the higher population of Murrah and graded Murrah buffaloes.

It was revealed that overall 98 per cent of the respondents practiced the heat detection only by observing the estrous signs like bellowing, frequent urination and mucus discharge in the study area. This practice was more similar in rural, semi-urban and urban areas. It was similar to the findings of Modi and Patel (2010) and Sinha *et al.* (2010b). It might be due to more experience of milk producers in buffalo rearing in the study area.

Time of breeding of buffaloes by following AM-PM method was practiced by overall 67.60 per cent of milk producers in the study area. It was observed to be higher in the rural area (90%) than that in semi-urban (64%) and urban area (30%) whereas Sinha *et al.* (2010b) found that 52.2 per cent farmers in rural area bred their animals just after onset of heat.

Artificial insemination in buffaloes was fully adopted by overall 74 per cent of milk producers in the study area. It was found to be higher in the semi-urban (79%) and urban (78%) areas than that in rural (67%) area. However, Ahirwar *et al.* (2010), Sinha *et al.* (2010b) and Sunil *et al.* (2011) reported that majority of buffalo farmers preferred natural service as system of breeding. The higher rate of adoption of AI in this study area might be due to the availability of larger number of AI centres of A.H department, District Co-operative Dairy Union and Gopala mitra services.

It was also observed that overall 80 per cent of the buffalo milk producers bred their buffaloes between 3-5 months after calving. It was found to be higher in the urban

(96%) area than that in semi-urban (87%) and rural (65%) areas. It indicated that the milk producers realised the importance of shorter service period for shorter calving interval so as to get more number of calves during the life time of dairy animals.

Pregnancy diagnosis was adopted by overall 86 per cent of the respondents in the study area. It was higher in the urban (94%) and semi-urban (92%) areas than that in rural (76%) area. It was nearly similar to the observations of Gupta *et al.* (2008) who reported that pregnancy diagnosis was practiced by 73 per cent of buffalo farmers in their study area. It was not in agreement with the findings of Sunil *et al.* (2011) who reported that only, 7.50 per cent of farmers practiced pregnancy diagnosis in their animals.

Majority of buffaloes calved in rainy season (55.20%) followed by winter (39.20%) and summer (5.60%) in the study area. The same trend was observed in rural, semi-urban and urban areas.

Further it was also found that overall 68 per cent of respondents adopted treatment of anestrous/ repeat breeding buffaloes in the veterinary dispensaries. It was found to be higher in the urban area (86%) than that in semi-urban (67%) and rural (60%) areas. It is not in agreement with the observations of Sunil *et al.* (2011) who reported that only 5 per cent of farmers got treated their animals for anestrous and repeat breeding problem in mid hills of Uttarakhand. The higher rate of adoption of treatment of anestrous and repeat breeding in buffaloes in the study area in the present study might be due to availability of larger number of Veterinary institutions in the rural, semi-urban and urban areas of Krishna district.

### 5.4.2 Feeding management practices

From the findings of Table 26, it could be seen that overall 82 per cent of respondents practiced green fodder production for feeding to their buffaloes in the study areas. The trend was almost similar in the rural, semi-urban and urban area. However, more extent of area was allocated in the rural (1.98 acre) area than that in semi-urban and urban areas. It was nearer to the findings of Munishkumar *et al.* (2005), Vij and Tantia (2005) and Sabapara *et al.* (2010). The higher rate of adoption of fodder production in the study area might be due to the availability of canal water for irrigation of fodder crops.

Chaffing of green fodder was adopted by overall 1.60 per cent of respondents in the study area. The trend was almost similar in the rural, semi-urban and urban areas. It was almost similar to the findings of Deoras *et al.* (2004b), Meena *et al.* (2008) and Singh *et al.* (2010) who reported that majority of the farmers did not prefer chaffing of fodder in rural and urban areas. However, Vij and Tantia (2005) reported that most of the farmers chaffed the fodder and fed the animals in groups in Punjab. The lower rate of adoption of chaffing of green fodder in the study area might be due to cultivation of para grass and pillipesera in the larger area and harvesting of fodders in tender stage.

It was found that paddy straw was the major source of dry fodder for feeding of buffaloes in the rural, semi-urban and urban areas of the study area as paddy is the main crop in this study area. Further it was also observed that majority of respondents fed their buffaloes with green and dry fodder as group feeding (52.8%) followed by individual feeding (47.2%) in the study area.

Hay making was practiced by overall 10.8 per cent of the respondents particularly in the rural (23%) area in the study area. Silage making and urea treatment of paddy straw were not practiced by the respondents in rural, semi-urban and urban

areas in the study area. It was in agreement with the observations of Rathore and Kachwaha (2009) and Sinha *et al.* (2009b) who reported that none of the farmer prepared hay and silage making and did not follow chemical treatment of low grade roughages to improve its nutritive value. The lower rate of adoption of these practices in the study area might be due to lack of awareness about these practices among the farmers.

Grazing of buffaloes was practiced by overall 72.40 per cent of the respondents in the study area. It was observed to be more in rural (90%) area than that in semi-urban (68%) and urban (46%) areas. The higher rate of adoption of this practice in rural area was due to the availability of more grazing area than that in semi-urban and urban areas. It was in agreement with the observations of Deoras *et al.* (2004b).

It was observed that homemade concentrate mixture was fed to the buffaloes by overall 59.2 per cent of the respondents in the study area. It was found to be higher in the rural area (74%) than that in semi-urban and urban areas whereas urban milk producers (68%) preferred to purchase the readymade concentrate mixture in the local market. It was mostly nearer to the observations of Deoras *et al.* (2004b) who reported that 96 per cent of rural farmers fed livestock with only brans and chunnies as a substitute of concentrate mixture whereas 100 per cent of urban farmers purchased it from local market. The higher rate of adoption of homemade concentrate mixture in the rural areas of the study area might be due to availability of larger quantity of cereal and pulse by product in their agricultural farm. It was found that overall 87.2 per cent of respondents fed soaked concentrate mixture to the buffaloes in the study area. It was observed to be higher in the semi-urban (94%) and urban (88%) areas than that in rural (88%) area.

Supplementation of mineral mixture and common salt in the feed was practiced by overall 30.4 and 29.2 per cent, respectively, in the study area. It was nearer to the observations of Malik *et al.* (2005). It was also found to be higher in the urban area than that in semi-urban and rural areas. Deoras *et al.* (2004b) reported that majority of farmers provided mineral mixture in urban area as compared to none of the farmer in rural area and higher number of rural farmers provided common salt to dairy animals in comparison to urban farmers. The lower rate of adoption of supplementation of mineral mixture and common salt in the feed in the study area might be due to lack of awareness about the importance of mineral mixture among the rural farmers.

It was observed that majority of the semi-urban (63%), urban (60%) and rural (55%) respondents fed their buffaloes with concentrate feed at the time of milking. It was nearer to the observations of Pundir *et al.* (2000). However, Sabapara *et al.* (2010) reported that concentrate feeding to the animals after milking was practiced by 91 per cent of farmers. Singh *et al.* (2010) observed that majority of the farmers (73%) fed concentrate mixture to buffaloes daily before milking. It indicated that the time of concentrate feeding to milch buffaloes varied from region to region in the country.

Extra concentrate feeding during advanced pregnancy and early lactation was adopted by overall 12 and 12.4 per cent of the respondents, respectively, in the study area. It was slightly higher in urban area than semi-urban and rural areas. Meena *et al.* (2008) reported that 45 per cent of farmers provided extra ration to advanced pregnant animals. The lower rate of adoption of these practices might be due to lack of awareness about the importance of good feeding during advanced pregnancy and early lactation of buffaloes.

It was observed that majority of rural milk producers (61%) and semi-urban milk producers (51%) provided drinking water to buffaloes from tank, whereas urban milk producers (56%) supplied drinking water to buffaloes from tube well. Malik *et al.* (2005) and Ahirwar *et al.* (2010) reported that majority of farmers provided drinking water from a tube well.

### 5.4.3 Housing management practices

On persual of Table 27, it was observed that majority of respondents in rural (63%), semi-urban (62%) and urban (60%) areas located the buffalo shed nearer to their dwelling. It is in agreement with the observations of Modi *et al.* (2010) who reported that 89 per cent of farmers kept dairy animals separately from their own dwelling. This was in contrary to findings of Munishkumar *et al.* (2005) and Sinha *et al.* (2009b) who observed that majority of respondents kept buffaloes inside their dwellings.

Loose housing system was practiced by majority of rural (83%), semi-urban (67%) and urban (56%) milk producers in the study area. It is similar to the findings of Modi *et al.* (2010) who reported that 63 per cent of farmers kept dairy animals in loose house.

Kutcha type of flooring was provided in the sheds by majority of rural (62%) milk producers, whereas pucca type of floor was provided by majority of urban (68%) and semi-urban (51%) milk producers in the study area. These findings were nearer to the observations of Ahirwar *et al.* (2010) who reported that majority of rural farmers (59.33%) had mud house, whereas in urban areas 68 per cent of farmers had pucca house with concrete floor in Indore district of Madhya Pradesh.

Thatched roofing was practiced by majority of rural (59%) and urban (56%) milk producers, whereas asbestos roofing was provided by majority of semi-urban

(54%) milk producers in the study area. It was similar to the findings of Mahendra *et al.* (2007) who reported that 57.5 per cent of farmers provided thatched roof, whereas Modi *et al.* (2010) observed that 34 per cent of farmers preferred iron sheets for roof of animal housing in rural milk shed of Gujarat. It indicated that thatched roofing was preferred by majority of milk producers so as to protect the buffaloes from high atmospheric temperature and radiation during the summer season.

Kutcha type of manger was provided in the buffalo shed by majority of rural (71%) and semi-urban (51%) milk producers, whereas pucca type of manger was provided by majority of urban (58%) milk producers in the study area. It was nearer to the observations of Modi *et al.* (2010) who reported that 64 per cent of farmers provided pucca manger. Pucca type of water trough was provided by majority of urban (90%), rural (87%) and semi-urban (86%) areas of the study area.

Pucca type of drainage was provided by majority of urban (60%) milk producers, whereas kutch type of drainage was arranged by majority of rural (77%) and semi-urban (64%) milk producers in the study area. These findings were nearer to the observations of Deoras *et al.* (2004b) who reported that majority of animal sheds in rural areas had improper drainage (98%) due to mud floor.

Majority of urban (80%) milk producers located manure pit beside the animal shed. Nearly 50 per cent of milk producers in rural and semi-urban areas provided manure pit far away from the animal shed, whereas Sinha *et al.* (2009b) observed that manure pit was distantly located by the rural (86.7%), semi-urban (73.3%) and urban (57.8%) farmers. Only 20 per cent of the urban milk producers arranged cooling devices like fans in the buffalo sheds, whereas the rural and semi-urban milk producers

did not provide any cooling devices in the animal sheds. It might be due to lack of awareness about the importance of cooling devices for high milk producing buffaloes.

Wallowing of buffaloes was practiced by majority of rural (98%) milk producers followed by semi-urban (83%) and urban (46%) milk producers in the study area. it was similar with the findings of Rathore and Kachwaha (2009) who reported that 39.5 per cent of the respondents followed buffalo wallowing practice in village water tank in Rajasthan. The higher rate of adoption of wallowing in the study area might be due to availability of large number of village water tanks and irrigation canals of Krishna river.

### 5.4.4 Buffalo calf rearing practices

From Table 28, it could be observed that cutting of navel cord was practiced by majority of urban (66%) and semi-urban (60%) milk producers, whereas 37 per cent of rural milk producers adopted this practice in the study area. The results of the present study were higher than the observations of Rathore and Kachwaha (2009) and Sinha *et al.* (2010a) who reported that this practice was higher in semi-urban (14.4%) and urban (11.1%) area. Application of tincture iodine to navel was not practiced by any milk producer in the rural, semi-urban and urban areas of the study area.

Colostrum feeding to new born calf within one to two hours of birth was practiced by majority of urban (94%), rural (76%) and semi-urban (68%) milk producers in the study area. These results were higher than the findings of Sreedhar (2009) and Sinha *et al.* (2010b).

It was observed that majority of rural (67%) and semi-urban (60%) milk producers allowed calf to take milk from one quarter of the udder in the study area. It was higher than the findings of Sreedhar (2009). The higher adoption rate of this

practice in the study area might be due to possession of large number of graded Murrah and Murrah calves. Very few milk producers in semi-urban (16%) and urban (20%) areas practiced weaning, whereas no rural milk producer adopted this practice. It was nearer to the observations of Sinha *et al.* (2010a). Very few milk producers in the urban (24%), semi-urban (14%) and rural (7%) areas adopted feeding of calf starter to calves in the study area. It was similar to the observations of Singh *et al.* (2011) who reported that most of the farmers did not feed any concentrate to calves.

Regular deworming of calves was practiced by majority of urban (76%), semi-urban (65%) and rural (62%) milk producers in the study area. It was higher than the findings of Rathore and Kachwaha (2009) and Sreedhar (2009), whereas Singh *et al.* (2011) reported that 93 per cent of farmers adopted deworming to their female calves, however deworming was not done in male calves in Patiala district of Punjab.

Vaccination of calves against HS, FMD was adopted by more than 90 per cent of the milk producers in rural, semi-urban and urban areas of the study area. These findings were higher than the observations of Mannivanan *et al.* (2009) and Rathore and Kachwaha (2009). The higher rate of adoption of deworming and vaccination of calves in the study area might be due to availability of larger number of veterinary institutions and more valuable graded Murrah buffalo calves.

### 5.4.5 Milking management practices

Table 29 revealed that all the milk producers adopted hand method of milking in rural, semi-urban and urban areas of study area. No respondent adopted machine milking in buffaloes in the study area. These findings were in agreement with the results of Kumar and Mehla (2011) who reported that no one practiced machine milking in the rural areas of Ferozpur district of Punjab.

Full hand method of milking was adopted by majority of urban (60%), semi-urban (45%) and rural (38%) milk producers in the study area. Overall only 19.2 per cent of milk producers practiced knuckling method of milking in buffaloes. It was more similar to the findings of Kumar and Mehla (2011). However Sinha *et al.* (2010a) reported that full hand method of milking was followed by 18.9, 16.7 and 46.7 per cent of farmers in rural, semi-urban and urban areas, respectively, and majority of rural and semi-urban farmers followed knuckling method. Ahirwar *et al.* (2010) also reported that 11.33 and 8 per cent of farmers followed full hand method in rural and urban areas, respectively. The rate of adoption of full hand method of milking was higher in the study area. It might be due to more experience of farmers in milking buffaloes.

It was found that all the milk producers adopted twice a day milking in rural, semi-urban and urban area of the study area. It was in agreement with the findings of Ahirwar *et al.* (2010), whereas Sinha *et al.* (2010) reported that 55.4 per cent farmers milked once and only 41.4 per cent twice a day in the rural area, whereas in semi-urban and urban areas 73.3 and 97.8 per cent of farmers, respectively, milked the animals twice a day.

It was also found that majority of milk producers used their family labour for milking the buffaloes in rural (98%), semi-urban (85%) and urban (78%) areas of the study area, whereas 22 per cent of milk producers in the urban area engaged hired labour for milking. Male and female family members had experience in milking buffaloes in this study area.

It was found that 20 and 10 per cent of urban and semi-urban milk producers, respectively, used oxytocin injection for letdown of milk in the buffaloes, whereas it was not followed in rural areas of the study area. It was mostly similar to the findings

of Sinha *et al.* (2010a) who reported that 10 and 2.2 per cent of urban and semi-urban milk producers, respectively, used injection for letdown of milk in buffaloes in Bareilly district of Utter Pradesh. Kumar and Mehla (2011) also found that 30 per cent of respondents used oxytocin injection for letdown of milk.

Washing of animals before milking was practiced by majority of the milk producers in urban (66%), rural (53%) and semi-urban (50%) areas of the study area. It was not in agreement with the findings of Kalyankar *et al*. (2004) who reported that none of the farmers followed cleaning of whole animals before milking in Parbhani district of Maharashtra. Washing of udder and utensils with clean water before milking was adopted by all the milk producers (100%) in the study area. These findings were in agreement with the observations of Kalyankar *et al.* (2004) who reported that washing of udder, teats and utensils with clean water before milking was practiced by 100 per cent of farmers, whereas Sinha *et al.* (2010a) observed that udder washing was followed by 90.0, 93.3 and 100 per cent of farmers in rural, semi-urban and urban areas, respectively.

It was found that all the milk producers (100%) did not follow the strip cup test before milking, dipping of teats in povidine iodine after milking and dry cow therapy in the study area. It was inagreement with the findings of Rathore and Kachwaha (2009) and Kumar and Mehla (2011) who reported that no one used dip or wipe the teats after milking in the rural areas of Ferozepur district of Punjab. It might be due to lack of awareness about the importance of practices among the milk producers. It might be predisposing the buffaloes for mastitis in the study area.

It was observed that majority of rural milk producers (62%) marketed the milk to the district cooperative dairy union whereas majority of urban milk producers (50%)

marketed the milk directly to the consumer followed by cooperative dairy. Meena *et al.* (2008) reported that 56.33 per cent of farmers sold milk to the milk dairy cooperatives. In the present study, it indicated that urban milk producers preferred to sell the milk directly to the consumer so as to get more income, whereas the rural milk producers sold the milk to the dairy cooperatives which provided assured market and reasonable price for milk even the remote rural areas.

### 5.4.6 Health care practices

A persual of Table 30 revealed that almost all the milk producers in rural (96%), semi-urban (98%) and urban (98%) areas vaccinated buffaloes against FMD and HS diseases in the study area. The rate of adoption of this practice was higher than the findings of Mahendra *et al.* (2007), Sinha *et al.* (2010b) and Sunil *et al.* (2011).

It was observed that the milk producers practiced regular deworming for adult buffaloes in rural (19%), semi-urban (13%) and urban (22%) areas in the study area. It was mostly nearer to the observations of Sinha *et al.* (2010b) who reported that deworming was done at regular interval by 2.2, 3.3 and 2.2 per cent of dairy farmers in rural, semi-urban and urban areas, respectively. It indicated that the adult buffaloes were dewormed as and when required but not as a preventive measure.

Control of ectoparasites using insecticides in adult buffaloes was practiced by very few milk producers in rural (2%), semi-urban (6%) and urban (20%) areas in the study area. It was most by in agreement with the findings of Sinha *et al.* (2010b) and Sunil *et al.* (2011) who reported that 90.83 per cent of the animal owners followed dusting of insecticide to control lice/ ticks in mid hills of Uttarakhand. It indicated that the incidence of lice and ticks infestation might be lower in the present study area as the animals were washed in tanks and canals regularly.

Isolation of sick animals was adopted by majority of milk producers in urban (70%), semi-urban (44%) and rural (42%) areas in the study area. It was mostly similar to the observations of Rathore and Kachwaha (2009) who reported that 59.75 per cent of the respondents isolated their sick buffalo from healthy animals. Sunli *et al.* (2011) observed that only 9.58 per cent of the respondents isolated their sick animals from healthy ones.

It was observed that majority of milk producers consulted the veterinarian for the treatment of sick animals in urban (74%), semi-urban (72%) and rural (62%) areas in the study area. They also consulted para veterinarian for the same purpose in rural (25%), semi-urban (19%) and urban (28%) areas. These observations were mostly similar to the findings of Sinha *et al.* (2010b) who reported that the farmers availed the advice from veterinary doctor in urban (77.1%), semi-urban (58.9%) and rural (44.4%) areas in Barielly district of Utter Pradesh. Sunil *et al.* (2011) also observed that majority of farmers consulted the veterinary doctor/ stock man for treatment of sick animals.

It was also observed that majority of milk producers rated the veterinary facilities as satisfactory in rural (70%), semi-urban (72%) and urban (48%) areas, whereas very few milk producers rated as good in rural (15%), semi-urban (24%) and urban (32%) areas in the study area. It was mostly similar to the observations of Sunil *et al.* (2011) who reported that the percentage of respondents rating veterinary facilities as good, satisfactory and poor were 8.33, 25.67 and 66.67 per cent, respectively, in mid hills of Uttarakhand.

## 5.5. CONSTRAINTS PERCEIVED BY MILK PRODUCERS AND FIELD VETERINARIANS IN BUFFALO PRODUCTION

### 5.5.1 Constraints perceived by buffalo milk producers in Krishna district

The results presented in Table 31 revealed that the overall 94.40 per cent of milk producers felt that high cost of pure bred buffaloes in the local market was the main constraint in the enhancement of buffalo milk production in the study area. This result was in agreement with the findings of Shashishankar *et al.* (2009b). This problem was slightly higher in the rural (99%) area than that in semi-urban (92%) and urban (90%) area. It might be due to low purchasing capacity of milk producers in the rural area. This problem might be solved by producing good quality farm born replacement stock instead of purchasing the animals from buffalo traders.

High cost of hired labour for maintaining dairy unit was perceived as serious constraint by overall 94 per cent of milk producers in the study area. It was similar to the findings of Yedukondalu *et al.* (2000). This problem was higher in urban area (96%) than that in semi-urban (94%) and rural (93%) areas. It might be due to the migration of labourers to work in the building construction works and small scale industries in the urban and semi-urban areas.

High cost of feed ingredients like oil cakes, brans and cereal grains was also viewed as a major problem by overall 92.4 per cent of the milk producers in the study area. It was similar to the observations of Yedukondalu *et al.* (2000), Ulmek *et al.* (1998) and Sanjeeva *et al.* (2009). This constraint was higher in the rural area (95%) than that in semi-urban (90%) and urban (92%) areas.

Lack of financial assistance for purchase of high milk producing buffaloes and equipment was perceived as a problem by overall 91.6 per cent of milk producers in the study area. This was in agreement with the findings of Yedukondalu *et al.* (2000), Ulmek and Patil *et al.* (2001) and Shashishankar *et al.* (2009b). It was higher in the urban area (94%) than that in rural (91%) and semi-urban (91%) areas.

Lack of extension activities was also viewed as a constraint for the adoption of buffalo milk production technologies by overall 88 per cent of the milk producers in the study area. This was similar to the observations of Yadav *et al.* (2007). This was slightly higher in the rural (88%) and semi-urban (89%) areas than that in urban (86%) area. It indicated that inadequate extension services to transfer technologies affected the adoption of certain scientific management practices in buffalo farming.

Non remunerative price for milk was perceived as a major problem by overall 80.4 per cent of the milk producers in the study area. It was in agreement with the findings of Yedukondalu *et al.* (2000), Ulmek and Patil *et al.* (2001) and Kathiravan and Selvam (2011). It was higher in the rural areas (86%) than that in semi-urban (81%) and urban (68%) areas. It indicated that remunerative price for milk motivated the milk producers for increasing the milk production by adopting the scientific milk production technologies.

Non availability of fodder seeds/ slips was also expressed as a problem by overall 68.8 per cent of the milk producers in the study area. It was in agreement with the findings of Sanjeeva *et al.* (2009) and Karamjit *et al.* (2010). It was higher in semi-urban area (82%) than that in rural (59%) and urban (62%) areas.

Problem of favouritism in providing inputs and loans to the milk producers was also viewed as a constraint by overall 68 per cent of the milk producers in the study

area. This problem was higher in the rural area (72%) than that in semi-urban (65%) and urban (66%) areas. It might be due to the local politics in the study area.

Inadequate supply of concentrate mixture/ mineral mixture on subsidised cost was perceived as a problem by overall 64 per cent of the milk producers in the study area. It was higher in the rural area (85%) than that in semi-urban (49%) and urban (52%) areas. It indicated that the government and co-operative agencies were not able to supply the required quantity of balanced concentrate mixture to the milk producers.

High incidence of repeat breeding in buffaloes was also expressed as a constraint by overall 60.4 per cent of the milk producers in the study area. It was higher in the rural area (65%) than that in semi-urban (62%) and urban (48%) area. This was similar to the observations of Sanjeeva *et al.* (2009), Shashishankar *et al.* (2009b) and Modi and Patel (2010). This problem might be solved by conducting fertility camps frequently in the buffalo rearing areas.

Low conception rates with AI in buffaloes were also viewed as a constraint by overall 58 per cent of the milk producers in the study area. It was in agreement with the findings of Shashishankar *et al.* (2009b), Karamjit *et al.* (2010) and Modi and Patel (2010). This problem was more in the rural area (64%) than that in semi-urban (53%) and urban (56%) areas. This constraint might be solved by educating the farmers about the heat detection and AI.

Feed and fodder shortage was perceived as a constraint by overall 57.6 per cent of milk producers in the study area. It was similar to the findings of Ulmek *et al.* (1998), Patil *et al.* (2009) and Kathiravan and Selvam (2011). This constraint was more in the urban area followed by semi-urban area than that in the rural area. It might be

due to non availability of crop by-products for feeding of buffaloes in the urban and semi-urban areas.

High incidence of anestrous in buffaloes was perceived as a problem by overall 54.4 per cent of milk producers in the study area. It was found more in the rural area (63%) than that in semi-urban (56%) and urban (34%) areas. It might be due to lack of adequate knowledge about the detection of estrous in buffaloes in the rural milk producers than that in urban and semi-urban areas.

Inadequate supply of veterinary medicines in the veterinary hospitals was expressed as a problem by overall 52.40 per cent of milk producers in the study area. It was in agreement with the observations of Uma *et al.* (2003), Yadav *et al.* (2007) and Sanjeeva *et al.* (2009). It was higher in the urban area (70%) than that in rural (50%) and semi-urban (46%) areas.

Distant location of veterinary hospital was also viewed as a problem by overall 46.40 per cent of the milk producers in the study area. It was similar to the observations of Yedukondalu *et al.* (2000), Uma *et al.* (2003) and Karamjit *et al.* (2010). This problem was observed to be higher in the rural area (68%) than that in semi-urban and urban areas.

Lack of adequate knowledge about scientific management of buffaloes was also felt as a constraint by overall 36.4 per cent of the milk producers in the study area. It was in agreement with the findings of Uma *et al.* (2003), Patil *et al.* (2009) and Sanjeeva *et al.* (2009). This problem was found to be higher in the rural area (62%) than that in urban (8%) and semi-urban (25%) area. It might be due to less exposure of the rural milk producers to the mass media and print media and their low literature level.

High incidence of prolapse of uterus in buffaloes was also expressed as a constraint by a few milk producers in the rural, semi-urban and urban areas of the study area.

### 5.5.2 Constraints perceived by field veterinarians in the buffalo production

The results presented in Table 32 revealed that majority of veterinarians expressed that problem of anestrous and silent heat and repeat breeding were the major constraints for enhancing the buffalo production.

Larger area to be covered for AI and treatment of livestock was also perceived as a serious constraint by 74 per cent of the field veterinarians. They also expressed that more area of operation and too many job responsibilities were the main reasons for inadequate extension work for transfer of technology to the milk producers. They also suggested that separate staff for extension work and implementing the livestock development programmes is required for increasing the milk production in the district.

The other important constraints perceived by the veterinarians in buffalo production in Krishna district were mastitis in buffaloes, calf mortality, prolapse of uterus, presence of bulls in the village which are often used for natural service, lack of subsidy on animal feeds, inadequate facilities for diagnostic purpose and specialized treatment and lack of sufficient knowledge of the farmers about scientific feeding and management of buffaloes. This result was in general agreement with the findings of Sharma and Makhija (1991) and Rajput and Hema (2010).

Based upon the analysis of the findings of the study, the following recommendations were suggested for the effective implementation of buffalo production programmes in Krishna district.

1. The existing AI programme should be strengthened by providing more number of mobile AI centres to provide AI services at the farmers' door step in rural and urban areas. AI fee can be charged at nominal cost as most of the milk producers are landless, marginal and small farmers. The milk producers can produce the superior graded Murrah buffalo calves from local buffaloes through AI. These calves should be well fed and maintained so as to reduce the mortality of superior calves and a good quality replacement stock can be developed in the village without purchasing the new stock from distant places at high cost.

2. Fertility camps should be organised frequently both in rural and urban areas. Slaughter of superior quality female buffaloes particularly in urban areas should be controlled by discouraging export of buffalo meat by taking away the concessions on export of buffalo meat to stop drain of good genetic material.

3. Community fodder production should be encouraged in the government waste lands in rural areas by providing required quantity of high yielding fodder varieties. The farmers of Krishna district have to be encouraged to replace the area under para grass completely with that of high yielding and good quality fodder crops like Hybrid napier wherever water logging is not a problem. Chaff cutters should be made available to the milk producers at reasonable cost so as to minimise the wastage of fodder.

4. Small feed plants could be established at every mandal head quarter under Cooperative sector/Mahila self help groups so that the milk producers can avail this facility for preparing the good quality concentrate feed for the milch buffaloes.

5. The milk producers' Cooperative societies and private dairies should consider the cost of milk production while fixing the procurement price of milk. The milk producers could be encouraged to increase the milk production particularly in the rural area by giving assured remunerative price for milk based on average cost of milk production. The milk procurement price should not be reduced during flush season because the feed and labour cost and other miscellaneous costs would not become less during flush season.

6. Nationalized banks should provide loans with reasonable interest for the purchase of one or two high milk yielding buffaloes by the milk producers who got sufficient feed and fodder resources for maintaining the animals.

7. Department of Animal Husbandary and District milk producers' Cooperative union should give more importance for organising the extension activities such as training programmes, demonstration, calf rallies, milk yield competitions and milk producers' meet to create awareness and interest among the milk producers about the milk production technologies. Sufficient funds are to be allocated for organising these extension activities at each mandal level.

8. The field veterinary staff, paid secretaries of milk producers' Cooperative societies and Gopala mitras should educate the milk producers regarding fodder production, feeding and other management practices of buffalo rearing in their jurisdiction as majority of milk producers was not aware of these practices. They should also be sent for short term refresher training programmes to the Regional Animal Husbandry Training Centres to update their knowledge and skills in the field of production and health care of buffaloes and other livestock.

# SUMMARY

# CHAPTER VI

# SUMMARY

A study was undertaken on the buffalo production and management practices followed by milk producers in rural, semi-urban and urban areas of Krishna district in Andhra Pradesh. In addition, the constraints felt by the milk producers and field veterinarians were also identified. The data obtained were tabulated, analysed statistically, interpreted and the results and recommendations were drawn.

The results showed that the total bovine population in Krishna district increased from 8.80 lakhs to 10.21 lakhs during the period from 1993 to 2007 with 31.52 per cent increase in buffalo population and 43.01 per cent decrease in cattle population during the same period. The annual buffalo milk production was increased by 109.28 per cent during 10 years period. The contribution of buffalo milk to the total milk production ranged from 73.97 to 96.81 per cent in the district during the 10 years period.

The average number of Murrah, Murrah graded and local buffaloes possessed by milk producers in urban area was significantly ($P \leq 0.01$) higher than that in semi-urban and rural areas.

It was observed that majority of milk producers belonged to middle age group followed by young and old age groups in rural, semi-urban and urban areas. Most of farmers belonged to backward caste, scheduled caste and tribe than the other caste in rural, semi-urban and urban areas. Majority of buffalo milk producers were literate ranging from primary to graduation level of education. Most of the milk producers in rural and semi-urban areas had agriculture as main occupation followed by dairying.

Majority of the milk producers were marginal farmers followed by landless, small and medium farmers. The availment of AI for breed improvement was higher in urban area followed by semi-urban and rural areas. The availment of treatment for infertility and sick animals was also higher in the urban area followed by rural and semi-urban area.

There was no significant difference in the average age at first calving, service period, calving interval, peak yield, lactation milk yield, lactation length and dry period of Murrah buffaloes were not having significant ($P \leq 0.05$) difference in the rural, semi-urban and urban areas of the study area.

The average age at first calving, service period, calving interval and dry period of graded Murrah buffaloes were significantly ($P \leq 0.05$) lower in urban area than that in semi-urban and rural areas. The average peak yield and lactation milk yield of graded Murrah buffaloes was significantly ($P \leq 0.05$) higher in the urban area than that in semi-urban and rural areas of the study area. However, there was no significant ($P \leq 0.05$) difference in the lactation period of graded Murrah buffaloes in rural, semi-urban and urban areas of the district.

The average age at first calving of local buffaloes was significantly ($P \leq 0.05$) lower in urban area than that in semi-urban and rural areas. The average peak yield and lactation milk yield of local buffaloes was significantly ($P \leq 0.05$) higher in the urban and semi-urban areas than that in rural area. However, there was no significant difference in the average service period, calving interval and lactation length of local buffaloes in rural, semi-urban and urban areas.

The average age at first calving, service period, calving interval, lactation length and dry period was significantly ($P \leq 0.05$) lower in Murrah than that in graded Murrah and local buffaloes. The mean peak yield and lactation milk yield was significantly

higher ($P \leq 0.05$) in Murrah than that in graded Murrah and local buffaloes in the study area.

The rearing of high milk producing buffalo breeds like Murrah and graded Murrah was adopted by overall 96.8 per cent of the milk producers in the study area. Overall 98 per cent of the milk producers practiced the heat detection by observing the estrous signs like bellowing and mucus discharge from vulva. These practices were mostly similar in rural, semi-urban and urban areas. Majority of respondents adopted AI in buffaloes in urban (78%), semi-urban (79%) and rural (67%) areas. Most of the respondents bred their buffaloes between 3-5 months after calving in urban (96%), semi-urban (87%) and rural (65%) areas. Majority of respondents followed pregnancy diagnosis in the urban (94%) and semi-urban (92%) than that in rural (76%) area. Overall most of buffaloes calved in rainy season (55.20%) followed by winter (39.20%) and summer (5.60%) season.

Overall 82 per cent of the milk producers practiced green fodder production in the study area. The trend was almost similar in the rural, semi-urban and urban areas. However more extent of area per farmer was allocated for fodder production in the rural area than that in semi-urban and urban areas. However, chaffing of green fodder was adopted by overall 1.60 per cent of farmers in the study area. The practice of feeding homemade concentrate mixture was higher in the rural area (74%) than that in semi-urban (58%) and urban areas (32%), whereas urban milk producers (68%) preferred to purchase the readymade concentrate mixture in the local market.

Majority of the milk producers in rural (63%), semi-urban (62%) and urban (60%) areas had located the buffalo shed nearer to their dwelling. Loose housing system was adopted by majority of rural (83%), semi-urban (67%) and urban (56%)

milk producers in the study area. Majority of urban (80%) milk producers located manure pit beside the animal shed. Wallowing of buffaloes was practiced by majority of rural (98%) milk producers followed by semi-urban (83%) and urban (46%) milk producers in the study area.

Colostrum feeding to new born calf within one to two hours of birth was practiced by majority of urban (94%), rural (76%) and semi-urban (68%) milk producers. Most of the rural (67%) and semi-urban (60%) milk producers allowed calf to take milk from one quarter of the udder. No rural milk producer adopted weaning of buffalo calves. Regular deworming and vaccination of calves was practiced by majority of urban, semi-urban and rural milk producers in the study area.

Full hand method of milking was adopted by majority of urban (60%), semi-urban (45%) and rural (38%) milk producers. No respondent adopted machine milking in buffaloes. It was also observed that 20 and 10 per cent of urban and semi-urban milk producers, respectively, used oxytocin injection for letdown of milk in buffaloes, whereas it was not followed in rural areas. Washing of udder and utensils with clean water before milking was adopted by all the milk producers. All the milk producers (100%) were not following the strip cup test before milking, dipping of teats in povidine iodine after milking and dry cow therapy in the study area.

Most of the milk producers in rural (965), semi-urban (98%) and urban (98%) areas vaccinated buffaloes against FMD and HS disease. Majority of milk producers rated the veterinary facilities as satisfactory in rural (70%), semi-urban (72%) and urban (48%) areas, whereas very few farmers rated as good in rural (15%), semi-urban (24%) and urban (32%) areas in the study area.

High cost of pure bred buffaloes, feed ingredients and hired labour, lack of financial assistance for purchase of high milk producing buffaloes and equipment, lack of extension activities, non remunerative price for milk, non availability of fodder seeds/slips were found to be some of the major constraints perceived by the buffalo milk producers in the study area. Problem of anestrous or silent heat, repeat breeding, mastitis, calf mortality, lack of subsidy on animal feeds and inadequate facilities for diagnostic purpose and specialized treatment were observed to be some of the major constraints perceived by the field veterinarians in buffalo production in the study area.

Based upon the findings and on observation of analysed results, the following recommendations were suggested. The existing AI programme should be strengthened by providing more number of AI Centres to provide AI services at the farmers' door step in rural and urban areas. Fertility camps should be organised frequently. The procurement price of milk should be based, as far as, possible on the average cost of milk production. All the technical services and inputs should be made available regularly to the milk producers. Extension activities are to be organised frequently so as to improve the knowledge and skills of the buffalo milk producers. All the technical and para technical persons of Department of animal Husbandry and milk cooperative societies should be sent for refresher training programme in order to improve their skills in production and health care of buffaloes.

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# APPENDIX

# Appendix

## A. INTERVIEW SCHEDULE FOR BUFFALO MILK PRODUCERS

Name of the farmer: Village:

Mandal:

**I. Socio economic characteristics of respondents:**

1. Age of farmer: Young age /Middle age /Old age

2. Cast: Scheduled caste/ Schedule tribe/Backward caste/ Other caste

3. Education: Illiterate/Primary/High school/College

4. Main occupation: Agriculture/Dairy/Business/Service

5. Land holding: Land less/ Marginal/Small/Medium/Large

6. Family size: Up to 5 members (small)/ Above 5 members (large)

7. Extension contact: Para veterinarian/Veterinarian/Others

8. Mass media exposure**:** Radio/Television/Farm magazine/None

9. Annual income:

| | |
|---|---|
| Agriculture | |
| Dairy | |
| Others | |
| Total | |

**Availament of technical services and inputs by the respondents**

| S.No. | Technical services and inputs | availed | Not availed |
|---|---|---|---|
| 1. | Artificial insemination | | |
| 2. | Treatment for infertility | | |
| 3. | Treatment for sick animals | | |
| 4. | Subsidised fodder seeds/ slips | | |
| 5. | Subsidised concentrate feed | | |
| 6. | Subsidised mineral mixture | | |
| 7. | Subsidised chaff cutters | | |
| 8. | Subsidised cattle insurance | | |
| 9. | Supply of milch animals | | |
| 10. | Credit facility from bank | | |

**II. Composition of herd**

| | **Murrah Buffaloes** | **Graded murrah** | **Local Buffaloes** | **Crossbreds cows** | **Local cows** |
|---|---|---|---|---|---|
| In milk | | | | | |
| Dry pregnant | | | | | |
| Dry non pregnant | | | | | |
| Heifers | | | | | |
| Female calves | | | | | |
| Male calves | | | | | |
| Bulls | | | | | |
| Bullocks | | | | | |

**III. ECONOMIC CHARACTERS OF BUFFALOES:**

| S.No. | Breed | Age at first calving (months) | Service period (days) | Calving interval (days) | Peak yield (liters) | Lactation milk yield ( litres) | Lactation period (days) | Dry period (days) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**IV. BUFFALO PRODUCTION AND MANAGENT PRACTICES**

**A. Breeding management practices**

1. Heat detection by: Estrous symptoms/ Bulls

2. Time of breeding of buffaloes: Early to mid heat/ AM-PM method

3. Method of breeding: Natural service/ Artificial insemination

4. Service after calving: 3-5 months/ After 5 months

5. Pregnancy diagnosis: Adopted/ Not adopted

6. Season of calving: Rainy/ Winter/ Summer

7. Treatment of anoestrous/repeaters: Adopted/ Not adopted

**B. Feeding management practices**

1. Green fodder production: Practiced/ Not practiced

If practiced extent of area (acre):

2. Chaffing of fodder: Practiced/ Not practiced

3. Feeding dry fodder: Paddy straw/ Others

4. Method of feeding green/dry fodder: Group/ Individual

5. Hay making: Practiced/ Not practiced

6. Silage making: Practiced/ Not practiced

7. Urea treatment of paddy straw: Practiced/ Not practiced

8. Grazing of buffaloes: Practiced/ Not practiced

9. Concentrate mixture: Homemade/ Purchased

10. Type of feeding concentrate mixture: Mash/ Soaked/ Boiled

11. Supplementation of mineral mixture to the feed: Practiced/ Not practiced

12. Supplementation of common salt in the feed: Practiced/ Not practiced

13. Time of concentrate feeding: Before milking/ At milking time

14. Extra concentrate feeding during advanced pregnancy: Practiced/ Not practiced

15. Extra concentrate during early lactation: Practiced/ Not practiced

16. Source of drinking water: Tube well/ Canal/ Tank

**C. Housing management practices**

1. Location of buffalo shed: Nearer to farmer dwelling/ Far away from farmer dwelling

2. Housing system: Loose/ Conventional

3. Floor: Kutch/ Pucca

4. Roof: Thatched/ Asbestos

5. Manger: Kutch/ Pucca

6. Water trough: Kutch/ Pucca

7. Drainage: Kutch/ Pucca

8. Location of Manure pit: Beside the shed/ Far away from animal shed

9. Calf Shed: Nearer by mother/ Separate calf shed

10. Cooling devices like fan: Practiced/ Not practiced

11. Wallowing of buffaloes: Practiced/ Not practiced

**D. Calf rearing practices**

1. Cutting of navel cord: Practiced/ Not practiced

2. Application of tincture iodine to navel: Practiced/ Not practiced

3. Colostrum Feeding to new born calf within one hour: Practiced/ Not practiced

4. Feeding of milk to calves per day: 1-2 lit/ One quarter

5. Weaning of calves: Practiced/ Not practiced

6. Feeding of calf starter: Practiced/ Not practiced

7. Regular deworming of calves: Practiced/ Not practiced

8. HS vaccination of calves: Practiced/ Not practiced

9. FMD vaccination of calves: Practiced/ Not practiced

**E. Milking management practices**

1**.** Method of milking: Hand/ Machine

2. Method of hand milking: Full hand/ Knuckling/ Stripping

3. Frequency of milking: Twice/ Thrice

4. Labour for Milking of animal: Family labour/ Hired labour

5. Oxytocin injection for letdown of milk: Practiced/ Not practiced

6. Washing of animals before milking: Practiced/ Not practiced

7. Washing of udder, utensils with water: Practiced/ Not practiced

8. Strip cup test: Practiced/ Not practiced

9. Dipping of teats in povidine iodine after milking: Practiced/ Not practiced

10. Dry cow therapy: Practiced/ Not practiced

11. Marketing of milk: Consumer/ Middle man/ Cooperative dairy/ Private dairy

**F. Health care practices**

1. Vaccination for FMD&HS: Practiced/ Not practiced

2. Deworming of adults buffaloes: Practiced/ Not practiced

3. Control of ecto parasites: Practiced/ Not practiced

4. Isolation of sick animals: Practiced/ Not practiced

5. Treatment of sick animals: Veterinarian/ Para veterinarian/ Others

6. Veterinary facilities: Good/ Satisfactory/ Un satisfactory

**V. Constraints perceived by buffalo milk producers**

| S.No. | Constraint | Agree |
|---|---|---|
| 1. | High cost of pure bred buffaloes | |
| 2. | High incidence of anestrous | |
| 3. | High incidence of repeat breeding | |
| 4. | Low conception rate with AI | |
| 5. | High incidence of prolapse of uterus | |
| 6. | Inadequate supply of concentrate mixture/mineral mixture on subsidized cost | |
| 7. | High cost of feed ingredients | |
| 8. | Feed and fodder shortage | |
| 9. | Non availability of fodder seeds/ slips | |
| 10. | Non remunerative price for milk | |
| 11. | Inadequate supply of medicines | |
| 12. | Distant location of veterinary hospital | |
| 13. | Lack of extension activities | |
| 14. | Lack of financial assistance for purchase of high milk producing buffaloes and equipment like chaffer cutter | |
| 15. | High cost of hired labour | |
| 16. | Problem of favouritism in providing inputs and loans to the milk producers | |
| 17. | Lack of adequate knowledge about scientific management of buffaloes | |

**B. Constraints perceived by field veterinarians in buffalo production practices in Krishna district**

**Name & Designation:**

| S.No. | CONSTRAINT | Agree | Partially agree | Disagree |
|---|---|---|---|---|
| 1. | Problem of anestrous or silent heat in buffaloes | | | |
| 2. | Problem of repeat breeding | | | |
| 3. | Problem of mastitis | | | |
| 4. | Problem of calf mortality | | | |
| 5. | Problem of prolapse of uterus | | | |
| 6. | Problem of low conception rates | | | |
| 7. | Animals are not brought in right time for AI | | | |
| 8. | Presence of some bulls in villages which are often used for natural service | | | |
| 9. | Larger area to be covered for AI and treatment of livestock | | | |
| 10. | Lack of maintenance of proper records by farmers | | | |
| 11. | Lack of subsidy on animal feeds | | | |
| 12. | Inadequate facilities for diagnostic purpose and specialized treatment | | | |
| 13. | Lack of sufficient knowledge to the farmers about the scientific feeding and management of buffaloes | | | |
| 14. | Sale of buffaloes for slaughter | | | |
| 15. | Any other problems | | | |

Suggestions for improvement of Buffalo production in Krishna district:

1.
2.
3.