# IMPACT OF DAIRY COOPERATIVES ON THE INCOME OF RURAL HOUSEHOLDS IN ANDHRA PRADESH

THESIS SUBMITTED TO THE
ICAR-NATIONAL DAIRY RESEARCH INSTITUTE
(DEEMED UNIVERSITY)
IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE OF

**MASTER OF SCIENCE**

**IN**

**AGRICULTURAL ECONOMICS**

**BY**

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**DIVISION OF DAIRY ECONOMICS, STATISTICS & MANAGEMENT**
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**KARNAL – 132001 (HARYANA) INDIA**

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This is to certify that the thesis entitled "**IMPACT OF DAIRY COOPERATIVES ON THE INCOME OF RURAL HOUSEHOLDS IN ANDHRA PRADESH**" submitted by **Ms. PATIBANDLA LAKSHMIPRIYA** towards the partial fulfilment of the award of the degree of **MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS** of the **ICAR-NATIONAL DAIRY RESEARCH INSTITUTE (DEEMED UNIVERSITY)**, Karnal, Haryana, India, is a bonafide research work carried out by her under my supervision and no part of the thesis has been submitted for any other degree or diploma.

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**Dated:** 16/07/18

*Dedicated*
*To My*
*Beloved Family*
*(PKS),*
*Respected Guide &*
*My Inspiration-*
*Rakul Preet Singh*

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**Date :** **Patibandla LakshmiPriya**
**Place : Karnal**

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# ABBREVIATIONS

| | |
|---|---|
| GDP | Gross Domestic Product |
| NDDB | National Dairy Development Board |
| AHD&F | Animal Husbandry Dairying and Fishery |
| MPCS | Milk Producer's Cooperative Societies |
| APDDCF | Andhra Pradesh Dairy Development Cooperative Federation |
| OMM&PG | Online Milk Monitoring and Payment Gateway |
| APCRDA | Andhra Pradesh Capital Region Development Authority |
| BMCU | Bulk Milk Cooling Units |
| MPIs | Milk Producer Institutions |
| DCS | Dairy Co-operative Societies |
| SAU | Standard Animal Units |
| BRGF | Backward Regions Grant Fund Programme |
| CRC | Capital Recovery Cost |
| IMR | Inverse Mills Ratio |
| WTO | World Trade Organization |
| AI | Artificial Insemination |
| SNF | Solids Not Fat |
| LLPD | Lakh Litres Per Day |

# ABSTRACT

In India, cooperatives are used as a potential tool for all round development of human society, especially of its rural sector. The institutional mechanism of dairy cooperatives are used as a potential tool in increasing the milk production, improving the nutritional standards of the people, generating employment opportunities, improving income levels as well as reducing income inequalities in rural areas, especially for landless labourers, small and marginal farmers. The present investigation was carried out to study the **impact of dairy cooperatives on the income of rural households in Andhra Pradesh.** The study is based on primary data collected from 80 members and 80 non-members. The data was analysed using statistical and econometric techniques like tabular analysis, binary logit regression and ordinary least square regression equations.

The average maintenance cost per day for local cow was found to be more for members (₹ 208.38) in comparison to non-members (₹ 200.10). The per litre cost of milk production for local cow in case of members (₹ 31.71) was lower than that of non-members (₹ 33.43). The net return per litre from local cow was more for member (₹ 1.26) than non-member (₹ 0.33). The average maintenance cost per day for crossbred cow was found to be more for members (₹ 262.85) in comparison to non-members (₹ 251.61). The per litre cost of milk production for crossbred cow in case of members (₹ 23.10) was lower than that of non-members (₹ 24.97). The net return per litre from crossbred cow was more for member (₹ 3.54) than non-member (₹ 2.35). The average maintenance cost per day for buffalo was found to be more for members (₹ 302.97) in comparison to non-members (₹ 283.96). The per litre cost of milk production for buffalo in case of members (₹ 31.56) was lower than that of non-members (₹ 33.54). The net return per litre from buffalo was more for members (₹ 4.61) than non-members (₹ 3.28).

The regression coefficients of green fodder, concentrate and labour had positive and significant influence on returns from buffalo milk in both the member and non-member groups. The regression coefficients of green fodder and concentrate had positive and significant influence on returns from crossbred cow milk in member and non-member groups. The regression coefficients of green fodder and dry fodder had positive and significant influence on returns from local cow milk in member and non-member groups.

The average quantity of marketed surplus of milk per day per household was higher in the member group (40.64 litres) as compared to the non-member group (22.93 litres). The per cent marketed surplus of milk to total production was higher in the member group (96.42 per cent) as compared to the non-member group (91.75 per cent).

Total quantity of milk disposed per day was more for members (40.64 litres) as compared to non-members (22.93 litres). In case of member group dairy farmers, about 95.21 per cent of the milk is disposed off to dairy cooperatives and around 4.78 per cent to unorganized sectors where as in case of non-member group, around 80.50 per cent of the milk is disposed off to dairy cooperatives, 12.88 per cent to private dairy and around 6.63 per cent to unorganized sectors.

The important determinants of membership in dairy cooperatives were procurement prices, location of milk collection centres and social participation. The young farmers and those who are socially more active preferred to participate in cooperatives. The cooperatives have significant impact on the productivity of milch animals in the study region as they are providing proper veterinary services to its members. The net income from milk production was higher for dairy cooperative members due to higher procurement prices paid by the dairy cooperatives. The study clearly indicated positive impact of dairy cooperatives on the income of rural households in Andhra Pradesh. Thus, efforts should be taken to bring greater number of milk producers in the cooperative network by making them aware about the benefits of the cooperative programme.

## सार

भारत में, सहकारी समितियों का उपयोग मानव समाज के विशेष विकास के लिए विशेष रूप से इसके ग्रामीण क्षेत्र के संभावित उपकरण के रूप में किया जाता है। डेयरी सहकारी समितियों के संस्थागत तंत्र का उपयोग दूध उत्पादन में वृद्धि, लोगों के पोषण मानकों में सुधार, रोजगार के अवसर पैदा करने, आय के स्तर में सुधार के साथ-साथ ग्रामीण क्षेत्रों में आय असमानताओं को कम करने, विशेष रूप से भूमिहीन मजदूरों के लिए, छोटे और सीमांत किसान आंध्र प्रदेश के ग्रामीण परिवारों की आय पर डेयरी सहकारी समितियों के प्रभाव का अध्ययन करने के लिए वर्तमान जांच की गई। यह अध्ययन 80 सदस्यों और 80 गैर-सदस्यों से एकत्रित प्राथमिक डेटा पर आधारित है। आंकड़ों का विश्लेषण सांख्यिकीय और अर्थशास्त्रीय तकनीकों जैसे टैब्यूलर विश्लेषण, बाइनरी लॉगिट रिग्रेशन और सामान्य कम से कम वर्ग प्रतिगमन समीकरणों का उपयोग करके किया गया था।

गैर-सदस्यों ( 200.10) की तुलना में स्थानीय गाय के लिए प्रति दिन औसत रखरखाव लागत सदस्यों ( 208.38) के लिए अधिक पाया गया था। सदस्यों ( 31.71) के मामले में स्थानीय गाय के लिए दूध उत्पादन की प्रति लीटर लागत गैर-सदस्यों ( 33.43) की तुलना में कम थी। स्थानीय गाय से लीटर प्रति शुद्ध रिटर्न गैर-सदस्य ( 0.33) की तुलना में सदस्य ( 1.26) के लिए अधिक था। गैर-सदस्यों ( 251.61) की तुलना में क्रॉसब्रेड गाय के लिए प्रति दिन औसत रखरखाव लागत सदस्यों ( 262.85) के लिए अधिक पाया गया था। सदस्यों ( 23.10) के मामले में क्रॉसब्रेड गाय के लिए दूध उत्पादन की प्रति लीटर लागत गैर-सदस्यों ( 24.9 7) की तुलना में कम थी। क्रॉसब्रेड गाय से लीटर प्रति शुद्ध रिटर्न गैर-सदस्य ( 2.35) की तुलना में सदस्य ( 3.54) के लिए अधिक था। गैर-सदस्यों ( 283.9 6) की तुलना में भैंस के लिए प्रति दिन औसत रखरखाव लागत सदस्यों ( 302.9 7) के लिए अधिक पाया गया था। सदस्यों ( 31.56) के मामले में भैंस के लिए दूध उत्पादन की प्रति लीटर लागत गैर-सदस्यों ( 33.54) की तुलना में कम थी। गैर-सदस्य ( 3.28) की तुलना में भैंस से प्रति लिटर शुद्ध रिटर्न सदस्य ( 4.61) के लिए अधिक था।

ग्रीन चारा, ध्यान और श्रम के प्रतिगमन गुणांक दोनों सदस्य और गैर-सदस्य समूहों में भैंस दूध से रिटर्न पर सकारात्मक और महत्वपूर्ण प्रभाव डालते थे। ग्रीन चारा और ध्यान के प्रतिगमन गुणांक में सदस्य और गैर-सदस्य समूहों में क्रॉसब्रेड गाय दूध से रिटर्न पर सकारात्मक और महत्वपूर्ण प्रभाव पड़ा। ग्रीन चारा और सूखे चारा के प्रतिगमन गुणांक में सदस्य और गैर-सदस्य समूहों में स्थानीय गाय दूध से रिटर्न पर सकारात्मक और महत्वपूर्ण प्रभाव पड़ा।

गैर-सदस्य समूह (22.93 लीटर) की तुलना में प्रति परिवार प्रति दिन दूध के बाजार में अधिशेष की औसत मात्रा सदस्य समूह (40.64 लीटर) में अधिक थी। गैर-सदस्य समूह (91.75 प्रतिशत) की तुलना में कुल उत्पादन में दूध का प्रतिशत अधिशेष सदस्य समूह (96.42 प्रतिशत) में अधिक था।

गैर-सदस्यों (22.93 लीटर) की तुलना में सदस्यों के लिए प्रतिदिन निपटाया गया कुल दूध (40.64 लीटर) अधिक था। सदस्य समूह डेयरी किसानों के मामले में, दूध डेयरी सहकारी समितियों को लगभग 95.21% और लगभग 4.78% असंगठित क्षेत्रों जहां गैर-सदस्य समूह के मामले में, दूध को डेयरी सहकारी समितियों को 80.50%, निजी डेयरी में 12.88% और असंगठित क्षेत्रों में लगभग 6.63% तक का निपटारा किया जाता है।

डेयरी सहकारी समितियों में सदस्यता के महत्वपूर्ण निर्धारक खरीद मूल्य, दूध संग्रह केंद्रों और सामाजिक भागीदारी का स्थान थे। युवा किसान और सामाजिक रूप से अधिक सक्रिय हैं जो सहकारी समितियों में भाग लेने के लिए पसंद करते हैं। सहकारी समितियों का अध्ययन क्षेत्र में दुग्ध पशुओं की उत्पादकता पर महत्वपूर्ण प्रभाव पड़ता है क्योंकि वे अपने सदस्यों को उचित पशु चिकित्सा सेवाएं प्रदान कर रहे हैं। डेयरी सहकारी समितियों द्वारा भुगतान की गई उच्च खरीद कीमतों के कारण दुग्ध सहकारी सदस्यों के लिए दूध उत्पादन से शुद्ध आय अधिक थी। अध्ययन ने आंध्र प्रदेश में ग्रामीण परिवारों की आय पर डेयरी सहकारी समितियों के सकारात्मक प्रभाव को स्पष्ट रूप से इंगित किया। इस प्रकार, सहकारी कार्यक्रम के लाभों के बारे में जागरूक करके सहकारी नेटवर्क में अधिक संख्या में दूध उत्पादकों को लाने के लिए प्रयास किए जाने चाहिए।

# CHAPTER - 1

# INTRODUCTION

# 1. INTRODUCTION

India is the largest producer of milk among the world's milk producing nations with an annual output of 155.49 million tonnes, contributing 18.5 per cent in the global milk production (NDDB, 2017). The per capita availability of milk in India is around 337 grams per day and has increased by 4.7 per cent over the previous year (AHDF, 2015-16). About 70 per cent of the milk is produced by small, marginal and landless farmers keeping up to three adult dairy animals. The importance of dairying in India hardly needs emphasizing. India has vast resources of livestock, which play an important role in the national economy and also in the socio-economic development of millions of rural households. India has one of the largest stocks of cattle and buffaloes: about 14 per cent of the world's cattle and 57 per cent of world's buffaloes (Livestock Census, 2017). Of total world cow milk production, India contributes 7.2 per cent, while its contribution to total buffalo milk production of world is 65.8 per cent. Livestock contributes around 4.11 per cent to the national GDP and around 25.6 per cent to the Agriculture GDP of India (GoI, 2015).

Indian dairymen are aware of the potentialities of scientific management of dairy animals in raising their standard of living. The success of dairy development programme has given them a way that dairying can be as profitable as any other vocation. The Operation Flood Programme is an integrated programme of production, processing and marketing of milk and milk products which is being implemented in the country since July, 1970. The overall aim of this programme is to improve the dairy farmer's income and productivity of animals and make availability of milk and milk products at reasonable prices to the urban consumers.

The co-operative movement started in India in the last decade of the 19$^{th}$ Century with two objectives i.e. (i) to protect the farmers from the hands of the private moneylenders and (ii) to improve their economic condition. The first Dairy co-operative was established at Allahabad (U.P.) in 1913. Later the dairy co-operative got momentum and spread subsequently in different parts of India. The large scale and systematic break-through in dairy cooperatives could be noticed since 1946, when Kaira District Co-operative Milk Producers Union Limited, popularly known as 'Amul Dairy' was set up in Anand in Gujarat State. The co-operative venture has been quite encouraging and successful in enabling the modern dairy industry to initiate the desired changes in quality, production and consumption of dairy products. The success story of Anand Cooperative Dairy has placed an example to bring up this throughout the country by planned efforts.

Dairy development in India was increasing tremendously with setting up of dairy plants throughout the country, establishment of dairy cooperatives, rural milk procurement, milk processing units, farmers membership, etc. Dairy development programmes in India have played major role in increasing milk production, improving the nutritional standards of the people, generating employment opportunities, improving level of income in rural areas especially for small and marginal farmers.

Milk being a perishable commodity, cannot be marketed individually. Due to this inconvenience, milk producer's cooperative societies have emerged as most viable institutions for milk procurement in rural areas. In India, about 198 dairy cooperative milk unions have covered 5.83 million farmers under 1,70,992 village level dairy cooperative societies up to march, 2016. The daily procurement of milk by dairy cooperative milk unions has reached 42.55 million kgs per day and the sale of liquid milk by them was 32 million litres per day in 2015-16 (GoI, 2016). The department of Animal Husbandry, Dairying and Fisheries for the first time organized "National milk day" on 26$^{th}$ Nov, 2016 to emphasise on promotion of dairy activities including non-operation flood areas by building up of cooperatives, restructuring of sick dairy cooperative milk unions and creation of infrastructure in the states for production of quality milk and milk products.

## DAIRY DEVELOPMENT IN ANDHRA PRADESH

Andhra Pradesh is predominately an agricultural state with an excellent potential for milk production. Andhra Pradesh stands 2$^{nd}$ in the buffalo population with 64.64 lakhs in 2015-16 and 8$^{th}$ in the cattle holdings of about 47.42 lakhs (GoAP, 2017). The state ranked 5$^{th}$ in the milk production with 108.17 lakh metric tonnes. The per capita availability of milk was 475 grams per day during 2015-16 (Annual Report, 2015-16).

In India, cooperative movement has spread in various states. In Andhra Pradesh, initially a pilot milk supply scheme was started in 1960 in Hyderabad, as a prelude to the implementation of the integrated milk project in 1964. During the same year UNICEF's (United Nations International Children's Emergency Fund) aid of ₹ one crore was utilized for starting two milk powder factories, one at Vijayawada and the other, Central Dairy, at Hyderabad. With the two projects, the dairy development in the state took a new turn. In 1967 installation of the chilling centres in Krishna District was also taken up and the work relating to the co-operative dairies at Nellore, Chittoor, Warangal and Kurnool was completed. Meanwhile, setting up of chilling and cooling centres at Warangal, Khammam and Nizamabad expanded the milk procurement network of the Hyderabad Central Dairy. Milk producers' co- operative societies were organized for this purpose in the villages covered by the milk routes.

Under Operation Flood-II, the state government established a separate dairy development department i.e. Andhra Pradesh Dairy Development Cooperative Federation (APDDCF) as a part of the state Ministry of Food and Agriculture which came into existence on April 2, 1974 as the apex body to cover larger areas in the state having 3 tier Anand pattern cooperative structure. The main objective of APDDCF is to develop dairy value chain with primary focus on milk procurement by organized sector and it is nodal agency for implementing dairy development scheme on behalf of Government and is involved in formulating dairy development policies. The APDDCF is manufacturing milk products such as whole milk powder, baby food and cheese butter. It has brought a silent economic revolution in the rural areas, creating a new hope for eliminating poverty and unemployment in rural areas. To bring the white revolution in the state which is an

integral part of the rural development, this corporation has concentrated more on modem technical inputs like, quality of crossbreed cattle, better quality of feed, etc., in order to increase the production of milk. APDDCF is providing milk marketing support to dairy farmers through 12 district milk unions which procure 37.24 crore litres of milk per annum through a network of 456 milk routes, 9154 milk collection centres covering 10,249 villages. Society for Elimination of Rural Poverty (SERP), in convergence with APDDCF has taken forward the activity to 158 mandals in the State covering 2806 villages and 1,38,910 milk producers. So far APDDCF created employment for 1,38,910 rural poor. APDDCF is marketing milk and milk products under the brand name of VIJAYA with a brand value of ₹ 1500 Cr. Now. It is also providing online milk monitoring and payment gateway (OMM&PG) milkosoft aiming timely payment of proper price to farmers directly through their bank accounts.

At present there are 7,000 primary Co-operatives including 300 Women Cooperatives with a membership of over 8 lakh people across the state. All primary cooperative societies in each district come under district cooperative federation.

**District Cooperative Federations**

The following are the existing district dairy development cooperative federations in Andhra Pradesh.

1. Kurnool District Dairy Development Cooperative Federation.
2. Nalgonda District Dairy Development Cooperative Federation.
3. Ongole District Dairy Development Cooperative Federation.
4. Vizag District Dairy Development Cooperative Federation.
5. Hyderabad District Dairy Development Cooperative Federation.
6. Chittoor District Dairy Development Cooperative Federation.
7. Nellore District Dairy Development Cooperative Federation.
8. Guntur District Dairy Development Cooperative Federation.
9. Krishna District Dairy Development Cooperative Federation.

## STATEMENT OF THE PROBLEM

Majority of the dairy farmers fail to make better use of their scarce resources and over or under utilization of the inputs which causes low productivity, production, consumption and marketed surplus and increase in cost of milk production. Marketed surplus of milk has to be increased in order to meet the demand as well as minimum nutritional requirements of milk. High yielding milch animals maintained by milk producers generally need better health care and management which may lead to increased human labour and higher income to rural households. But with the provision of necessary technical inputs and services under dairy cooperatives, the households will get encouraged to make optimum use of their scarce resources and thereby reducing the cost of milk production, increasing productivity of milch animals and increasing the returns. The success of dairy cooperatives in a particular area largely depends upon the level of milk production, procurement and marketed surplus. Therefore, assessment of economic

impact of dairy cooperatives is needed in order to know whether the investment on the cooperatives is contributing significantly for the development of the economy of rural households as a whole or not. The study will provide useful and relevant information to policy makers, planners, administrators and dairy farmers who can make rationale decisions for the benefit of cooperative member farmers.

Keeping in view the above facts, the present investigation entitled **"Impact of dairy cooperatives on the income of rural households in Andhra Pradesh"** was undertaken with the following specific objectives:

1. To analyze the economics of milk production among the member and non-member groups.
2. To determine the disposal pattern and marketed surplus of milk in the study region.
3. To assess the impact of dairy cooperatives on farmer's income in the study area.

## LIMITATIONS OF THE STUDY

- No farm records were maintained by dairy farmers, the data was collected by survey method based on respondent's honesty, memory, and involvement. Hence there is a possibility of not getting accurate data.
- Data regarding the hours of work done for various activities in dairying is not exact. The respondents are reluctant to disclose their income either it is exaggerated or lowered by them during data collection.
- Owing to time and resource constraints, the study has been limited to Guntur and Chittoor districts of Andhra Pradesh with a sample size of 80 members and 80 non-members.

## ORGANIZATION OF THE THESIS

The thesis has been organized into six chapters for expositional convenience. Chapter-I deals with the "*introduction" in which* focus of the problem to be investigated, objectives of the present study and limitations of the study. Chapter-II entitled "*Review of Literature*'' pertaining to the objectives of the study. Chapter-III entitled "*Profile of the study area*" gives a broader understanding of the study area about its general and agricultural characteristics. Chapter-IV on "*Methodology*" delineates the sampling plan, method of data collection and analytical tools used for the study. Chapter-V envelops the presentation of "*Results and discussion*" of the study. The chapter-VI is on "*Summary and conclusions*'' that provides a concise picture of different findings of the present study and brings out the major area of concern and policy implications for various stakeholders. At the end "*Reference*" and "*Appendices*" are given for information.

# CHAPTER - 2

# REVIEW OF LITERATURE

# 2. REVIEW OF LITERATURE

Review of literature helps in identification of the research problem and provides basic information about the empirical perspective of the research. It has a great importance in formulation of hypothesis, selection of research design, plan of research and also regarding reporting of the finding of the current study and relating it to the findings from the earlier studies. Review of literature is indispensable part of a research study which helps the researcher to set particular objectives with respect to the problems selected and to follow the appropriate methodology to achieve the defined objectives.

Keeping the objectives in view and the nature of the current study, care has been taken to select only the relevant and the latest studies available in published and unpublished literature. For the present study, the review have been divided on the following topics and presented in chronological order :

2.1 Cost and returns of milk production

2.2 Disposal pattern and marketed surplus of milk

2.3 Impact of dairy cooperatives on the farmer's income

## 2.1 COST AND RETURNS OF MILK PRODUCTION

Milk production is influenced by many factors. Feed and labour are the two principal inputs responsible for milk production. In this section, an attempt has been made to review the research work conducted in the past on different aspects of cost and returns of milk production. Some of the prominent studies are discussed below:

**Rao (1991)** studied the impact of operation flood programme on the economics of milk production in Guntur district of Andhra Pradesh and found that overall milk production for beneficiary and non-beneficiary households were 4.20 and 2.01 litres, respectively. Highest milk production was recorded in the winter season for beneficiary and in summer season for non-beneficiary households.

**Shiyani and Singh (1995)** conducted a study on economics of milk production for the member and non-member milk producers in the Saurashtra region of Gujarat and observed that the net cost of maintaining a buffalo were respectively ₹ 36.30, ₹ 40.15, ₹ 24.35 per day in rainy, winter and summer seasons in the case of the member respondents as against ₹ 32.49, ₹ 37.97 and ₹ 26.10 per day for the non-member respondents. The corresponding figures for the milch cow were ₹ 17.52, ₹ 19.27and ₹ 16.93 in the case of the member respondents as against ₹ 16.13, ₹ 20.14 and ₹ 16.46 per day in the case of non-member respondents. The season wise analysis indicated that the highest cost of milk production per day was found in winter season both in the case of members and non-members. The main reasons for the higher cost during winter season were better feeding and management practices adopted by the milk producers to obtain more milk yield.

Further, it was observed that feeds and fodder constituted about 70 per cent of the total maintenance cost of a milch buffalo and nearly two-thirds of the total cost of cow milk production. On an average, per litre cost of buffalo milk production was ₹ 5.56 and ₹ 6.47 for members and non-members, respectively. Corresponding figures for milch cows were ₹ 4.12 and ₹ 4.63.

**Shukla *et al. (1995)*** studied the impact of Operation Flood Programme on the economy of rural milk producers in Kanpur district – Dehat (UP) and found that the investment pattern in dairy enterprise revealed that the average investment per household was ₹ 17,648 in the programme area as compared to ₹ 11,374 in the non-programme area. The higher investment could be mainly due to the higher value associated with the superior quality of animals maintained by the households in the programme area. The overall average cost per milch animal and per household per annum was found to be ₹ 7,588 and ₹ 18,286, respectively in the programme area as compared to ₹ 6,854 and ₹ 11,584 in the non-programme area. The average cost of milk production per litre was found to be ₹ 3.59 and ₹ 3.67 in programme and non-programme areas, respectively.

**Rao and Singh (1995a)** conducted a study on impact of operation flood programme on the economics of the buffalo milk production in Guntur district of Andhra Pradesh and found that variable cost formed about 84 per cent of total cost in the beneficiary and 80 per cent in non-beneficiary households. The gross cost of milk production was ₹ 2,982.05, ₹ 3,274.05, ₹ 2,744.80, ₹ 2,682.75 per annum for landless, small, medium and large categories in the case of the beneficiary households as against ₹ 2,544.05, ₹ 2,252.05, ₹ 2,113.35 and ₹ 2,314.10 per annum for landless, small, medium and large categories for the non-member households. The beneficiary households spent higher amount of expenses as compared to non-beneficiary households. This may be due to increased awareness among the beneficiaries about the importance of feeds and fodders and better management of animals, besides assured market for their milk. The average cost of milk production was ₹ 2.80 per litre on the beneficiary households as compared to ₹ 3.75 per litre on the non-beneficiary households. Therefore, it was concluded that operation flood programme had a positive impact on the economics of buffalo milk production in the study area.

**Kumar and Sharma (1999)** studied the impact of dairy cooperatives on the rural economy in Nalanda district of Bihar and observed that higher milk productivity of milch animals on beneficiary households was observed for individual category of households. Average annual income in terms of gross income, net income and returns to fixed cost was found to be much higher in the beneficiary household as compared to non-beneficiary households. It was noted that dairy enterprise provided an employment of about 217.05 and 209.87 man-days per year for beneficiary and non-beneficiary households, respectively. Male, female and children accounted for about 59, 31 and 9 per cent of total family labour use per household, respectively on beneficiary households. However in case of non-beneficiary households, corresponding figures were 55, 34 and 11 per cent. It was further observed that male labour utilization was higher in beneficiary

households as compared to non-beneficiary households whereas, the reverse trend was observed in case of female and child labour.

**Arun Kumar (2003)** conducted a study on economics of milk production in Vellore district of Tamil Nadu and observed that share of fixed and variable cost in the gross cost was 90 per cent and 10 per cent, respectively. The net cost per day per animal was highest for buffalo (₹ 66.68) followed by crossbred cow (₹ 60.06) and local cow (₹ 40.82). Feed cost was the main item of gross cost which accounted for about 81.06, 67.90 and 84.61 per cent for crossbred cows, local cows and buffaloes, respectively. The study reported that the per litre cost of milk production, in general, was lowest for crossbred cows (₹ 7.70) as compared to buffaloes (₹ 12.05) and local cows (₹ 9.99).

**Hymajyothi *et al.* (2003)** examined economics of buffalo milk production in West Godavari district of Andhra Pradesh and found that per day per animal maintenance cost of buffalo were ₹ 28.01, ₹ 38.60 and ₹ 48.00 in small, medium and large categories of milk producers, respectively. The maintenance cost increased with increase in the size of herd. Expenditure on fodder and concentrates formed the major share in the total cost of milk production among all categories of milk producers. The average per litre cost of buffalo milk production was ₹ 7.95, ₹ 7.92 and ₹ 7.86 for small, medium large herd size milk producers, respectively.

**Rishikanta Singh (2006)** conducted a study on Economics of milk production and marketed surplus in Imphal west district of Manipur and observed that the maintenance cost per day per milch local cow and per milch crossbred cow were ₹ 22.89 and ₹ 72.95 respectively. Net returns from local cow and crossbred cow were ₹ 4.27 per day and ₹ 48.70 per day. Expenditure on green fodder and concentrate were found positive and significant for crossbred cows only but green fodder was found to be underutilized.

**Sirohi *et al.* (2007)** conducted a study on economics of milk production in Karnal district of Haryana and reported that the average net maintenance cost per day per milch animal were ₹ 48.67 and ₹ 65.33 for buffaloes and crossbred cows, respectively. The per litre cost of milk production were observed as ₹ 10.68 and ₹ 7.90 in buffaloes and crossbred cows, respectively.

**Meena (2008)** studied the impact of dairy cooperatives on the economy of rural households in Alwar district of Rajasthan and found that overall average Gross income and net income per day in case of cow milk production were higher at ₹ 45.20 and ₹ 5.37 for member households as compared to ₹ 39.66 and ₹ 1.82 for non-member households.

**Singh (2012)** studied the impact of Integrated Dairy Development Project in rural households in Meghalaya state and found that the per day average net maintenance cost of milch crossbred cow was slightly lower in member groups (₹ 21.84) as compared to non-members (₹ 123.62). The overall cost per litre of milk production was highest for non-members (₹ 20.20) as compared to members (₹ 17.51). The overall average gross return, net return and return per litre of milk production was higher for members as compared to non-members.

**Tanwar *et al.* (2012)** conducted a study to estimate the economics of milk production among different categories of members and non-members of dairy cooperatives. The study revealed that overall gross maintenance cost per animal per year was higher (₹ 21,532.81) for members in comparison to non-members (₹ 19,768.30). The share of variable and fixed cost in total maintenance cost was 82.36 per cent and 17.64 per cent in members families and almost same in case of non-members families i.e, 82.9 per cent and 17.05 per cent. The overall cost per litre of milk was lower (₹ 10.47) in members families than non-members families (₹ 11.29). Overall net return per animal per year was higher for members than the non-members.

**DESM (2015)** standardized the methodology for estimation of cost of milk production through consultation and participatory approach involving economists, statisticians, animal scientists, stakeholders from central and state departments of animal husbandry, dairy cooperatives, etc. The key elements of methodology standardization were developing regional standard animal units, application of capital recovery cost method for assessing the cost of durable assets, developing methodology for estimation of cost of feed input through grazing, application of scientific approach for estimation of dung output, etc.

**Kumari (2015)** conducted research on the estimation of cost and returns of milk production in Begusarai district in Bihar. The study revealed that the fixed cost accounted for about 16 per cent and variable cost accounted for about 84 per cent of the gross cost in case of both members and non-members. Feed and fodder cost accounted for about 65 per cent of the total variable cost followed by labour cost at 22 per cent. The per cent share of feed cost increased with increase in herd size while labour cost decreased with increase in herd size in case of both members and non-members. It was found that the per litre cost of milk production for crossbred cow in case of members (₹ 20.78) was lower than that of non-members (₹ 24.52). The return per litre in case of members was highest for large farmers (₹ 6.01) and was least for small farmers (₹ 5.93). The per litre cost of milk production for buffalo in case of members (₹ 34.20) was lower than that of non- members (₹ 36.87). The return per litre was more for members (₹ 0.77) than non-members (₹ 0.62).

### 2.1.1 INPUT – OUTPUT RELATIONSHIP

**Shiyani (1993)** studied the input output relationship in milk production in Saurashtra region of Gujarat and observed that the regression coefficient of concentrate in all the seasons were positive and highly significant for both the members and non-members which indicated greater bearing of concentrate on buffalo milk production. The regression coefficient of green fodder was found to be positive and highly significant in winter and summer seasons but was non-significant in rainy season. This may be due to better availability of green fodder during rainy season as compared to other seasons. Negative sign of regression coefficient of dry fodder in winter and rainy seasons implied its over utilization. However, it had a positive and significant impact in summer season. This is because of relatively higher price and less quantum of dry fodder fed during summer season. Similarly, labour had also greater role during summer season. Thus, it was

concluded that the feed, fodder and labour had greater bearing on buffalo milk production. The results of Chow test clearly indicated that two functions for member and non-member households differed significantly in case of buffaloes. He further reported that the regression coefficients of concentrate and labour were found to be positive and significant impact indicating on their milk yield of cows in both the members and non-members. The coefficients of green fodder and dry fodder were found to be positive and significant on member households, while these variables were found to be positive but non-significant on non-member households. Further, the results of Chow test clearly indicated that two functions for member and non-member households differed significantly in case of cows.

**Chand (1997)** studied milk production function in Kurukshetra district (Haryana) using the linear relationship and found that the concentrates and labour had positive impact on milk production, while stage of lactation had a negative impact on milk production for buffalo. The variables concentrate, green fodder and labour had a positive impact on milk yield while stage of lactation had a negative impact on milk yield for crossbred cows. In case of local cows, concentrate and green fodder showed positive impact on milk yield while stage of lactation, a negative impact on milk yield. Further, analysis of data revealed that expenditure on concentrate was the single most significant factor affecting the milk production of all types of milch animals. A critical examination of the MVPs revealed that there is a possibility of increasing returns from milk by increasing the expenditure on concentrate in all types of milch animals.

**Dixit (1999)** investigated the factors affecting the milk production in Mandya district of Karnataka and reported that the value of green fodder and concentrate had a positive and significant impact on milk yield. Labour expenses, value of dry fodder and miscellaneous expenses showed positive but non-significant influence on milk production in case of local cows and buffaloes. Green fodder, labour and concentrate demonstrated their positive and significant impact on milk yield, while dry fodder and miscellaneous expenses demonstrated negative but non-significant influence on milk production in case of crossbred cows.

**Das (2004)** conducted a study on economic efficiency of milk production and marketed surplus in rural areas of Burdwan district in West Bengal and reported that in milk production function, the coefficients of green fodder and dry fodder were positive and significant for all types of milch animals, whereas coefficient of concentrate was found to be positive and significant in case of local cows. The difference between MVP and MFC was statistically significant in case of green fodder and concentrate for buffaloes and crossbred cows, whereas in case of local cows, the differences were not significant for green fodder and concentrates.

**Singh *et al.* (2007)** studied resource use efficiency in milk production and disposal of milk in Imphal West district of Manipur and found that expenditure on concentrate and green fodder had a positive and significant impact on returns from milk for crossbred cows. Hence productivity of crossbred cows could be increased through feeding of green

fodder and concentrates. The coefficients of value of labour and miscellaneous expenditure were found to be positive but not significant. Further, the difference between MVP and MFC was positive and statistically significant for green fodder which indicated that green fodder was underutilized in the study.

**Meena (2008)** studied the impact of dairy cooperatives on the economy of rural households in Alwar district of Rajasthan. The study has analyzed about input-output relationship and found that green fodder, dry fodder, concentrate and labour had positive and significant influence on returns from buffalo milk in both member and non-member groups. The results of Chow test revealed that the production functions of buffalo milk between member and non-member groups differed significantly.

**Ravishankara (2014)** studied the impact of dairy cooperative societies on rural economy in Mandya district of Karnataka. This study analyzed about input-output relationship and found that green fodder, concentrate and labour had a positive and significant impact on milk production for both member and non-member groups. Green fodder and concentrate are found to be over utilized and labour was found to be under-utilized.

Salient notable points after reviewing the literature are:

- Average milk production per household was higher in member group than in non-member group and increases with increase in herd size/ size of land holdings in both the cases.
- The maintenance cost of dairy animals was more and per litre cost of milk production was found to be lower for the dairy cooperative members as compared to non-members. Variable cost was found to be a major cost item followed by fixed cost.
- Multiple regression analysis was used to compare the input use efficiency in cow and buffalo milk production on member and non-member households.
- Concentrate was found to have positive influence on the milk production in all the milch species. Labour and dry fodder showed negative influence on milk production indicating their excessive use.

## 2.2 DISPOSAL PATTERN AND MARKETED SURPLUS OF MILK

**Mattigatti (1990)** attempted to evaluate the impact of operation flood on milk marketing in Dharwad district of Karnataka and observed that all the members of the dairy cooperatives in the study area sold their produce entirely through the dairy cooperatives. The majority of non-members sold through milk vendors and identified three different marketing channels.

**Rao (1991)** studied the impact of operation flood programme on the economics of milk production in Guntur district of Andhra Pradesh and found that average marketed surplus for beneficiary (2.22 ltr) was more than twice than for non-beneficiary households (1.02 ltr).

**Rani *et al.* (1992)** evaluated the impact of milk producer's women cooperative societies on milk production and marketed surplus of milk in the Chittoor milk shed area of Andhra Pradesh. The study revealed that the dairy cooperatives made a positive and significant impact on the levels of milk produced, consumed and marketed. On an average, milk production increased by 106 per cent, milk consumption increased by 8 per cent and marketed surplus of milk was increased by 150 per cent between the two periods of study. Similar trend of increase were observed on all size groups. Moreover, this impact was more pronounced in the case of small producers as compared to medium and large producers.

**Badal (1994)** studied the disposal pattern of milk in Gopalganj district of Bihar and found that daily milk production per household was 7.25 litres, out of which 5.75 litres was sold representing marketed surplus of 79 per cent on the sample households. Both the production and absolute marketed surplus of milk increased with the increase in herd size category. Linear relationship between the marketed surplus of milk and factors influencing it was observed. The milk production was the single most important factor influencing the marketed surplus. It was observed that the family size had a negative influence on marketed surplus of milk while the price of milk had no significant impact on marketed surplus of milk in the study area.

**Chand (1997)** in a study on marketed surplus of milk in Kurukshetra district of Haryana state revealed that the production and marketed surplus of milk in absolute terms was less in summer season, while relative marketed surplus of milk was more in summer season as compared to the rainy and winter seasons. By and large, percentage of marketed surplus was found to be about 56 per cent of the total milk produced which showed an increasing trend across the herd size categories in the study area. Dairy co-operatives and milk vendors procured majority of the marketed surplus. Among the various factors influencing the marketed surplus of milk, production had positive influence and family size had a negative impact. Land holding and education level of head of the household did not show any significant impact on the marketed surplus of milk.

**Tiwari and Arya (2001)** carried out a research on the impact of milk producer's cooperative society in Bareily district of UP. This study revealed that the average milk production by the successful and unsuccessful society members was 7.78 and 3.93 litres per day per household, respectively. Average milk consumption of the successful and unsuccessful society members were 2.32 litres and 1.28 litres per day per household, respectively. The average milk sold by members of successful society was 5.46 litres per day per household whereas, it was 2.65 litres per day per household for the members of unsuccessful society.

**Ashalatha *et al.* (2004)** conducted a study to know the impact of dairy cooperative societies on milk production, consumption and marketed surplus in Krishna district of Andhra Pradesh. The study revealed that the production, consumption and marketed surplus of milk across different herd size categories were significantly different between member and non-member households. There existed a significant difference in the per capita consumption of milk between the member and non-member households.

**Vedamurthy (2004)** conducted study on economic analysis of milk marketing in Shimoga district of Karnataka and reported that around 53.69 per cent of total milk was disposed off to the unorganized sector. Out of this, 28.05 per cent was disposed off to vendors, 14.62 per cent to processing unit, 8.44 per cent to consumers and only 2.58 per cent to tea shops. Around 46.37 per cent of milk was disposed off to dairy cooperatives.

**Rishikanta Singh (2006)** conducted a study on economics of milk production and marketed surplus in Imphal west district of Manipur and analyzed about the marketed surplus of milk and observed that out of total milk produced, marketed surplus accounted for 96 per cent and the rest 4 per cent was consumed at home. The marketed surplus of milk was disposed to either milk vendors (53 per cent) or to the consumers directly (47 per cent).

**Singh (2008)** analyzed the economic analysis of milk production in Varanasi district of Uttar Pradesh. The study revealed that marketed surplus accounted for 54 per cent and the remaining 46 per cent was consumed at home. The marketed surplus of milk was disposed off through milk vendors (64 per cent), shops (33 per cent) and consumers directly (2 per cent).

**Khoveio (2011)** studied economics of milk production, marketed surplus and its disposal pattern in Nagaland. The study found that the overall marketed surplus of milk was estimated to be 12.26 litres which was 85.83 per cent of the total milk produced. The disposal pattern of milk showed that 59.18 per cent of the marketed surplus was disposed directly to local consumers and the remaining 40.82 per cent to MPCS.

Salient notable points after reviewing the literature are:

- Average marketable surplus for beneficiary households was more than twice as compared to non-beneficiary households.
- Milk consumption of beneficiaries was exactly twice than that of non-beneficiary households.
- Majority of the members of the dairy cooperatives disposed off their produce entirely through the dairy cooperatives.
- The majority of non-members sold their produce through milk vendors.

## 2.3 IMPACT OF DAIRY COOPERATIVES ON THE FARMER'S INCOME

**Udawat (1983)** studied the impact of dairy cooperatives on rural economy of milk producers in Ajmer district of Rajasthan and reported that the income shares from crop and livestock were 43.67 and 17.68 per cent, respectively, for participants and 38.56 and 13.58 per cent, respectively, for non-participants. It was also revealed that Co-operatisation of milk marketing generated higher per annum employment (3202.71 man hours) for participants than that of non-participants (3066.29 man hours). The Gini concentration ratio measuring income inequalities for the participants was higher (0.3709) than non-participants (0.3196). This indicated that income of the participants was less evenly distributed than that of non-participants. It was concluded that the process of co-

operatisation has not tended to income equalizer and egalitarian method of removing existing income inequalities.

**Kherde and Subramanian (1986)** conducted a study on 200 milk producers from cooperative villages and 50 milk producers from control villages in Erode district and found that the net income of the milk producers under cooperative villages was higher than their counterparts in non-cooperative villages. The producers of society villages generated more employment per farm per annum than the producers of control villages.

**Alderman (1987)** studied the impact of dairy cooperatives established in Karnataka under operation flood programme. He used the Heckman two stage model and observed that controlled household characteristics like literacy, household size, farm size, etc., showed that average daily milk production per household was about 2.56 liters higher in operational areas. Higher production was due to herd size composition and not due to higher number and productivity of animals.

**Shiyani (1993)** conducted a study on economics of milk production for the member and non-member milk producers in the Saurashtra region of Gujarat**.** The study revealed the positive impact of cooperatives on milk yield of animals. The lactation yield of milch animals belonging to members of dairy cooperatives was 2629 litres while for that of non-members it was 2211 litres. Due to lower cost of milk production and higher prices of milk received by the member households, they made higher net profit per litre of milk (₹ 2.23) than ₹ 0.41 by the non-members.

**Singh and Sharma (2006)** in a study on income generation through dairy enterprise among members and non-members of dairy cooperative societies in southern Rajasthan found that major source of income generation of respondents was dairy enterprise followed by service, crop cultivation and other enterprises. It was found that members of dairy cooperative societies earned ₹ 50,374.65 per year as compared to ₹ 23,751.21 per year on non-members respondents. It showed that that income of member respondents from dairy enterprise was 36 per cent more than that of non-member respondents.

**Sharma *et al.* (2009)** employed a multinomial logit model to investigate the determinants of market channel choice of milk producers in nine districts of four states namely Gujarath, Punjab, Haryana & Uttara Pradesh. The study observed that the farmers supplying milk to cooperatives and private processors have higher income than those selling milk to traditional markets. Education, membership, veterinary services and herd size have significant impact on income of cooperative members.

**Shahnawaz (2013)** conducted a study on performance and impact of dairy cooperatives in Kashmir region and by using Heckman two stage model observed that provision of input services by milk procurement agents had favourable influence on productivity of milch animals. The net income from milk production was positively influenced by the herd size and the procurement prices of milk.

**Binita Kumari (2015)** analysed the impact of membership of women in dairy co-operative societies on their income and employment in Begusarai district of Bihar. The mean monthly net income was found to be significantly more for WDCS members than non-members. The membership dummy was positive and significant in both crossbred cows and buffaloes. Hence, it could be inferred that co-operatives have a positive and significant impact on gross income of women dairy farmers. The impact of season on income was also found to be positive and significant, indicating higher income in winter than summer season.

Salient notable points after reviewing the literature are:

- Extension area/beneficiary/member households recorded higher income as compared to control area / non-beneficiary / non-member households.
- The average human labour utilization per milch animal and per household was observed to be higher in extension area / beneficiary / member households as compared to that of control area / non-beneficiary / non-member households.
- Dairy cooperatives have shown positive impact on employment, productivity of milch animals and income for member group.
- Higher milk production was due to herd size composition and not due to higher number and productivity of animals.
- Heckman-two stage method was used to assess the impact of dairy cooperatives on farmer's income which corrects the self-selection bias in sample.

# CHAPTER - 3

# PROFILE OF THE STUDY AREA

# 3. PROFILE OF THE STUDY AREA

The present study was conducted in Guntur and Chittoor districts of Andhra Pradesh. The overall economic development of any region depends on its physical endowment, human resources and technological progress. Therefore, an objective description of the study area is useful to understand the scope and limitation for its economic development. Information regarding the historical background, geographical location, demographic features, land use pattern, agro-climatic conditions including soil and rainfall, government institutions and infrastructure facilities for dairying and animal husbandry of the study area is presented in this chapter under the following sub headings :

3.1 An overview of Andhra Pradesh state

3.1.1 An overview of Guntur district

3.1.2 An overview of Chittoor district

## 3.1 AN OVERVIEW OF ANDHRA PRADESH

Andhra, the first Indian state formed primarily on a linguistic basis, was carved from the Madras Presidency in 1953. In 1956, Andhra State was merged with the Telugu-speaking portion of Hyderabad state to create the state of Andhra Pradesh. The Lok Sabha approved the formation of Telangana from ten districts of Andhra Pradesh on 18th February 2014.

Andhra Pradesh state is situated on the south eastern India. It is the 8th largest state in India covering an area of 162,970 $km^2$. As per the 2011 Census of India, it is the 10th most populous state with population of 84,665,533, of which male and female population were 42,509,881 and 42,155,652, respectively. The population of Andhra Pradesh forms 7 per cent of India. The largest city in the state is Visakhapatnam. On 2nd June 2014, the north-western portion of Andhra Pradesh was separated to form a new state of Telangana. Andhra Pradesh's long time capital, Hyderabad, was transferred to Telangana as part of the division. However, in accordance with the Andhra Pradesh Reorganisation Act, 2014, Hyderabad will remain the *de jure* capital of both Andhra Pradesh and Telangana states for a period of time not exceeding 10 years. The new riverfront *de facto* capital, Amaravati, is under the jurisdiction of the Andhra Pradesh Capital Region Development Authority (APCRDA). The official language of Andhra Pradesh is Telugu.

## 3.1a Geography

Andhra Pradesh lies between 12°41' and 19.07°N latitude and 77° and 84°40' E longitude. The state is bordered by Telangana, Chhattisgarh, and Orissa in the North, the Bay of Bengal in the East, Tamil Nadu to the South and Karnataka to the West. Among the other states, which are situated on the country's coastal area, Andhra Pradesh has got a

coastline of around 974 km, which gives it the 2nd longest coastline in the nation. Two major rivers, the Godavari and the Krishna run across the state. A small enclave of 30 km², the Yanam district of Puducherry, lies in the Godavari Delta in the north east of the state. The state includes the eastern part of Deccan plateau as well as a considerable part of the Eastern Ghats. Historically the region comprising the state was known as Andhraapatha, Andhradesa, Andhraavani and Andhra vishaya.

## 3.1b Climate and Rainfall

The climate of Andhra Pradesh is generally hot and humid. The summer season generally extends from March to June. During these months the moisture level is quite high. The coastal areas have higher temperatures than the other parts of the state. In summer, the temperature generally ranges between 20 °C to 40 °C. The summer is followed by the monsoon season, which starts during June and continues till September. This is the season for heavy tropical rains in Andhra Pradesh. The major role in determining the climate of the state is played by south-west monsoons. About one third of the total rainfall in Andhra Pradesh is brought by the north-east Monsoons around the month of October. The winters in Andhra Pradesh are pleasant. This is the time when the state attracts most of its tourists. October to February are the winter months in Andhra Pradesh. Since the state has a quite long coastline, the winters are comparatively mild. The range of winter temperatures is generally from 13 °C to 30 °C.

The rainfall in the State is influenced by both south-west and north-east Monsoons. The annual normal rainfall of Andhra Pradesh is 940 mm. About 624 mm (66 per cent) is contributed by south-west monsoon (June to September), and 224 mm (24 per cent) during the north-east monsoon (October to December). An average of 14 mm of rainfall during winter and 78 mm during summer constitute remaining 10 per cent of the total annual rainfall. The region- wise distribution of annual average rainfall is about 1078 mm in Coastal region and 714 mm in Rayalaseema region.

Andhra Pradesh has three important agro-climatic zones: Krishna-Godavari Zone (Zone-I), North Coastal Zone (Zone-II) and Southern Zone (Zone-III). The zone-I, zone-II and zone-III has 6, 3 and 4 districts receiving an annual rainfall of 800-1,100 mm, 1,000 – 1,100mm and 700 – 1,000 mm, respectively.

### 3.1c Soil Type

The State is endowed with a wide variety of soils having less fertile coastal sands to highly fertile and productive deltaic alluviums of major river basins developed from different parent materials. The major soil groups are red and laterite, black, alluvial and coastal soils occupying 66, 25, 5 and 3 per cent of the total area, respectively.

**Table 3.1: Agro-climatic zones of Andhra Pradesh and their characteristics**

| Sl. No. | Zone | District | Rainfall | Temperature | Soil type | Crops grown |
|---|---|---|---|---|---|---|
| 1 | Krishna-Godavari Zone (Zone-I) | East Godavari, West Godavari, Krishna, Guntur & contiguous areas of Khammam, Nalgonda & Prakasam districts | South-west monsoon 800-1,100 mm | Max. 29-42ºC Min. 16-24ºC | Deltaic alluvium, red soils with clay, black cotton soils, red loams, coastal sands and saline soils | Rice, groundnut, sorghum, pearl millet, tobacco, cotton, chilli, sugarcane and horticultural crops |
| 2 | North Coastal Zone (Zone-II) | Srikakulam, Vizianagaram, Vishakhapatnam and uplands of East Godavari district | South-west monsoon 1,000 – 1,100 mm | Max. 29-42ºC Min. 18-27ºC | Red soils with clay base, pockets of acidic soils, laterite soils with pH 4-5. | Rice, groundnut, mesta, jute, sunhemp, seasmum, sorghum, pearl millet, blackgram and horticultural crops |
| 3 | Southern Zone (Zone-III) | Nellore, Chittoor, southern parts of Prakasam and Cuddapah and eastern parts of Anantapur district | South-west monsoon 700 – 1,000 mm | Max. 28-40ºC Min. 13-27ºC | Red loamy soils, shallow to moderately deep. | Rice, groundnut, cotton, sugarcane, millets and horticultural crops |

## 3.1d Cropping Pattern

Andhra Pradesh grown 28 important crops in both the seasons put together has been covered an area of about 62.21 lakh ha., during 2015-16. The important crops grown were Rice (21.43 lakh ha), Maize (2.31 lakh ha), Pulses (4.42 lakh ha), Groundnut (7.75 lakh ha), Cotton (6.67 lakh ha), Chillies (1.56 lakh ha), Tobacco (0.96 lakh ha), Sugarcane (1.22 lakh ha), etc. The important cropping sequences were :

Rice–sunflower, Tomato–onion, Mesta based systems, Rice-rice, Rice-maize, Sunflowe-sunflower, Sorghum-sunflower, Rice-pulse, Maize-groundnut, Maize-soybean, Sorghum-green gram and Turmeric-maize intercropping.

## 3.1e Land Utilization Pattern

The total geographical area of the state is 275.04 lakh hectares. Out of which, the net sown area is 135.66 lakh hectares (50.68 per cent) in 2008-09. Forests spread over a reporting area of 62.10 lakh hectares (22.60 per cent) of the total geographical area in the state and it is much less than as aimed at in the National Forest Policy resolution. An area of 6.50 lakh hectares of cultivable waste land (2.40 per cent) of the total geographical area and offers scope for extending area under cultivation. The other fallow lands and current fallow lands consist of an area of 14.88 lakh ha. (5.40 per cent) and 26.24 lakh ha. (9.60 per cent), respectively, in the total geographical area.

## 3.1f Literacy

Literacy rate in Andhra Pradesh has seen upward trend. As per 2011 population census, literacy rate is 67.66 per cent in Andhra Pradesh. Out of which, male literacy stands at 75.56 per cent while female literacy is at 59.74 per cent. The total literates in Andhra Pradesh stands at 51,438,510, of which males were 28,759,782 and females were 22,678,728.

## 3.1g Sex Ratio

As per census 2011, sex ratio of Andhra Pradesh is 992 i.e. for each 1000 male, which is above national average of 940.

## 3.1h Livestock Resources and Veterinary Services

Presently Andhra Pradesh stands first in Poultry (1005.80 lakhs) and Sheep population (210.15 lakhs), second in Buffalo population (107.68 lakhs), seventh in Goat population (64.27 lakhs), and eighth in Cattle (94.24 lakhs) and Pig population (5.49 lakhs) in the Country ($19^{th}$ livestock census, 2012). At present veterinary health cover is provided by 5013 field veterinary institutions comprising of 22 Veterinary Poly Clinics at district level. 281 Taluk level veterinary hospitals manned by Assistant Directors, 1794 Veterinary Dispensaries manned by Veterinary Assistant Surgeons and 2916 Rural Livestock Units at Village level manned by Para Vets are functioning. There are 22 Animal Disease Diagnostic Laboratories are functioning, one each at district headquarters with facilities for disease investigation, quick diagnosis and for mapping out diseases to render timely and effective control measures. These are the district referral laboratories for effective diagnosis and vaccine distribution work.

## 3.1i Dairy Farming

Under Operation Flood-II, the state government established a separate dairy development department i.e Andhra Pradesh Dairy Development Cooperative Federation (APDDCF) as a part of the state Ministry of Food and Agriculture which came into existence on April 2, 1974 as the apex body to cover larger areas in the state having 3 tier Anand pattern cooperative structure. The main objective of APDDCF is to develop dairy value chain with primary focus on milk procurement by organized sector and it is nodal agency for implementing dairy development scheme on behalf of Government and is involved in formulating dairy development policies. There are nine district milk producer's cooperative unions affiliated to the milk federation of the state. These milk unions covers 9 districts of the state and the remaining 4 districts are being covered directly by the federation. Different milk unions, which are organising the DCS networks in these districts are as follows:

**Table 3.2 : List of Registered Milk Plants in the State**

| Sl.No. | Name of the Union | Registered Capacity (LLPD) |
|---|---|---|
| 1. | Chittoor District Cooperative Milk Producers' Union Ltd., Chittoor | 1.40 |
| 2. | Cuddapah District Cooperative Milk Producers' Union Ltd., Proddutur | NA |
| 3. | Godavari Cooperative Milk Producers' Union Ltd., Rajahmundry | 0.40 |
| 4. | Guntur District Milk Producers' Cooperative Union Ltd., Vadlamudi | 1.59 |
| 5. | Krishna District Milk Producers' Cooperative Union Ltd., Vijayawada | 1.03 |
| 6. | Kurnool District Cooperative Milk Producers' Union Ltd., Nandyal | 0.26 |
| 7. | Nellore District Milk Producers' Cooperative Union Ltd., Nellore | 0.55 |
| 8. | Prakasam District Cooperative Milk Producers' Union Ltd., Ongole | NA |
| 9. | Sri vijaya visakha District Cooperative Milk Producers' Union Ltd., Vishakhapatnam | 1.48 |

NA = Not Available, LLPD = Lakh Litres Per Day

**Source :** Andhra Pradesh Dairy Development Board, 2016

## 3.1.1 AN OVERVIEW OF GUNTUR DISTRICT

Guntur district is one among the 13 districts of Andhra Pradesh state. It was formed on 1st October 1904 after bifurcating Krishna and Nellore districts with Head Quarter at Guntur. Guntur district spread over an area of 11391 $km^2$. It has 57 revenue mandals divided into three revenue divisions. There are 729 revenue villages with 1024 Gram Panchayats and 10 municipalities. As per 2011 population census, the total population of the district is 48,87,813 and of this 71.2 per cent are living in rural areas. About 42 per cent of total population were workers. Literacy rate is 55 per cent which is higher than both the state and national average. The density of population in the district is above 429 per $km^2$. Places of historical importance in Guntur district are Amaravathi, Ponnur, Bhattiprolu, Vinukonda, Kotappakonda, Undavalli caves, Gurazala, Macherla, Kondavid fort and the archeological museum in Guntur.

### 3.1.1.1 Geography

The district is bounded on the North by Krishna and Nalgonda districts, on the West by Prakasam and Mahboobnagar districts, on the South by Prakasam district, on the East by Krishna district and Bay of Bengal. It is situated between 15˚18' and 16˚50' of the Northern Latitude and 70˚10' and 80˚55' of the Eastern Longitude. It has an average elevation of 33 m and is situated on the plains. There are few hills in the surrounding suburban areas and Perecherla Reserve Forest on the north west. The city is around 40 miles (64 km) to the west of the Bay of Bengal on the east coast of India. The Krishna delta lies partly in the Guntur district. There are other smaller rivers and channels in the region such as Guntur Channel, Chandravanka, Naagileru, Guntur Branch Canal, etc.

### 3.1.1.2 Climate and Rainfall

This district has a tropical climate. In winter, there is much less rainfall than in summer. The district suffers from hot climate, especially in the summer. In Guntur district, the year may be divided into four seasons. They are 1) Dry and Cool Winter Season (December to February), 2) Summer Season (March to May), 3) South-West Monsoon Season (June to September) and 4) Post Monsoon or Retreating Monsoon Season (October to November). The average annual temperature is 28.5 °C. The temperatures are highest on average in May, at around 33.6 °C. In December, the average temperature is 24.1 °C. It is the lowest average temperature of the whole year. The heat is very severe in Rentachintala, where the maximum temperature in the state is recorded.

The rainfall generally decreases from east to the west. The rain is experienced mostly by both south-west monsoon and the retreating monsoon. October is the rainiest month of the year. On an average there are 47 rainy days in a year. The average rainfall in the district is 833 mm. The least amount of rainfall occurs in January (average is 1 mm). The highest rainfall recorded was 386 mm at sattenapalli on 19th of November, 1879.

Most precipitation falls in July, with an average of 171 mm. The variation in the precipitation between the driest and wettest months is 170 mm.

### 3.1.1.3 Soil Type

The black cotton and red loamy soils are predominant in the district. About 69 per cent of the total area of the district is black cotton while 24 per cent of that is the red loamy soils. The soils of the district are broadly divided into alluvial regar, red and arenaceous and are further subdivided into clayey, loamy and sandy. The alluvial soils occupy 7 per cent, while 53 per cent fall under regar series, 38 per cent under red and the remaining 2 per cent is covered by the arenaceous series.

### 3.1.1.4 Cropping Pattern

Out of total geographical area of 11,52,000 hectares nearly 6,16,000 hectares are under cultivation. The food crops occupied most important place in cropping pattern with about 66.10 per cent of the gross cropped area. The most predominately cultivable crop with and area of 2,83,334 hectares was paddy followed by cotton (1,49,627 hectares), black gram (1,08,206 hectares), chillies (64,665 hectares) in 2007-08. Within the food crops paddy has emerged as the most important food crop occupying about 36.75 per cent to the total cropped area. Cotton, major commercial crop of the area occupied an important place among non-food crops accounting for nearly 21.25 per cent of the total cropped area. The share of chillies accounts for 7.81 per cent of the total cropped area. The farmers have stated growing new crops like sugarcane and turmeric in place of maize, pulses (Red gram, Black gram and Bengal gram) and tobacco. Even though the area under these crops is very small, their place in the agro-business is significant.

### 3.1.1.5 Land Utilization Pattern

Out of the total geographical area of 11,52,000 hectares nearly 6,16,000 hectares are under cultivation which accounting for 52.17 per cent of the total geographical area. An area of 151 thousand hectares is cultivable waste land (13.11 per cent) and more than 14.06 per cent of the total geographical area is under forest. The district is rich in mineral resources. The principal minerals available are limestone, lime kankar, Napa slabs, Copper and Lead. The cement factories of Macherla and Tadepalli are utilizing limestone. There are copper mines at Agnigundala of Ipur Mandal.

### 3.1.1.6 Literacy

As per census 2011, the population of the district was 48,87,813 lakhs with a density of 429 per Sq. Km. Average literacy rate of Guntur district is 60.57 per cent. Male literacy rate is 66.98 per cent and female literacy rate is 54.17 per cent. Total literates in Guntur district is 2,960,441.

### 3.1.1.7 Sex Ratio

As per census 2011, sex ratio of Guntur district is 1003 females per 1000 males.

### 3.1.1.8 Livestock Resources and Veterinary Services

Guntur district is rich in livestock. It has a livestock population of 45,35,857 consisting cattle of 1,37,484 and buffaloes of 10,22,456, the goat and sheep are accounted for 6,37,612 and 7,70,671, respectively. Besides, there is poultry population of 27,61,651. The district ranks first in the state in the production of milk and milk products like butter and ghee. The infrastructural facilities made available by the animal husbandry department for animal health care in the district are 16 veterinary hospitals, 100 livestock supervisory units, 158 rural veterinary dispensaries and 5 sheep extension centers. Of the total institutions, 211 are provided with artificial insemination facility.

### 3.1.1.9 Dairy Farming

The programs that were taken up to develop dairy industry in India are named as 'OPERATION FLOOD PROGRAMS'. Under the Operation Flood-I, 18 districts were selected within the country for spread of Dairying in India and among them is the Guntur district in Andhra Pradesh state. Guntur district was selected for development of Dairy under Anand pattern. As a part of the program 'feeder balancing' dairy has been established at the village Vadlamudi for balancing the supply of milk, which was called as the 'SANGAM DAIRY'. This dairy was set up by NDDB with the financial assistance from Indian Dairy Corporation in the year 1976. The name of Sangam dairy is due to the presence of 'SANGAMESWARA' temple at Sangam Jagarlamudi village near the vicinity of Vadlamudi village. The dairy is located on the Guntur-Tenali state high-way about 15 km from Guntur and 10 km from Tenali having good architectural view attracting visitors. It became one of the most familiar visiting spot in Guntur District.

Sangam dairy has a strength of 1.67 lakh member producers and procures around 479 lakh litres per annum. It pumps back around ₹ 240 lakh into the rural economy, every 10 days towards payment to the milk producers. Sangam Co-operative has spread over and interwoven with 643 villages of Guntur District. Sangam besides giving remunerative price to the farmers has been consistently paying price difference to all its milk producers from its surpluses. Sangam dairy has 4 milk chilling centers at Narasaraopet, Gurajala, Vinukonda and at Bhattiprolu and also having 7 bulk milk cooling centers in the district. This dairy has one cattle feed plant at Vadlamudi, seed processing plant and city marketing office at Guntur. Maize, sorghum, napier grass and some of the legume species are mostly cultivated as fodder crops.

Dairying is also likely preferred by the farmers because the farm yard manure which is a by-product of animal helps them to improve the fertility of their soil. More than 73 per cent of the rural households in the country maintain livestock as a source of subsidiary income generation which accounts for 40 per cent of their annual income. Almost 80 per cent of the 479 million livestock are held by small and marginal farming

households, thereby making the livestock rearing an integral component of their livelihood system. Sangam Dairy is the 1st co-operative milk union in the state and it is the role model for all the milk unions in the state for implementation of technical input programs, breed development programs, etc.

## 3.1.2 AN OVERVIEW OF CHITTOOR DISTRICT

Chittoor district, is a part of the Rayalaseema region in Andhra Pradesh. The district was formed on 1st April 1911, taking Chittoor, Palamaneru, Chandragiri from the North Arcot District of Tamil Nadu and Madanapalli, Vayalpadu from Cuddapah and Punganur, Sri Kalahasti, Kametinagar fiom Zamindari provinces to form united Chittoor district. There are 66 Mandals and 14 Assembly constituencies in Chittoor district. The district is famous for Tirupati, Kanipakam and Sri Kalahasti temples. It lies in the Poini river valley of southern most Andhra Pradesh, on the NH4 Bangalore - Chennai highway. It is a major market center for mangoes, grains, sugarcane and peanuts. Major industries around the city are Amaron Batteries - nations leading automobile batteries, and Nutrine Confectionaries-a major chocolate candies producer and this city is one of the major Granite, mango pulp producing centers of India.

### 3.1.2.1 Geography

Chittoor district occupies an area of 15,359 $km^2$. The district is bounded by Anantapur district to the northwest, Cuddapah district to the north, Nellore district to the northeast, Krishnagiri, Vellore and Timvallur districts of Tamil Nadu state to the south and Kolar district of Karnataka state to the west. Chittoor district lies extreme south of the Andhra Pradesh state approximately between $12^0$37'-$14^0$8' North latitudes and $78^0$3'-$79^0$55' East longitudes.

### 3.1.2.2 Climate and Rainfall

The climate of the district is dry and healthy. Out of 66 Mandals in the district, 31 are upland mandals, which are located in Madanapalli division and are comparatively cooler than the eastern mandals, except Chittoor mandal where the climate is moderate. Winter weather in the district commences from the end of November. December and January are the coldest months, temperature ranges between 15.2˚ to 26˚C. The period between March and June is summer. May is the hottest month, the mean daily maximum temperature rising above 40˚C. The average annual rainfall is 438 mm.

### 3.1.2.3 Soil Type

Red loam and Red sand soils formed 57 per cent and 34 per cent respectively, of the total land area in the district. These soils are suitable for sugarcane, paddy and groundnut (if irrigation facilities are available) and for mango, banana, cashew nut, coconut and citrus. The other soils, viz. Black, Clay, Black Loams and Red clay, together form only 9 per cent. A major portion of the district is covered by red soils. Alluvial soil is found in Chittoor and Bangarupalem. Red loamy soils constitute 57 per cent of the

district, red sandy 34 per cent, while the remaining is covered by black clay, black loamy, black sandy and red clay. In 2006 the Indian government named Chittoor one of the country's 250 most backward districts. It is one of the thirteen districts in Andhra Pradesh currently receiving funds from the Backward Regions Grant Fund Programme (BRGF).

**Table 3.3 : Demographic features and livestock profile of the study area**

| Sl. No. | Particulars | Andhra Pradesh | Guntur | Chittoor |
|---|---|---|---|---|
| I Demographic features (as per 2011 census) | | | | |
| 1 | Geographical area (Sq. Km) | 1,62,970 | 11,391 | 15,359 |
| 2 | Net cultivated area (hectares) | 61.35 lakh | 6.16 lakh | 4.03 lakh |
| 3 | Revenue divisions | 50 | 4 | 3 |
| 4 | No. of mandals | 676 | 57 | 66 |
| 5 | No. of villages | 16,158 | 712 | 1493 |
| 6 | Total population | 84,66,553 | 48,87,813 | 41,74,064 |
| | Rural population | 56,36,170 | 32,35,075 | 29,42,678 |
| | Urban population | 28,21,907 | 16,52,738 | 12,31,386 |
| | Male population | 42,50,988 | 24,40,521 | 18,89,690 |
| | Female population | 42,15,565 | 24,47,292 | 18,56,185 |
| 7 | Population density (people/Sq. Km) (2011) | 308 | 429 | 275 |
| 8 | Sex ratio (Female: Male) | 992:1000 | 1003:1000 | 997:1000 |
| 9 | Total literacy rate (%) | 67.66 | 60.57 | 71.53 |
| | Male literacy rate (%) | 75.66 | 66.98 | 79.83 |
| | Female literacy rate (%) | 59.74 | 54.17 | 63.28 |
| 10 | Average rainfall (mm/year) (2017) | coastal region-1078.0<br>Rayalaseema region-714.0 | 830 | 438 |
| 11 | Actual rainfall (mm/year) (2017) | 940 | 934 | 906 |
| II Livestock profile (2011 census) | | | | |
| 1 | Cattle population (lakhs) | 94.24 | 1.37 | 9.25 |
| 2 | Buffalo population (lakhs) | 107.68 | 10.22 | 0.83 |
| 3 | Sheep (lakhs) | 210.15 | 7.70 | 9.37 |
| 4 | Goat (lakhs) | 64.27 | 6.37 | 2.45 |
| 5 | Poultry birds (lakhs) | 1005.8 | 27.61 | 80.23 |

**Source: www.ap.nic.in**

### 3.1.2.4 Cropping Pattern

*Kharif* and *Rabi* are the two important growing seasons in the district. However *Kharif* season is dominating one. Out of the total cropped area, more than 70 per cent of

the cropped area comes under *Kharif* season and rest comes under the *Rabi* season. In general, *Rabi* crop has been practicing in potential irrigated source areas. Since Chittoor district has diversity in geographical location, a considerable number of crops are cultivated. They are paddy, total millets, total grams, sugarcane, groundnut, fruits and vegetables and others. On the basis of their hectare, the percentage of individual crops of the total cropped area has been computed for the gross cropped area of both *Kharif* and *Rabi*. Groundnut, fruits and vegetable, paddy and sugarcane occupied the first four ranks among the crops in the district.

### 3.1.2.5 Land Utilization Pattern

The land utilization pattern in the district is : forest 431,345 hectares, barren and un-cultivable land 1,64,220 hectares, land put to non-agricultural use 1,42,254 hectares, permanent pastures and other governing lands - 36,502 hectares, tree crops - 25,165 hectares, net area sown 4,03,774 hectares, total geographical area - 14,98,778 hectares, total cropped area 4,43,005 hectares.

### 3.1.2.6 Literacy

. Average literacy rate of Chittoor district is 71.53 per cent. Male literacy rate is 79.83 per cent and female literacy rate is 63.28 per cent. Total literates in Chittoor district are 2,667,878 people as per 2011 census.

### 3.1.2.7 Sex Ratio

Chittoor district has a sex ratio of 997 females for every 1000 males as per 2011 census.

### 3.1.2.8 Livestock Resources and Veterinary Services

The cow population has increased from 8.56 lakhs in 1999 to 9.25 lakhs in 2012. The year 2007 recorded the highest number of cows at 11.04 lakhs. The buffalo population was 1.44 lakhs in 1999 as against 0.83 lakhs in 2012. The total number of cows and buffaloes put together was 10 lakhs in 1999 while it was 10.08 lakhs in 2012. The share of cows in the total livestock population varied between 85.40 per cent and 91.70 per cent during 1999 and 2012, respectively. The rest, 14.40 per cent, 8.30 per cent in the former and the latter, are buffaloes. To promote dairying in the district, the government has initiated certain measures for the growth of livestock population. This is the backbone for the growth of dairy. There is one veterinary polyclinic in Chittoor. There are 15 veterinary hospitals with four in each of Chittoor and Madanapalli revenue divisions while seven are in Tirupati revenue division. Of the 135 veterinary dispensaries, the highest number 66**,** exist in Tirupati revenue division followed by Chittoor (38) and Madanapalli (31) revenue divisions. In the case of rural livestock units, 67 are located in Tirupati revenue division, 59 in Chittoor revenue division and 45 in Madanapalli revenue division. Of the total gopala mitra centers, 157 are located in Tirupati revenue division, 152 in Chittoor revenue division and 102 in Madanapalli revenue division. It may be

concluded that, in terms of livestock infrastructure in the district, Tirupati revenue division ranks first followed by Chittoor and Madanapalli revenue divisions.

### 3.1.2.9 Dairy Farming

The Chittoor Cooperative Milk Producer's Union is the largest dairy in the cooperative sector in Asia. It remained a jewel in the district's crown for a long time. Established in 1969 with an output of 6,000 liters per day, it reached a phenomenal capacity. The huge surplus milk was converted into milk powder, which, however, could not be sold owing to slump in prices. This sealed the fate of the dairy, which was closed down. Private dairies came up between 2000 and 2005 to fill the vacuum, but their operations took an ugly turn when they formed a syndicate to exploit milk reducers by paying them between ₹ 5 and ₹ 7 a litre. The farmers approached the district authorities to seek remunerative prices for their milk produce. As per the directive of the district administration, Tirupati-based Balaji Dairy, an offshoot of the chittoor cooperative milk producers Union was undertaken by the National Dairy Development Board (NDDB), which agreed to procure milk from the farmers. The DRDA jumped into the fray by establishing two Bulk Milk Cooling Units (BMCUs) on a pilot basis in Gangavaram and Venkatagiri Kota with a capacity of 3,000 litres a day. Subsequently, the BMCUs were established in 50 out of 66 mandals in the district. There are 87 BMCUs with a network of 2,12l (MPIs) and 19,586 pourers. The milk procurement per day is 2.90 lakh liters. All the BMCUs in the district are spread over not only the dairy-rich but in the poverty-stricken mandals. Maize, sorghum, napier grass, dhaincha and some of the legume species are mostly cultivated as fodder crops. The dairy sector has not only put Chittoor at the forefront of a white revolution in south India but also helped it in achieving women's empowerment.

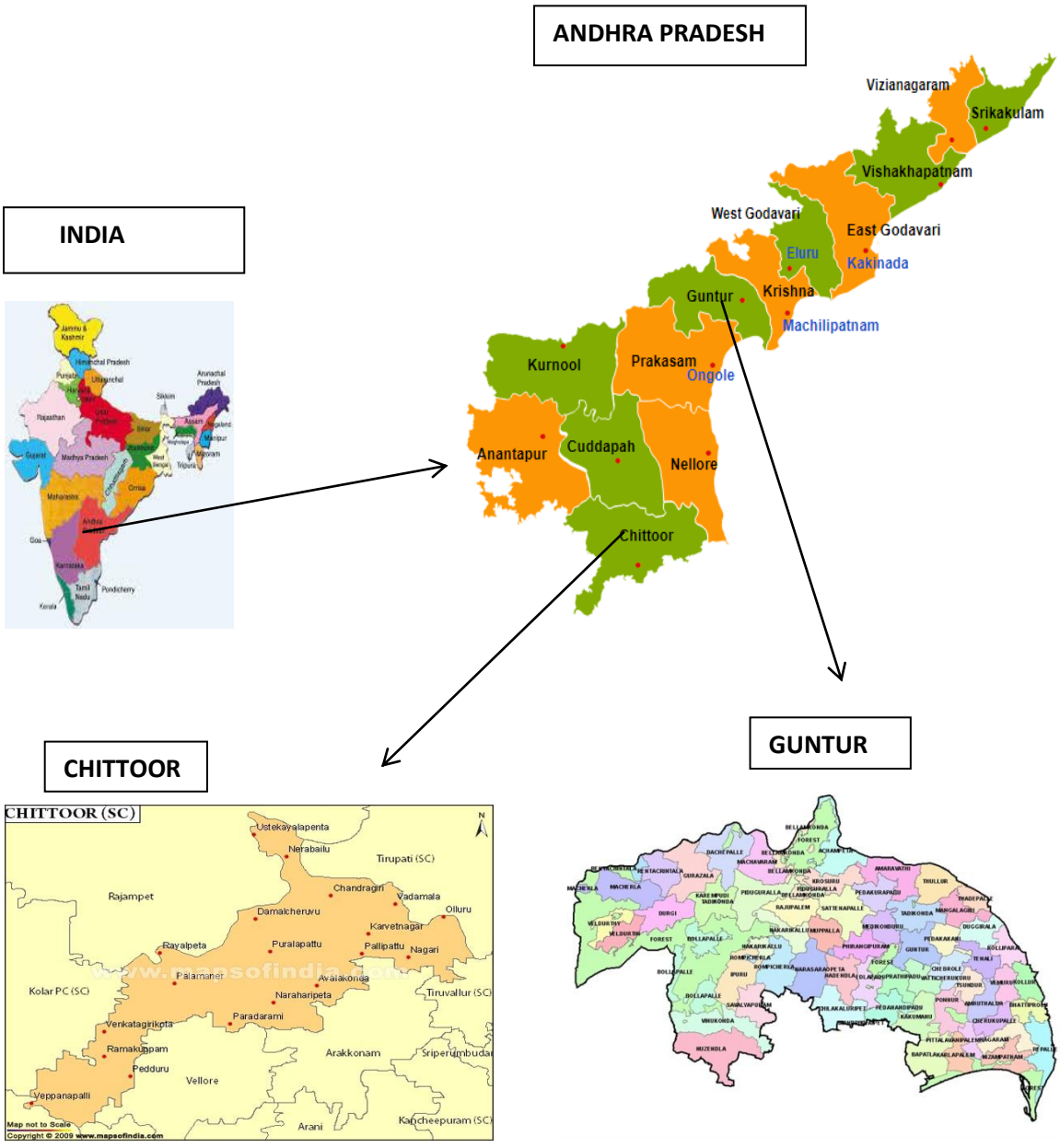


**Figure 3.1 Location of the study area**

# CHAPTER - 4

# RESEARCH METHODOLOGY

# 4. RESEARCH METHODOLOGY

Methodology is the proposed blue print of the current investigation. It refers to all the procedures, methods and processes to approach a research problem and seek an answer to the pre-defined questions keeping in view the proposed objectives. This chapter explains sampling design, data collection and methods applied to analyse the objectives of the study. Various tools and techniques applied in the study have been selected based on study domain, data type and objectives. The assumptions of the technique and properties of estimates have been kept in view while selecting the method.

The methodology adopted in conducting the proposed research is described under the following sub-headings:

4.1 Sampling Design

4.2 Data Collection

4.3 Analytical Framework

## 4.1 Sampling Design

The sampling design consisted of selecting the ultimate sampling unit. For the present study, member and non-member of cooperative dairy farmers were selected using the multistage random sampling method. The mandals, dairy cooperative societies and sample respondents constituted the first, second and third stages of sampling, respectively.

### 4.1.1 Selection of the State

Andhra Pradesh state has been purposively selected to conduct present study. In India, cooperative movement has spread in various states. Andhra Pradesh is one amongst them which is predominately an agricultural state with an excellent potential for milk production. It stands 2$^{nd}$ in the buffalo population with 64.64 lakh and 8$^{th}$ in the cattle holdings of about 47.42 lakhs in 2015-16. The state ranked 5$^{th}$ in the milk production with 108.17 lakh metric tonnes. The per capita availability of milk was 475 grams per day during 2015-16. The number of functional dairy cooperative societies in the state were 5072 covering 7.13 lakh farmers with an average daily milk procurement of 960,000 kgs per day. The major share of milk in the state comes from buffalo with 7445 thousand tonnes in 2015-16 which has a growth of -28.6 per cent in 2014-15 to 13.25 per cent in 2015-16 due to consistent and sustainable support of state government to promote Murrah buffalo. The livestock sector contributes about 26 per cent of the state Agricultural GDP. In order to support the dairy industry, there is a vast network of dairy co-operative societies in the state. There are more than 7000 milk co-operative societies with a membership of 8 lakh people across the state. The dairy cooperatives in Andhra Pradesh are predominant in adequate supply of inputs and fodder facilities to the dairy farmers. Since the objectives were to estimate the cost and returns from milk production

and to access the impact of dairy cooperatives on the farmer's income, the state of Andhra Pradesh was selected for the study.

## 4.1.2 Selection of the Districts

Andhra Pradesh is classified into three agro-climatic zones viz., Krishna-godavari zone (Coastal Andhra, zone-I), North coastal zone (Zone-II) and Southern zone (Rayalaseema, zone-III). Out of 13 districts of Andhra Pradesh, two districts Guntur and Chittoor are purposively selected for the study as Guntur is representing Agro-climatic zone-I in Coastal Andhra region and Chittoor is representing zone-III in Rayalaseema region. Guntur district has highest Buffalo population and it stands 2nd in milk production in the state, where as Chittoor district has highest cattle population and stands 1st in milk production in Rayalseema region and 4th in the state. Salient features of two districts are listed in the Table 4.1.

**Table 4.1 Salient Features of the Study Area on Dairying**

| Particulars | Andhra Pradesh | Guntur* | Chittoor |
|---|---|---|---|
| Agro-climatic zone | Three | Krishna Godavari (Zone-I) (Coastal Andhra) | Southern (Zone-III) (Rayalseema) |
| DCS (No.) | 7000 | 744 | 766 |
| Members (No.) | 8,23,714 | 1,12,018 | 1,01,000 |
| Livestock population | 560.99 lakhs | Highest in Buffalo (64.64 lakhs) | Highest in cattle (9.52 lakhs) |
| Milk Production (Lakh Metric Tonne) (2013-14) | 90.83 | 9.77 (second) | 9.48 (fourth) |

*One among the 18 districts selected under the program Operation Flood-1

### 4.1.3 Selection of the Mandals

Total four mandals were selected randomly, two each from Guntur and Chittoor districts based on highest and least milk procurement per day in the district. Out of 57 mandals in the Guntur district, two mandals, Rompicherla which is highest milk procurement mandal and Bollapalli which is least milk procurement mandal were selected. Out of 66 mandals in the Chittoor district, two mandals, Palamner which is highest milk procurement mandal and Yerpedu which is least milk procurement mandal were selected for the study.

### 4.1.4 Selection of Dairy Cooperative Societies

Overall eight cooperative societies were selected randomly i.e., two from each mandal. In Guntur district, Machavaram and Kothaplli village dairy cooperative societies (DCS) in Rompicherla mandal where as Vellaturu and Mugachintalapadu village dairy cooperative societies in Bollapalli mandal were selected randomly. In Chittoor district, Bandapalli and Parlapalli DCS in Palamner mandal where as Katrakayalagunta and Balakrishnapuram in Yerpedu mandal were selected randomly. The dairy cooperative societies selected in the sample are mentioned in Table 4.2 along with selected member and non-member dairy farmers.

### 4.1.5 Selection of sample households

A predetermined sample of 160 milk suppliers was drawn randomly from all eight societies according to probability proportional to the size of total milk producers poring milk to the cooperative societies. Out of 160 dairy farmers, 80 dairy farmers which comprising of 40 members and 40 non-members were selected randomly from both Guntur and Chittoor districts, respectively (Figure 4.1). The households were, thus classified into three herd size categories based on standard animal units (SAUs) namely Small (1-3 SAUs), Medium (4-6 SAUs) and Large (> 6 SAUs).

**Table 4.2 : Selection of Dairy Co-operative Societies (DCS) and dairy farmers**

| Name of the district | Name of the mandal | Milk procurement (Lpd) | Name of the DCS | Milk Procurement (Lpd) | Selected Members | Selected Non-members | Total |
|---|---|---|---|---|---|---|---|
| Guntur | Rompicherla | 10,000 | Machavaram | 400 | 10 | 10 | 20 |
| | | | Kothapalli | 160 | 10 | 10 | 20 |
| | Bollapalli | 850 | Vellaturu | 110 | 10 | 10 | 20 |
| | | | Mugachintalapadu | 76 | 10 | 10 | 20 |
| Chittoor | Palamner | 15,000 | Bandapalli | 500 | 10 | 10 | 20 |
| | | | Parlapalli | 60 | 10 | 10 | 20 |
| | Yerpedu | 1000 | Katrakayalagunta | 79 | 10 | 10 | 20 |
| | | | Balakrishnapuram | 50.5 | 10 | 10 | 20 |
| Total | | | | | 80 | 80 | 160 |

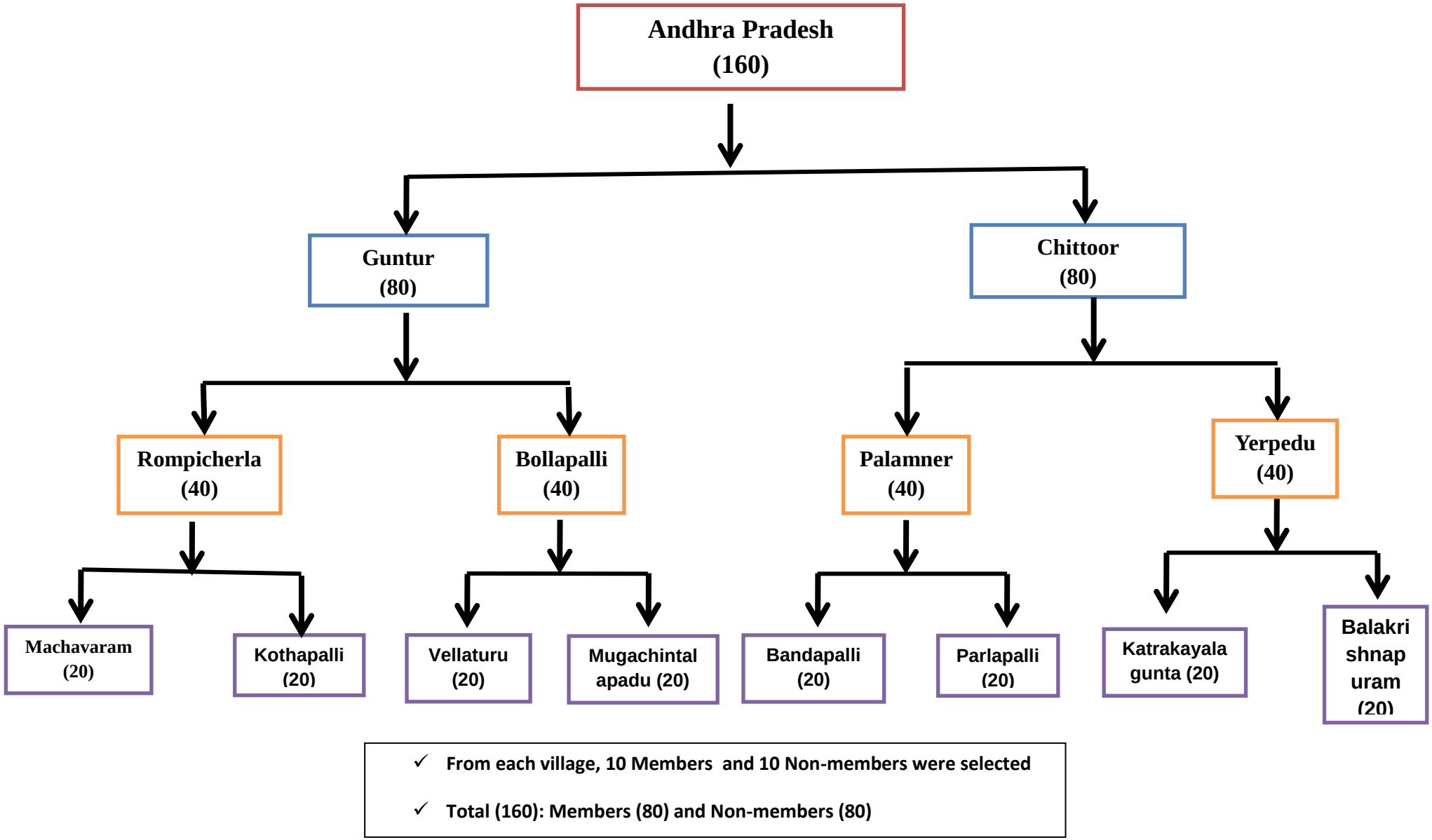


**Figure 4.1: Sampling Design**

## 4.2 DATA COLLECTION

For the purpose of the study both primary and secondary data were collected from the necessary sources.

### 4.2.1 Primary Data

Primary data were collected in the month of November, 2017 to February, 2018 by personal interview method using a well – structured schedule from head of the 160 respondent households. The schedule used for data collection is given in Annexure-III. Data was collected on milk production and productivity, input use like green fodder, dry fodder, labour, value of animal, veterinary expenses, miscellaneous costs and price of milk from the dairy farmers. The information was also collected on various socio-economic aspects related to family size and composition, herd size, assets, buildings, education of head of family, etc (Figure 4.2).

### 4.2.2 Secondary Data

Secondary data regarding total geographical area of the district, agro climatic features, cropping pattern, bovine population, dairy plants, infrastructure facilities for dairying and animal husbandry, milk co-operative societies, etc., were collected from various published and unpublished sources like Basic Animal Husbandry Statistics, Andhra Pradesh Statistical Abstract, Department of Veterinary and Animal Husbandry, Andhra Pradesh, etc.

## 4.3 ANALYTICAL FRAMEWORK

To achieve the objectives of the study, the data collected from 160 respondents were scrutinised, tabulated and analysed by employing various analytical tools. The techniques so employed are discussed in the present section.

### 4.3.1 Tabular Analysis

The data collected from both members and non-members were systematically arranged, organized and finally subjected to tabular analysis for drawing inferences. Average family size of households, education score of the respondents, size of operational land holdings and area under fodder crops, herd size in terms of standard animal units etc., were computed according to herd size categories in both the member and non-member groups. Different economic parameters such as average cost, productivity, income and employment, etc., were analysed with the help of tabular analysis.

### 4.3.2 Estimation of Cost and Returns of Milk Production

The total cost involved in dairy farm operations composed of fixed cost and variable cost. These costs when compared with returns indicate economic efficiency of milk production and the profitability of the enterprise. The different components of costs and returns and method of calculation are discussed briefly in the following section.

**Fixed Costs**

Fixed costs do not vary with the level of output and remain unchanged over a short period of time. The various components of fixed cost are depreciation and interest on fixed capital. Capital recovery cost (CRC) method was used to calculate depreciation. The interest on fixed capital does not need to be accounted for separately in CRC approach.

**Depreciation of Costs**

Depreciation is the loss in the value of an asset due to normal wear and tear, time and technological obsolescence. It can be accounted by using the capital recovery cost (CRC) method. The CRC method is defined as annual payment that will repay the cost of fixed input over the useful life of input and provide an economic rate of return on investment. The formula for estimation of CRC is :

$$\boldsymbol{R = Z\left[\frac{(1+r)^n\, r}{(1+r)^n - 1}\right]}$$

Where,

R = capital recovery cost

Z = initial value of the capital asset

r = interest rate

n =useful life of the assets

In case of practical difficulties in getting the information on initial outlay at the field level, the current value of asset was considered. When the asset was purchased from borrowed capital the actual interest rate charged by the bank was taken as 'r', while in case of owned funds, the interest on term deposit of 1-5 years was taken. The useful life of assets was assumed to be 50 years for pucca cattle shed, 10 years for katcha shed, 6 years for manual chaff cutter, 10 years for power operated chaff cutter. The useful life of milch animals also varied with the type of animal and was taken as 10, 8 and 10 years for local cow, crossbred cow and buffalo, respectively. The total CRC was then apportioned to the individual animal in accordance with the Standard Animal Units (SAUs).

**Variable Cost**

Variable costs are those costs, which are incurred on the variable factors of production and can be altered in the short run. It includes feed cost, labour cost, veterinary cost and miscellaneous cost.

**Feed and Fodder Cost**

Cost on green fodder, dry fodder and concentrate were worked out by multiplying quantities of feeds and fodders consumed by animals with their respective prevailing prices in the study area.

**Fig 4.2: Primary data collection from farmers**

**Fig 4.3 Cattle shed with fodder store room**

**Plate – 1**

**Labour Cost**

It included family as well as paid labour (hired labour). The hired labour was calculated considering type of work allotted and wages paid. In case of family labour, the imputed value obtained based on the time spend in dairying and prevailing wage rate of casual labour in the study area.

**Veterinary Cost**

It included the cost incurred on natural service, Artificial Insemination (A.I.), vaccination, medicines and as fees of veterinary doctor.

**Miscellaneous Cost**

Miscellaneous costs are the cost of repairs, electricity, water charges, purchase of milk can, bucket, rope, etc. They were calculated on the basis of per milch cows per day for different types of milch cows kept by the sample commercial dairy farms.

**Apportionment of Joint Costs**

Among the various items of cost discussed above, certain expenses were incurred by the farmers for the entire herd on the farm. For instance, fixed assets like cattle shed, stores, mangers, buckets, chains, etc. are jointly used for animals of all age groups and either sex. For the apportionment of such joint expenses on per animal basis; the total number of animals with the farmer, comprising of adult, young male and female animals, were converted into Standard Animal Units by using the ratios suggested by Sirohi *et al.* (2015).

**Standard Animal Units (SAUs):**

**Table 4.3 : Standard animal units for southern regions of India**

| Type of Animal | Buffalo | Crossbred cow | Local cow |
|---|---|---|---|
| Adult male ( ≥3 years) | 1.04 | 1.12 | 0.97 |
| Adult female (≥3 years | 1.24 | 1.62 | 1.00 |
| Young stock male ( < 1 year) | 0.24 | 0.24 | 0.22 |
| Young stock female (< 1 year ) | 0.28 | 0.3 | 0.27 |
| Young stock male ( > year ) | 0.6 | 0.63 | 0.54 |
| Young stock female ( > 1 year ) | 0.51 | 0.52 | 0.47 |
| Heifer | 0.77 | 0.86 | 0.82 |

Source: Sirohi *et al.* (2015)

Considering the differences in regional endowments of animal wealth and species, the dairy animals have been converted into SAUs using factors suggested by Sirohi *et al.* (2015) for the southern region. This study apart from labour utilization, the body weight of the animal was

also taken into consideration for the estimation of the SAUs. Based on expert opinion, 60 per cent weight was given to labour utilization and 40 per cent to the body weights of animals for the final estimation. As the study area falls in the southern region, so the standard animal units for this region was shown in the Table 4.3.

**Gross Cost**

Gross cost was obtained by adding all the cost components including fixed and variable costs.

Gross Cost = Total Variable Cost + Total Fixed Cost

**Net Cost**

The net cost was reckoned by deducting the imputed value of dung from the gross cost.

Net Cost = Gross Cost- Imputed value of dung

**Gross Returns**

Gross returns were obtained by multiplying milk yield of an individual animal with respective prevailing prices in the study area.

Gross Returns = Quantity of milk X Market price of milk

**Net Returns**

Net return was calculated by subtracting net cost from gross returns.

Net Returns = Gross Returns- Net Cost

**Cost per Litre of Milk Production**

In order to estimate the cost per litre of milk, the average net maintenance cost per animal per day was divided by average milk production per animal per day, i.e.

$$\text{Cost per litre (₹ )} = \frac{\text{Net cost per animal per day}}{\text{Total milk produced per animal per day}}$$

**4.3.3 Input-Output Relationship**

**Selection and specification of variables**

Milk production function is basically a technical and mathematical relationship between input resources used in the production process and its final output. Production function provides us knowledge on the kind and quantity of the product that could be expected when quality and quantity of input resources are employed in the production process. As we know that milk production is a complex biological process and is

influenced by a number of genetic, environmental, management factors like breed, order and stage of lactation, inherent potential of animal, preceding dry period, quantity and quality of feeds and fodders, labour, health care, housing and management, etc. But it is impossible to incorporate all the multitudinous factors responsible for milk production in a single production function due to qualitative nature of some factors and inputs like feeds respond differently under different resources situations. The simultaneous use of these variables is starkly erroneous as it leads to the problem of multicollinearity eroding the precision of estimates obtained. Therefore, appropriate selection and specification of variables are essential steps in the specification of appropriate milk production function.

A brief description of the selected variables and their determination is given as under.

**Dependent variable**

**Value of milk:** Value of milk was stipulated to be dependent variable. The actual daily milk yield per animal per day on the previous day of visit during different seasons was determined. It was multiplied by the price realized by the milk producer household in order to transform it to monetary value.

**Explanatory variables**

**Value of green fodder**: To determine the value of green fodder fed, the actual quantity of green fodder fed to individual animal on the previous day of visit in the selected household was multiplied by the purchase price or market price of the different types of green fodder fed. The expenditure was expressed in rupees.

**Value of dry fodder:** To determine the value of dry fodder fed**,** the actual quantity of dry fodder fed to individual animal on the previous day of visit in the selected household was multiplied by the purchase price or market price of the different types of dry fodder fed. The expenditure was expressed in rupees.

**Value of concentrate:** The quantity of compounded readymade concentrate or the composition and quantity of concentrate in case of homemade mix fed to individual animal on the previous day of visit in the selected household was ascertained. The cost of each ingredient of homemade concentrate mix was also ascertained. The cost per kilo gram of homemade concentrate mix was calculated. In case of compounded feed, market price in terms of its cost per kg was ascertained. The expenditure on concentrate was arrived at by multiplying the quantity fed to individual animals by its price.

**Value of human labour:** Generally, a bovine keeping rural household maintained different categories of animals like animals in milk, dry animals, heifers, young stock and draught animals. By and large, labour utilization is recorded for the entire herd reared by the bovine keepers. Family labour viz., adult male and female, child male and female labour were used which were later converted into standard male equivalent units based on the wage rates for different category of labour prevailing in the study area. Similarly, different categories of animals maintained by the households were also converted into standard animal units by using the ratios suggested by Sirohi *et al* (2015). The labour

utilized per standard animal unit in terms of adult male unit was converted into appropriate number of man hours of adult male units for different categories of animals. The standard man hours of labour employed per animal per day was converted into monetary terms by multiplying the prevailing wage rate.

**Expenses on veterinary services:** The charges for natural services, artificial insemination and treatment of milch animals were calculated based on prevailing charges. Per day expenditure on veterinary services per animal were worked out on the basis of seasonal expenditure on these items.

**The model:** The functional form, thus was specified as follows: -

$$Y = f(X_1, X_2, X_3, X_4, X_5,)$$

Where,

Y = Value of milk produced per animal per day (₹ )

$X_1$ = Value of green fodder fed per animal per day (₹ )

$X_2$ = Value of dry fodder fed per animal per day (₹ )

$X_3$ = Value of concentrate fed per animal per day (₹ )

$X_4$ = Value of labour employed per animal per day (₹ )

$X_5$ = Value of veterinary services per animal per day (₹ )

Ideally, output (Y) and inputs ($X_i$) in the above functional forms should be measured in physical units. However, in the present study, monetary values of inputs and output were preferred over their physical quantities. This has been done because quality of feeds and fodder differed a good deal from one respondent to the other and can be more appreciably reflected only in value terms.

**Choice and specification of model**

The regression analysis requires specification of a particular functional form and its subsequent estimation. The choice for a specific functional form was made both on the basis of economic and statistical criteria. The economic criteria consisted of looking at the sign and size of the estimate of parameters while statistical criteria consisted in looking at the statistical significance of parameter estimates and co-efficient of multiple determination ($R^2$). Chow test was used to test the equality of parameters of the two production functions (for member and for non-member group). Cobb-Douglas regression was tried in the present study. The functional forms tried are given as under,

Cobb-Douglas form

$$\ln Y = \ln a + b_i \sum_{i=1}^{5} ln\ X_i + \mu$$

Where,

Y = Output

$X_i$'s = Inputs variables used, i=1,2,3,4,5

a = Constant term

$b_i$'s = Parameters to be estimated

u = Random error term assumed to follow normal distribution with zero mean and constant variance

**Chow Test**

Chow test was carried out to test the hypothesis whether production functions of member and non-member group are statistically different.

**Step by step procedure for chow test is given as under:**

**Step 1:-** Setting up of null and alternate hypothesis

$H_0$; $b_m = \boldsymbol{\beta}_{nm}$ *i.e.,* there is no significance difference between the production functions of both member and non-member groups.

$H_1$; $b_m \neq \boldsymbol{\beta}_{nm}$ i.e., there is significance difference between the production functions of two groups.

**Step 2 :-** Perform regression analysis on each group separately.

Equation for the member group

$$\mathbf{Ln}\ \hat{Y}_{\boldsymbol{m}} = \mathrm{Ln}\ \hat{\boldsymbol{b}}_{\mathbf{0}} + \hat{\boldsymbol{b}}_{\boldsymbol{i}} \sum_{\boldsymbol{i=1}}^{\mathbf{5}} \boldsymbol{Ln}\ \boldsymbol{X_i}$$

$$\sum \boldsymbol{e_m}^{\mathbf{2}} = \sum \boldsymbol{y_m}^{\mathbf{2}} - \sum \hat{y}_{\boldsymbol{m}}^{\mathbf{2}} \text{ with } (n_1 - \mathrm{k}) \text{ degrees of freedom}$$

. Equation for the non-member group

$$\mathbf{Ln}\hat{Y}_{\boldsymbol{nm}} = \mathbf{Ln}\boldsymbol{\beta}_{\mathbf{0}} + \boldsymbol{\beta}_{\boldsymbol{i}} \sum_{\boldsymbol{i=1}}^{\mathbf{5}} \boldsymbol{LnX_i}$$

$$\sum \boldsymbol{e_{nm}}^{\mathbf{2}} = \sum \boldsymbol{y_{nm}}^{\mathbf{2}} - \sum \hat{y}_{\boldsymbol{nm}}^{\mathbf{2}} \text{ with } (n_2 - \mathrm{K}) \text{ degrees of freedom}$$

**Step 3:-** Add together the unexplained variations of the two samples

$$\left(\sum \boldsymbol{e_m}^{\mathbf{2}} + \sum \boldsymbol{e_{nm}}^{\mathbf{2}}\right) \text{ with } (n_1 + n_2 - 2\mathrm{K}) \text{ degrees of freedom}$$

**Step 4 :-** Pool together the two samples

$$\mathbf{Ln}\hat{Y}_{\boldsymbol{P}} = \hat{\mathbf{a}} + \hat{\boldsymbol{b}}_{\boldsymbol{i}} \sum_{\mathbf{i=1}}^{\mathbf{5}} \mathbf{Ln}\ \boldsymbol{X_i}$$

$$\sum \boldsymbol{e_P}^{\mathbf{2}} = \sum \boldsymbol{y_P}^{\mathbf{2}} - \sum \hat{y}_{\boldsymbol{P}}^{\mathbf{2}} \text{ with } (n_1 + n_2 - \mathrm{K}) \text{ degrees of freedom.}$$

**Step 5:-** Substract the sum of residual variations obtained at step 3 from pooled residual variation obtained at step 4.

$$\sum e_P^2 - (\sum e_m^2 + \sum e_{nm}^2)$$ with K degrees of freedom

**Step 6 :-** Appropriate test statistic

$$\text{F-test} = \frac{[\sum e_P^2 - (\sum e_m^2 + \sum e_{nm}^2)]/K}{(\sum e_m^2 + \sum e_{nm}^2)/(n_1 + n_2 - 2K)} \sim F_{0.05}(K, n_1 + n_2 - 2K)$$

F calculated value will be compared with F table value at 5 per cent level of significance or suitable level of significance at K and $n_1 + n_2$ - 2K degrees of freedom.

**Step 7:-** Decision rule

If $F_{cal} > F_{0.05}$ (K, $n_1 + n_2$ - 2K) degrees of freedom, then the null hypothesis will be rejected at 5 per cent level of significance i.e., the two functions differ significantly.

### 4.3.4 Marketed Surplus and Disposal Pattern of Milk

**Marketed surplus of milk**

The marketed surplus of milk is the quantity of milk sold after meeting the family requirements for consumption and for conversion into other milk products like butter milk, curd, etc. Thus the marketed surplus of milk was calculated as

Marketed Surplus = Total milk production - Total milk consumption

. The information was collected on quantity of milk consumed at home and the quantity of milk sold by the respondent households.

**Disposal pattern of milk**

Disposal pattern pertains to the agency to whom milk sold by the respondent households like cooperatives, private dairies, milk vendors or directly to consumers. The information was collected on the agency to whom milk was sold along with the average price realized and the reasons for selling milk to the particular agency. The relative share of each marketing agency in the marketed surplus of milk was worked out by using tabular analysis.

### 4.3.5 Impact of dairy cooperatives on farmer's income

To analyse the impact of dairy cooperatives on the farmers income, heckman two stage model was used.

#### 4.3.5.1 *Heckman two stage model*

A vital issue in estimating impact is self-selection bias. Selection bias results from estimation on a sub sample of individuals who have essentially selected themselves for participation in a particular program. Several techniques have been developed to correct for this bias, mostly a two-stage technique attributed to Heckman (Heckman, 1979). In the Heckman two-stage method, the binary membership variable is estimated on the total sample of members and non-members in the outcome equation. Logit analysis is the most commonly used method in the estimation. The predicted membership probabilities was used to calculate a correction term. The correction term also known as Inverse Mills Ratio (IMR) which was included in the outcome equation and the outcome model was estimated by using ordinary least squares on the total sample and used to suggest the net impact of the programme.

In the first stage, the membership in dairy cooperatives decision was estimated and in the second stage the effect of membership on household income and productivity of milch animals was studied.

##### 4.3.5.1.1 First stage:- Factors influencing membership (Binary logit model)

In case of multinomial choices, the probit model has found to be limited use in evaluating multiple integrals of the normal distribution. In this contrast, the logit model has been widely used in many fields.

The decision to take membership in this study has been modelled as

$$\alpha_{ij} = \beta_j X_{ij} + \varepsilon_{ij}$$

Where,

$\alpha_{ij}$ = latent variable i.e., membership (j = 1 for membership in dairy cooperative societies) of the $i^{th}$ farmer

$\beta_j$ = vector of parameters to be estimated

$\varepsilon_{ij}$ = random-error of estimation

$X_{ij}$ = vector of independent variables affecting membership and includes the following variables like

*Age* (AGE) of dairy farmer is the number of years of the head of household. It is hypothesized that age of household head will be negatively related to membership in dairy cooperative which means that the older household head is less likely to participate in the dairy cooperatives. Younger farmers tend to be more enterprising, fast decision makers, and have capacity to adopt new technologies.

*Education* (EDU) refers to score obtained for the level of education (on a 10 point scale) of the household head. Education is expected to favour entry into the dairy cooperatives. Education and age is also an indicator of management capabilities.

*Social participation* (SOCIAL) is reflector of the respondent's character of being associated to various social groups like panchayat, religious organisations, political parties etc. Higher the social participation of a given household more is his probability of being a member of dairy co-operative societies. This variable was captured on a 20 point scale giving score 1 if he is a member of a given organisation and 2 if he is an office barrier.

*Herd size* represents overall herd strength of dairy animals. In this study herd strength was taken by two ways, one, as number of milch cows (HERD) and second, in terms of standard animal units (SAU) of the entire stock (including young animals and adult males). It can be considered a proxy for financial capability and production capacity of a farmer. A positive effect of this variable is expected on membership in the dairy cooperatives.

*Land ownership* (LAND) is the land in hectares as owned by the dairy farmer. Since, land is usually positively related to the herd size and availability of financial capital, it is postulated that larger farmers would select dairy cooperatives as compared to smaller ones.

*Distance to paved road* (DPR) is the distance from the household to metalled road measured in kilometres. It is expected to inversely related to the membership decision to dairy cooperatives. In general, the famers with lower transaction costs are more likely to become a member in the dairy cooperatives. Those living near roads would have easier access to dairy cooperatives thus, as the distance from paved road increases, the dairy farmers will refuse to take membership in the dairy cooperatives.

*Distance to market* (DM), the distance to a main market measured in kilometres is taken as a proxy for access to alternative markets. It is hypothesized that nearness to the market gives the dairy farmers more choice of selecting a dairy cooperative.

*Distance to milk collection centre* (DMCC) is the distance in kilometres to the collection centre of co-operative society in a given village. The more the farmer has to commute, the less he would opt for the cooperative agency.

*Provision of veterinary services* (INPUT) means provision of services like veterinary health services, breeding services, feed input support, credit and insurance facilities to be provided to a dairy farmer by the dairy cooperatives. The variable has been taken as dummy, D=1 if any service is provided by dairy cooperatives, D =0, otherwise. A positive relation is expected between veterinary services and membership to the dairy cooperatives.

*Price* is the main economic incentives for the membership in dairy cooperatives

Actual procurement price (PRICE) is the amount paid per litre of milk to a dairy farmer by the dairy cooperatives. Price offered is expected to be an important determinant to take membership in the dairy cooperatives. Higher the price paid by the dairy cooperative, higher will be the probability of the household to take membership in dairy cooperatives. Price has a significant effect on membership in the dairy cooperatives. Price appear to affect membership in dairy cooperative positively; i.e. as procurement price increases farmers tend to take membership in dairy cooperatives because of stable pricing policies adopted by dairy cooperatives.

**4.3.5.1.2. Second stage:- Impact of dairy cooperatives on net income and milk yield**

In the second stage, impacts of farmers' membership, $\boldsymbol{\alpha_{ij}}$ and their impacts on farmers' income and yield was studied.

**Estimation of Outcome Variables**

***Productivity:*** The information on milk drawn in pail during morning and evening was recorded for each animal. For animals that had calf at heal, the quantity of milk that the calf must be consuming was also noted. Thus, the daily milk yield of each lactating animal was recorded on the day of visit. The average productivity of animals (herd average) on each sample household was worked out as:

Productivity (lit./day) = Total milk production on the test day/ number of milch animals

From the estimates of daily productivity of each animal hence obtained, the average milk yield on each sample household was worked out.

***Net Income:*** The net income was computed from the detail information on the cost and returns in milk production.

Net Income (₹/animal) = Gross Returns – Gross Cost

The net income per animal was aggregated over number of animals in a household to arrive at dairy net income of the household from milk production.

The two impact equations are

$$\boldsymbol{YIELD_i = \beta_0 + \beta_1 M_i + \beta_2 NM_i + \beta_3 AGE_i + \beta_4 EDU_i + \beta_5 SOCIAL_i + \beta_6 DM_i + \beta_7 INPUT_i + \beta_8 SAU_i + \beta_9 IMR\_M_i + \beta_{10} IMR\_NM_i + u_i}$$

$$\boldsymbol{NET\_INC_i = \Upsilon_0 + \beta_1 M_i + \Upsilon_2 NM_i + \Upsilon_3 AGE_i + \Upsilon_4 EDU_i + \Upsilon_5 SOCIAL_i + \Upsilon_6 DM_i + \Upsilon_7 HERD_i + \Upsilon_8 PRICE_i + \Upsilon_9 IMR\_M_i + \Upsilon_{10} IMR\_NM_i + v_i}$$

Where,

YIELD = average productivity of milch animals on the sample households (lit./day)

NET_INC = Net income of households from milk production (₹ /day)

$M_i$ = Dummy for member group (= 1 for members, 0 for otherwise)

$NM_i$ = Dummy for non- member group (=1 for member, 0 for otherwise)

AGE = Age of household head (in years)

EDU = Educational score of the head of household

SOCIAL = Social participation score of the dairy farmer

DM = Distance from market (kms.)

PROVISION OF VETERINARY SERVICES = Dummy for veterinary services provided by dairy cooperatives like feed input support and credit to their members (=1 if provided, =0 for otherwise)

SAU = Standard Animal Unit

HERD = Number of milch animals of a given household

PRICE = Procurement price of milk (₹ /lit)

IMR_M = Inverse Mills Ratio for cooperative members

IMR_NM= Inverse Mills Ratio for cooperative non-members

*Age:* We hypothesized that age of household head will be negatively related to productivity and net income which means that the younger farmers are expected to be more enterprising, fast decision makers, and have capacity to adopt new technologies, leading to more productivity of dairy animals and hence net income.

*Membership:* It is expected to be positively related to net income and productivity of milch animals that means the dairy farmers who took membership in dairy cooperatives will have more productivity and hence net income.

*Education and social participation:* Social characteristics of dairy farmers like education and social participation are hypothesised to be positively related to the impact variables. Both these social variables are expected to increase managing capabilities and facilitate adoption of new technologies of the dairy farmer leading to more productivity and net income.

*Provision of veterinary services* : It expected to be positively related to productivity of milch animals, higher the services provided by dairy cooperatives more is the productivity of milch animals of the dairy farmers.

Distance to market is hypothesised to be negatively related to impact variables, as more the distance to market means lesser accessibility to inputs and hence lower productivity and net income.

SAU is expected to be negatively related to productivity of milch animals, as it imposes under resource constraint due to less availability of feed and fodder in the study area.

PRICE is hypothesised to be positively related to productivity and net income, higher the prices of milk more will be procurement of inputs like feed leading to more productivity and hence net income.

Both the impact equations were estimated in STATA 16.0. software.

# CHAPTER - 5

# RESULTS AND DISCUSSION

# 5. RESULTS AND DISCUSSION

In the view of the objectives set forth for this study, the data which was collected from respondents were analyzed by using appropriate statistical techniques. The results so obtained have been presented and discussed in this chapter. The interpretation and discussion is based on the findings of the study. Results are presented under different headings as follows:

5.1 General Profile of the Sample Households.

5.2 Cost and Returns of Milk Production.

5.3 Milk Production Function (Input-Output Relationship).

5.4 Marketed Surplus and Disposal Pattern of Milk.

5.5 Impact of Dairy Cooperatives on Farmer's income.

## 5.1 GENERAL PROFILE OF THE SAMPLE HOUSEHOLDS

Knowing general socio economic profile of the sample households is very important for interpretation of the major findings of the study. Therefore, this section throws light on distribution of sample households, education, family and herd size, occupation, feeding pattern, average milk yield, etc. Land is the main resource for the farmer and determines size of the production activity and the income status of the farmer. Similarly, family size and educational status determine the level of family labour availability and adoption of improved dairy farming practices, respectively. Therefore, an attempt is made in this section to document the important socio-economic characteristics of the sample households.

The primary data was collected from 160 dairy farmers of Andhra Pradesh, comprising 80 each from Guntur and Chittoor districts. Out of 80 farmers from each district, 40 were members and 40 were non-members of dairy cooperatives. The primary data was collected from respondents during the period of November, 2017 to February, 2018. The households were then post stratified into three categories on the basis of their herd size as per standard animal units (SAUs) by using cumulative square root frequency method. The three categories were i) small herd size category (1-3 SAUs), ii) medium herd size category (4-6 SAUs) and iii) large herd size category (> 6 SAUs). Then, households were categorized with respect to member and non-member dairy farmers. Based on the herd size categories in the present study, the member households were categorized into 19, 26 and 35 as small, medium and large farmers, respectively and non-members were categorized into 27, 33 and 20 as small, medium and large farmers, respectively (Table 5.1). The data collected have been analysed using different statistical measures and interpreted across herd-size categories of milk producers as well as overall.

**Table 5.1: Category-wise distribution of sample households across herd size category**

**(Numbers)**

| Particulars | Herd-size category | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Members | | | | Non-members | | | |
| | Small (1-3 SAUs) | Medium (4-6 SAUs) | Large (> 6 SAUs) | Overall | Small (1-3 SAUs) | Medium (4-6 SAUs) | Large (> 6 SAUs) | Overall |
| Farms | 19 (23.75) | 26 (32.50) | 35 (43.75) | 80 (100) | 27 (33.75) | 33 (41.25) | 20 (25.00) | 80 (100) |
| SAU/Farm | 2.79 | 5.68 | 10.41 | 7.06 | 2.65 | 4.87 | 7.29 | 4.73 |
| Milch SAU/Farm | 2.47 | 4.77 | 8.47 | 5.84 | 2.28 | 3.99 | 5.71 | 3.84 |

*Figures in parentheses indicate percentage of row total*

The proportion of small, medium, and large herd size categories were 23.75, 32.50, and 43.75 per cent among the member households and 33.75, 41.25 and 25 per cent among the non-member households, respectively. Overall, SAU/Farm for member and non-member households were 7.06 and 4.73, respectively. Where as, milch SAU/Farm for members and non-members were 5.84 and 3.84, respectively. It was found that both SAU/Farm as well as milch SAU/Farm were higher for members as compared to non-member groups. The distribution of sample households across herd size category of Guntur and Chittoor districts are presented in Appendix-1A.

### 5.1.1 Average Family Size and Composition of sample households

Information on the composition of family of the respondents gives an idea regarding supply of labour since animal rearing is basically a labour intensive activity and much of the labour requirements are met from the family itself. The particulars relating to this are presented in Table 5.2.

Table 5.2 depicts the average family size and composition across different herd size category among both member and non-member dairy farmers in Andhra Pradesh. The overall average family size of member group dairy farmers was 4.32 which were higher than non-member dairy farmers as their overall average family size was 3.94.

Inter category comparison among member dairy farmers revealed that the average family size was observed highest in case of large herd size category (4.57 members) followed by medium (4.31 members) and small herd size category (3.89 members), where as among non-member dairy farmers, the higher average family size was observed in case of large herd size category (4.32 members) followed by medium (3.97 members) and small herd size category (3.61 members). It was also observed that

**Table 5.2: Average family size and its composition across different herd size category**

**(Number/household)**

| Categories | Family composition | | | | | | | | Average family size | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Adult | | | | Children | | | | | |
| | Male | | Female | | Male | | Female | | | |
| | M | NM | M | NM | M | NM | M | NM | M | NM |
| Small | 1.68 (43.19) | 1.54 (42.66) | 1.42 (36.50) | 1.38 (38.23) | 0.47 (12.08) | 0.42 (11.63) | 0.32 (8.23) | 0.27 (7.48) | 3.89 (100) | 3.61 (100) |
| Medium | 1.77 (41.07) | 1.57 (39.55) | 1.50 (34.80) | 1.43 (36.02) | 0.58 (13.46) | 0.54 (13.60) | 0.46 (10.67) | 0.43 (10.83) | 4.31 (100) | 3.97 (100) |
| Large | 1.80 (39.39) | 1.74 (40.28) | 1.57 (34.35) | 1.53 (35.42) | 0.69 (15.10) | 0.58 (13.43) | 0.51 (11.16) | 0.47 (10.88) | 4.57 (100) | 4.32 (100) |
| Overall | 1.76 (40.74) | 1.60 (40.66) | 1.51 (34.96) | 1.44 (36.52) | 0.60 (13.92) | 0.51 (12.97) | 0.45 (10.38) | 0.39 (9.84) | 4.32 (100) | 3.94 (100) |

*(Figures in parentheses are in percentage)* M-Member, NM-Non-member

Small = 1-3 SAUs, Medium = 4-6 SAUs, Large = > 6 SAUs

There was positive association between average family size and the herd size category in both member and non-member dairy farmers. In both member and non-member group of farmer's, proportion of males was higher than females among all three category of dairy farmers. The average number of adults was higher than those of children in both the groups. Further, the number of adults was higher than those of children in both the groups implying relatively more availability of work force for dairy enterprise in the study area. Average family size and its composition across different herd size categories of Guntur and Chittoor districts are presented in Appendix-1B.

### 5.1.2 Educational Status of Head of the Sample Households

Education is believed to be the facilitating factor in realizing higher performance in dairy enterprise. The awareness and knowledge level of farmer is best reflected through their higher education. Better education enables better comprehension of farming technologies and their possible adoption in farm enterprises. It shows significant effect on the decision making for different activities like pricing and selling of the products, diversification on the farm and level of profit. This especially true in dairy farming which warrants a better quality of management of inputs. The distribution of member and non-member households according to educational score of the head of the household is presented in Table 5.3.

The information of the Table 5.3 depicts the educational status of head of sample households across different herd size categories of Andhra Pradesh. In case of member dairy farmers 16.25 per cent heads of families were illiterate, 22.50 per cent had primary school level education, 28.75 per cent had studied up to secondary level, 23.75 per cent had higher secondary level education and 8.75 per cent were found educated up to graduation or above level.

**Table 5.3: Educational status of heads of sample households across herd size category**

| Educational score | Members | | | | Non-members | | | |
|---|---|---|---|---|---|---|---|---|
| | Small | Medium | Large | Overall | Small | Medium | Large | Overall |
| 0 (Illiterate) | 4.00 (21.05) | 6.00 (23.08) | 3.00 (8.57) | 13.00 (16.25) | 3.00 (11.11) | 5.00 (15.15) | 1.00 (5.00) | 9.00 (11.25) |
| 1 (Primary) | 6.00 (31.58) | 4.00 (15.38) | 8.00 (22.86) | 18.00 (22.50) | 5.00 (18.52) | 9.00 (27.27) | 7.00 (35.00) | 21.00 (26.25) |
| 2 (Secondary) | 5.00 (26.32) | 8.00 (30.77) | 10.00 (28.57) | 23.00 (28.75) | 9.00 (33.33) | 8.00 (24.24) | 6.00 (30.00) | 23.00 (28.75) |
| 3 (Higher secondary) | 4.00 (21.05) | 7.00 (26.92) | 8.00 (22.86) | 19.00 (23.75) | 5.00 (18.52) | 8.00 (24.24) | 3.00 (15.00) | 16.00 (20.00) |
| 4 (Graduation & above) | 0.00 (0.00) | 1.00 (3.85) | 6.00 (17.14) | 7.00 (8.75) | 5.00 (18.52) | 3.00 (9.09) | 3.00 (15.00) | 11.00 (13.75) |
| Total | 19.00 (100.00) | 26.00 (100.00) | 35.00 (100.00) | 80.00 (100.00) | 27.00 (100.00) | 33.00 (100.00) | 20.00 (100.00) | 80.00 (100.00) |

*Figures in parentheses indicate percentage of row total*

Small = 1-3 SAUs, Medium = 4-6 SAUs, Large = > 6 SAUs

Similarly, in case of non-member group 11.25 per cent were illiterate, 26.25 per cent had primary school level education, 28.75 per cent had secondary level education, 20 per cent had higher secondary level education and 13.75 per cent were found up to graduation or above level. The illiteracy level was observed to be maximum for medium herd size category in both member and non-member groups. It could be concluded that a maximum percentage of respondents, both members (28.75 per cent) and non-members (28.75 per cent) had studied up to secondary level education. It was observed during investigation that both the member and non-member groups had similar views about scientific dairy practices such as artificial insemination and they strongly believed in artificial breeding. The distribution of member and non-member households of Guntur and Chittoor districts according to education of the head of household is presented in Appendix-1C.

### 5.1.3 Occupational Status of Sample households

Occupational status of sample households is given in the Table 5.4. The information regarding the occupation of the households is useful to see the adoption of the dairy farming as subsidiary or main occupation. Since the agriculture and allied activities potential in the study area is high, thus, the main occupation of majority of the farmers was found agriculture and the dairy farming was the subsidiary occupation. In case of member group, overall, 47.50 per cent of the households were adopting

**Table 5.4: Occupational status of sample households**

**(Numbers)**

| Occupation | Particulars | Members | | | | Non-members | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **Small** | **Medium** | **Large** | **Overall** | **Small** | **Medium** | **Large** | **Overall** |
| **Main** | Agriculture | 7 (36.84) | 12 (46.15) | 19 (54.29) | 38 (47.50) | 12 (44.44) | 15 (45.45) | 4 (20.00) | 31 (38.75) |
| | Dairy | 10 (52.63) | 11 (42.31) | 10 (28.57) | 31 (38.75) | 3 (11.11) | 6 (18.18) | 9 (45.00) | 18 (22.50) |
| | Agricultural labour | - | - | - | - | 2 (7.41) | 2 (6.06) | 1 (5.00) | 5 (6.25) |
| | Business | 1 (5.26) | 2 (7.69) | 4 (11.43) | 7 (8.75) | 5 (18.52) | 8 (24.24) | 4 (20.00) | 17 (21.25) |
| | Rural artisans | 1 (5.26) | - | 1 (2.86) | 2 (2.50) | 1 (3.70) | 1 (3.03) | 1 (5.00) | 3 (3.75) |
| | Services | - | - | 1 (2.86) | 1 (1.25) | 3 (11.11) | - | 1 (5.00) | 4 (5.00) |
| | Others | - | 1 (3.85) | - | 1 (1.25) | 1 (3.70) | 1 (3.03) | - | 2 (2.50) |
| | Total | 19 (100) | 26 (100) | 35 (100) | 80 (100) | 27 (100) | 33 (100) | 20 (100) | 80 (100) |
| **Subsidiary** | Agriculture | 6 (31.58) | 9 (34.62) | 10 (28.57) | 25 (31.25) | 4 (14.81) | 8 (24.24) | 5 (25.00) | 17 (21.25) |
| | Dairy | 11 (57.89) | 11 (42.31) | 11 (31.43) | 33 (41.25) | 11 (40.74) | 13 (39.39) | 8 (40.00) | 32 (40.00) |
| | Agricultural labour | 2 (10.53) | 2 (7.69) | 4 (11.43) | 8 (10.00) | 4 (14.81) | 4 (12.12) | 2 (10.00) | 10 (12.50) |
| | Business | - | 2 (7.69) | 4 (11.43) | 6 (7.50) | 1 (3.70) | 3 (9.09) | 4 (20.00) | 8 (10.00) |
| | Rural artisans | - | - | 3 (8.57) | 3 (3.75) | 5 (18.52) | 3 (9.09) | - | 8 (10.00) |
| | Services | - | 2 (7.69) | 2 (5.71) | 4 (5.00) | 2 (7.41) | 2 (6.06) | 1 (5.00) | 5 (6.25) |
| | Others | - | - | 1 (2.86) | 1 (1.25) | - | - | - | - |
| | Total | 19 (100) | 26 (100) | 35 (100) | 80 (100) | 27 (100) | 33 (100) | 20 (100) | 80 (100) |

*Figures in parentheses indicate percentage*

Small = 1-3 SAUs, Medium = 4-6 SAUs, Large = > 6 SAUs

agriculture as main occupation, while dairy farming was adopted as main occupation by 38.75 per cent of the member households as against 38.75 per cent of the households were adopting agriculture as main occupation and 22.50 per cent of households adopting

dairy farming as main occupation in case of non-member group. Dairying was observed as main occupation of 52.63 per cent of small herd size category, 42.31 per cent of medium herd size category and 28.57 per cent of large herd size category households in case of member group where as in case of non-member group, dairying was observed as main occupation of 45.00 per cent of large herd size category, 18.18 per cent of medium herd size category and 11.11 per cent of small herd size category households. As evident from the Table 5.4, an overall 41.25 per cent households occupied with dairying as subsidiary occupation followed by agriculture (31.25 per cent) and business (8.75 percent) in case of member group where as in case of non-member group, an overall 40.00 per cent households occupied with dairying as subsidiary occupation followed by agriculture (21.25 per cent) and business (21.25 per cent). Among herd size categories, the highest adoption of dairy farming as subsidiary occupation was observed in case of small herd size category among both member and non-member groups. Occupational status of sample households of Guntur and Chittoor district is presented in Appendix-1D.

### 5.1.4 Composition of Dairy Herd

The herd strength and the number of milch animals in the study area comprises of local cow, crossbred cow and Buffaloes. The cattle population comprises of milch animals, heifers, calves below 1 year age and calves between 1 to 2 years age (Table 5.5).

The Table 5.5 depicts the composition of herd for members and non-members across different herd size categories of Andhra Pradesh. This study area comprises of crossbred cows (Figure 5.1 and Figure 5.2), local cows (Figure 5.3) and buffaloes (Figure 5.4). It was observed that total number of milch crossbred cow for member group was 160 (56.14 per cent) which was more than non-member group i.e 95 (55.88 per cent). Similarly, the total milch local cows was found to be 50 (60.20 per cent) and 27 (57.40 per cent) for members and non-members, respectively. The total milch buffaloes was found to be 129 (54.20 per cent) and 105 (53.03 per cent) for members and non-members, respectively. In case of both members and non-members the cattle population was found to be more in crossbred cows followed by buffaloes and local cows. The composition of herd for members and non-members across different herd size categories of Guntur and Chittoor districts is presented in Appendix-1F.

**Fig. 5.1 Crossbred cow (Holstein Friesian cow) reared by the farmers**

**Fig.5.2 Crossbred cow (Jersey cow) reared by the farmers**

**Plate-2**

**Fig. 5.3 Local cow reared by the farmers**

**Fig. 5.4 Murrah buffaloes reared by the farmers in the study area**

**Plate-3**

**Table 5.5 : Herd composition by groups across herd size categories**

| Herd Size category | Milch Animal | Heifer | Calf (≤1 year) | Calf (1-2 years) | Total | Milch Animal | Heifer | Calf (≤1 year) | Calf (1-2 years) | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | Members | | | | | Non-Members | | | | |
| **Local cow*** | | | | | | | | | | |
| Small | 5 (83.30) | 0 (0.00) | 1 (16.70) | 0 (0.00) | 6 (100.00) | 4 (80.00) | 0 (0.00) | 1 (20.00) | 0 (0.00) | 5 (100.00) |
| Medium | 13 (56.50) | 2 (8.70) | 6 (26.10) | 2 (8.70) | 23 (100.00) | 10 (62.50) | 1 (6.30) | 3 (18.80) | 2 (12.50) | 16 (100.00) |
| Large | 32 (59.30) | 4 (7.40) | 12 (22.20) | 6 (11.10) | 54 (100.00) | 13 (50.00) | 3 (11.50) | 7 (26.90) | 3 (11.50) | 26 (100.00) |
| Overall | 50 (60.20) | 6 (7.20) | 19 (22.90) | 8 (9.60) | 83 (100.00) | 27 (57.40) | 4 (8.50) | 11 (23.40) | 5 (10.60) | 47 (100.00) |
| **Crossbred cow** | | | | | | | | | | |
| Small | 10 (52.63) | 1 (5.26) | 7 (36.84) | 1 (5.26) | 19 (100.00) | 13 (44.83) | 3 (10.34) | 11 (37.93) | 2 (6.90) | 29 (100.00) |
| Medium | 41 (57.75) | 3 (4.23) | 26 (36.62) | 1 (1.41) | 71 (100.00) | 45 (60.00) | 2 (2.67) | 17 (22.67) | 11 (14.67) | 75 (100.00) |
| Large | 109 (55.90) | 8 (4.10) | 61 (31.28) | 17 (8.72) | 195 (100.00) | 37 (56.06) | 4 (6.06) | 22 (33.33) | 3 (4.55) | 66 (100.00) |
| Overall | 160 (56.14) | 12 (4.21) | 94 (32.98) | 19 (6.67) | 285 (100.00) | 95 (55.88) | 9 (5.29) | 50 (29.41) | 16 (9.41) | 170 (100.00) |
| **Buffalo** | | | | | | | | | | |
| Small | 22 (55.00) | 0 (0.00) | 16 (40.00) | 2 (5.00) | 40 (100.00) | 30 (60.00) | 1 (2.00) | 15 (30.00) | 4 (8.00) | 50 (100.00) |
| Medium | 36 (56.25) | 3 (4.69) | 22 (34.38) | 3 (4.69) | 64 (100.00) | 45 (49.45) | 5 (5.49) | 31 (34.07) | 10 (10.99) | 91 (100.00) |
| Large | 71 (52.99) | 10 (7.46) | 45 (33.58) | 8 (5.97) | 134 (100.00) | 30 (52.63) | 5 (8.77) | 13 (22.81) | 9 (15.79) | 57 (100.00) |
| Overall | 129 (54.20) | 13 (5.46) | 83 (34.87) | 13 (5.46) | 238 (100.00) | 105 (53.03) | 11 (5.56) | 59 (29.800 | 23 (11.62) | 198 (100.00) |

*Figures in parentheses indicate percentage of row total*

*Particular to Chittoor district only.

Small = 1-3 SAUs, Medium = 4-6 SAUs, Large = > 6 SAUs

### 5.1.5 Average Size of Land holdings

Land is the main resource base of the farmers in the production process. In agriculture, land holding determines the livelihood status of the farmers. The economic and social progress of the households largely depends on the size of operational holdings. There exists interdependency between crop farming and livestock maintenance. The average size of land holdings across different herd size categories of Andhra Pradesh is presented in Table 5.6.

**Table 5.6 : Average land holdings and area under fodder crop of sample households**

| Herd size Category | Average land holdings (acres) | | Area under fodder crop (% to land holdings) | |
|---|---|---|---|---|
| | Member | Non-Member | Member | Non-Member |
| Small | 3.19 | 4.63 | 0.77 (24.25) | 0.44 (9.83) |
| Medium | 3.59 | 5.24 | 1.08 (30.82) | 0.53 (10.15) |
| Large | 4.49 | 5.72 | 1.18 (26.42) | 0.71 (12.16) |
| Overall | 3.82 | 5.25 | 1.01 (28.13) | 0.56 (10.18) |

*Figures in parentheses indicate percentage*
Small = 1-3 SAUs, Medium = 4-6 SAUs, Large = > 6 SAUs

Table 5.6 depicts the average size of land holdings and area under fodder crop of sample households. It was observed that overall average land holding in non -member group (5.25 acres) was higher than member group dairy farmers (3.82 acres). The area under fodder crop was found to be 1.01 acres (28.13 per cent) for members as against 0.56 acres (10.18 per cent) for non-members. Average land holding was found to be highest in case of large herd size category for both members (4.49 acres) and non-members (5.72 acres). The size of operational land holding increased with an increase in the herd size in both the groups thus, revealing a direct relationship between herd size and land holding.

Area under fodder crops was found to be maximum in case of large herd size category households for both members and non-members at 1.18 acres (26.42 per cent) and 0.71 acres (12.16 per cent), respectively. It was observed that although the average land holding was more in case of non-members but the area under fodder crops was found to be more for member group. This indicates that members gave more importance to proper feeding to the animals and also due to better quality seed inputs provided by the dairy cooperatives for the member dairy farmers at subsidized rates. The average size of land holdings across different herd size categories of Guntur and Chittoor districts is presented in Appendix-1E.

### 5.1.6 Average Daily Milk Yield of Milch Animals

Milk yield is the main output of a dairy enterprise. It depends upon many factors. The important factors are breed of animal, type of feed and fodder,etc. It has economic significance that ultimately bring returns to the milk producers. The peak yield in a month or period was observed and recorded for different species to adjudge the productivity of milch animals across different herd size categories. The peak yield approximation was used to estimate milk yield per animal per day. The milk yield per milch animal per day for both members and non-members of Andhra Pradesh is presented in the Figure 5.5.

As depicted in the Figure 5.5, the average daily milk production was highest for large farmers for local cow, crossbred cow and buffalo in both the groups and was least for small herd size category. Average milk yield for local cow in case of large farmers was 6.85 and 6.47 litres for members and non-members, respectively. Similar figures for small farmers were 5.65 and 5.33 litres for members and non-members, respectively. Average milk yield for crossbred cow in case of large farmers was 11.46 and 10.25 litres for members and non-members, respectively. Similar figures for small farmers were 10.83 and 9.62 litres for members and non-members, respectively. Similarly, the average daily milk yield for buffalo was highest for large farmers at 9.78 litres for members and 8.70 litres for non-members and was lowest for small farmers at 9.02 litres for members against 7.93 litres for non-members. In case of all the three local cow, crossbred cow and buffalo the average daily milk yield for members was found to be more than non-members. This may be due to better breed of animals maintained by the members. The average milk yield for local cow in member group ranged from 5.65 for small herd size category to 6.85 litres for large herd size category with an overall milk yield of 6.44 litres. The average milk yield for crossbred cow in member group ranged from 10.83 for small herd size category to 11.46 litres for large herd size category with an overall milk yield of 11.19 litres. The average milk yield for buffalo in member group ranged from 9.02 for small herd size category to 9.78 litres for large herd size category with an overall milk yield of 9.47 litres. The average daily milk yield for crossbred cow was found to be more followed by buffalo and local cow in case of both members and non-members. The milk yield per milch animal per day for both members and non-members of Guntur and Chittoor districts is presented in Appendix-1H.

### 5.1.7 Feeding Pattern of Milch Animals

Green fodder, dry fodder and concentrates were the major sources of feed for milch animals to supply the required roughages, nutrients and minerals for optimum growth and production. The assessment of feeds and fodder fed and the expenditure incurred on feeding is an essential component from the cost of milk production point of view. Feed and fodder is an important factor of animal productivity. The green fodder in the study area comprised of Napier grass, Jowar, Berseem, Dhaincha and cowpea tops (Figure 5.6) whereas dry fodders consisted of Wheat straw, Paddy straw and Jowar straw (Figure 5.7). Concentrate were generally homemade comprising of various proportions of grains, pulse husks, rice bran etc. Groundnut cake was also given as concentrate. Balanced concentrate feed was given in the form of ***"Sangam dhana"*** supplied by the dairy cooperatives at subsidied rate (Figure 5.8). In the study area it is a common practice to take only buffaloes for grazing. The average daily feed intake per milch animal for local cows, crossbred cows and buffaloes has been presented in Table 5.7.

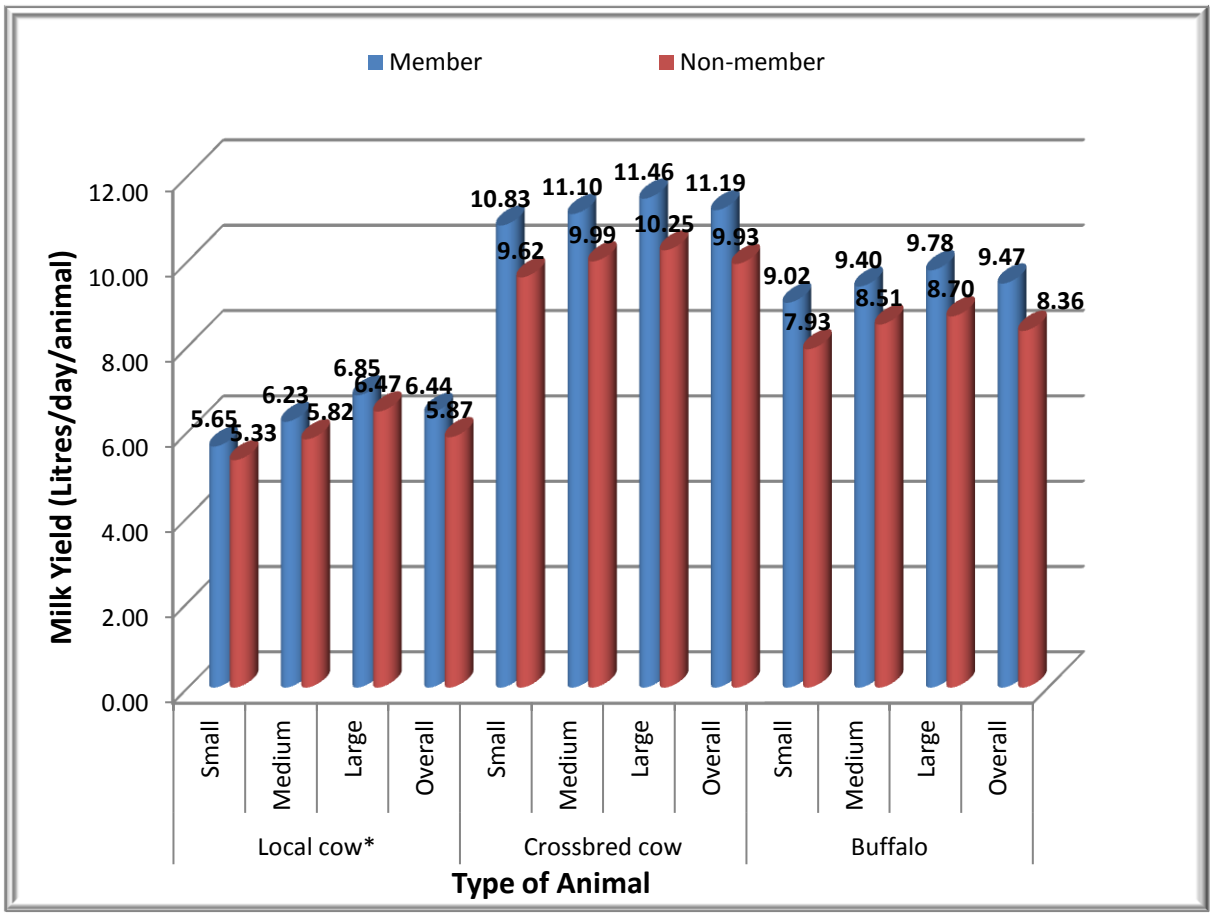


**Figure 5.5: Average daily milk yield of milch animals by groups across different herd size categories**

*particular to Chittoor district only.

**Table 5.7 Average intake of feed and fodder fed to the animals across different herd size category**

**(kg/animal/day)**

| Feed and fodder | Animal type | Herd Size Category | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Small | | Medium | | Large | | Overall | |
| | | M | NM | M | NM | M | NM | M | NM |
| Green Fodder | Local cow* | 15.14 | 14.08 | 15.42 | 14.25 | 15.98 | 14.79 | 15.65 | 14.36 |
| | Crossbred | 20.09 | 18.63 | 21.41 | 19.62 | 23.41 | 20.39 | 21.97 | 19.47 |
| | Buffalo | 23.77 | 22.65 | 24.52 | 23.83 | 25.49 | 24.47 | 24.76 | 23.59 |
| Dry Fodder | Local cow* | 5.04 | 4.95 | 5.38 | 5.26 | 5.54 | 5.43 | 5.40 | 5.22 |
| | Crossbred | 4.45 | 4.63 | 4.69 | 4.94 | 5.16 | 5.15 | 4.84 | 4.89 |
| | Buffalo | 5.43 | 5.05 | 5.62 | 5.33 | 5.86 | 5.61 | 5.68 | 5.31 |
| concentrate | Local cow* | 2.69 | 2.71 | 2.87 | 2.96 | 3.16 | 3.29 | 2.98 | 2.98 |
| | Crossbred | 3.38 | 3.58 | 3.69 | 3.80 | 3.80 | 3.97 | 3.67 | 3.77 |
| | Buffalo | 3.91 | 3.85 | 4.24 | 4.17 | 4.56 | 4.46 | 4.30 | 4.13 |

*particular to Chittoor district only M-Member, NM-Non-member

**Fig 5.6 Green fodder fed to the cattle**

**Fig 5.7 Dry fodder fed to the cattle**

**Plate - 4**


**Fig 5.8 Concentrate fed to the cattle**

**Fig 5.9 Electronic milk analyzer**

**Plate -5**

Persual of the Table 5.7 shows that overall average daily quantity of green fodder, dry fodder and concentrates fed per milch local cow were 15.65 kg, 5.40 kg and 2.98 kg for member group as against 14.36 kg, 5.22 kg and 2.97 kg for non-member groups, respectively. Further, the quantity of green fodder, dry fodder and concentrate fed were observed to be higher in member group than non-member group. However, for crossbred cows the overall average daily quantity of green fodder, dry fodder and concentrates fed per milch cow were observed to be 21.97 kg, 4.84 kg and 3.67 kg for member group which was relatively higher than the corresponding figures of 19.47 kg, 4.89 kg and 3.77 kg for non-member groups, respectively. Similarly, overall average daily quantity of green fodder, dry fodder and concentrates fed per milch buffaloes were 24.76 kg, 5.68 kg and 4.30 kg for member group as against 23.59 kg, 5.31 kg and 4.13 kg for non-member groups, respectively. The average daily feed intake per milch animal for local cows, crossbred cows and buffaloes in Guntur and Chittoor districts has been presented in Appendix-1G.

## 5.2 COST AND RETURNS OF MILK PRODUCTION

An analysis of cost of milk production guides the decision making bodies and the policy makers to understand whether or not farmers are getting remunerative prices required for dairy development to meet the future demand. There is a desirability as well as scope for developing the dairy sector both as a specialized or a supplementary enterprise. Keeping this in view, an effort was made using the appropriate methodology to estimate costs and returns of different types of milch animals in this section.

Dairy farmers can increase their family income in two ways *i.e.,* by increasing milk production or by reducing cost of milk production. The first alternative is limited as productivity enhancement of the individual milch animal is influenced by certain biological as well as climatic factors such as genetic potential of the animal, climatic parameter like temperature, rainfall, relative humidity, etc. These externalities by no means are subjected to control by the farmer and their, an economic sense can only be applied on the latter issue. The second alternative can be achieved through judicious use of various factors of production.

The cost and returns was worked out for different species of milch animals based on per day milk production across different herd size categories. The cost component comprises of fixed and variable cost. Fixed costs included depreciation on cattle shed and stores, dairy equipments and milch animals. Variable cost included expenditure on green fodder, dry fodder, concentrates, human labour and miscellaneous items. Variable cost forms the major part of the total cost. Returns are obtained by selling of milk. The value of dung was deducted from gross cost to estimate net cost of maintaining animal.

### 5.2.1 Cost and Returns of Milk Production from Local cow in Chittoor district

Table 5.8 shows that the average maintenance cost per day were found to be more for members (₹ 208.38) in comparison to non-members (₹ 200.10). In case of both

**Table 5.8 Cost and returns of milk production from local cow by groups across herd size categories of Chittoor district**

(₹ /animal/day)

| Cost Components | Small | | Medium | | Large | | Overall | |
|---|---|---|---|---|---|---|---|---|
| | M | NM | M | NM | M | NM | M | NM |
| Total Fixed Cost (TFC) | 24.58 (12.58) | 23.77 (12.51) | 25.16 (12.27) | 24.2 (12.14) | 26.15 (12.03) | 25.23 (11.94) | 25.55 (12.26) | 24.38 (12.18) |
| Green Fodder (F1) | 60.56 (46.77) | 56.32 (44.92) | 61.68 (45.61) | 57.00 (43.19) | 63.92 (44.47) | 59.16 (41.88) | 62.60 (45.21) | 57.44 (43.26) |
| Dry Fodder (F2) | 15.12 (11.68) | 14.85 (11.84) | 16.14 (11.94) | 15.78 (11.96) | 16.62 (11.56) | 16.29 (11.53) | 16.20 (11.70) | 15.65 (11.79) |
| Concentrate (F3) | 53.8 (41.55) | 54.20 (43.23) | 57.40 (42.45) | 59.20 (44.86) | 63.20 (43.97) | 65.80 (46.58) | 59.67 (43.090 | 59.68 (44.95) |
| Feed & Fodder cost (V1= F1+F2+F3) | 129.48 (75.77) | 125.37 (75.44) | 135.22 (75.18) | 131.98 (75.37) | 143.74 (75.15) | 141.25 (75.91) | 138.48 (75.26) | 132.78 (75.56) |
| Labour cost (V2) | 21.17 (12.39) | 20.97 (12.62) | 22.67 (12.60) | 21.56 (12.31) | 23.86 (12.47) | 22.25 (11.96) | 23.00 (12.50) | 21.59 (12.29) |
| Miscellaneous cost (V3) | 20.23 (11.84) | 19.85 (11.94) | 21.98 (12.22) | 21.56 (12.31) | 23.67 (12.38) | 22.58 (12.13) | 22.52 (12.24) | 21.35 (12.15) |
| Total variable cost (TVC= V1+V2+V3) | 170.88 (87.42) | 166.20 (87.49) | 179.87 (87.73) | 175.1 (87.86) | 191.27 (87.97) | 186.08 (88.06) | 184.00 (88.30) | 175.72 (87.82) |
| Gross cost (A= TFC+TVC) | 195.46 (100.00) | 190 (100.00) | 205.03 (100.00) | 199.3 (100.00) | 217.42 (100.00) | 211.31 (100.00) | 208.38 (100.00) | 200.10 (100.00) |
| Value of dung (B) | 3.98 | 3.67 | 4.12 | 3.98 | 4.36 | 4.11 | 4.22 | 3.93 |
| Net cost ( C= A-B) | 191.48 | 186.3 | 200.91 | 195.32 | 213.06 | 207.20 | 204.16 | 196.18 |
| Price of milk | 32.35 | 33.26 | 32.56 | 33.78 | 33.45 | 34.24 | 32.97 | 33.76 |
| Average milk production/animal/day ( E ) (in litres) | 5.65 | 5.33 | 6.23 | 5.82 | 6.85 | 6.47 | 6.44 | 5.87 |
| Gross return (D) | 182.78 | 177.28 | 202.85 | 196.60 | 229.13 | 221.53 | 212.27 | 198.12 |
| Net return ( D-C ) | -8.70 | -9.01 | 1.94 | 1.28 | 16.07 | 14.33 | 8.10 | 1.94 |
| Cost/litre ( C/E ) | 33.89 | 34.95 | 32.25 | 33.56 | 31.10 | 32.02 | 31.71 | 33.43 |
| Return / litre | -1.54 | -1.69 | 0.31 | 0.22 | 2.35 | 2.22 | 1.26 | 0.33 |

*Figures in parentheses indicate the percentage with their respective totals*

M – Member, NM – Non-member

Small = 1-3 SAUs, Medium = 4-6 SAUs, Large = > 6 SAUs

members and non-members gross cost was highest for large farmers at ₹ 217.42 and ₹ 211.31, respectively and least for small farmers at ₹ 195.46 and ₹ 190.00, respectively. The fixed cost was found to be ₹ 25.55 in case of members and ₹ 24.38 in case of non-members. The total variable cost was found to be ₹ 184.00 and ₹ 175.72 per local cow for members and non-members, respectively. Thus, fixed cost accounted for about 12.26 per cent for members and 12.18 per cent for non-members whereas variable cost accounted for 88.30 per cent for members and 87.82 per cent for non-members, respectively. Feed and fodder cost accounted for 75.26 per cent of the total variable cost followed by labour cost at 12.50 per cent for members whereas in case of non-members feed and fodder cost accounted for 75.56 per cent of the total variable cost followed by labour cost at 12.29 per cent.

The per litre cost of milk production in case of members (₹ 31.71) was lower than that of non-members (₹ 33.43). In case of members, the cost per litre was found to be highest for small farmers (₹ 33.89) and was least for large farmers (₹ 31.10). Similarly, for non-members the cost per litre was highest for small farmers (₹ 34.95) and least for large farmers (₹ 32.02). The net return per litre was more for member (₹ 1.26) than non-member (₹ 0.33). The net return per litre was found negative for small farmers and positive for medium and large farmers in case of both member and non-member groups. The net return per litre in case of members was highest for large farmers (₹ 2.35) and was least for small farmers (₹ -1.54). Similarly, in case of non-members the return per litre was highest for large farmers (₹ 2.22) and least for small farmers (₹ -1.69). Though the net return was less as compared to crossbred and buffalo but people in the study area also rearing indigeneous cow because they are easily adaptable to the existing climate and also the maintenance cost was less as compared to crossbred and buffalo.

### 5.2.2 Cost and Returns of Milk Production from Crossbred cow in Andhra Pradesh

Table 5.9 shows that the average maintenance cost per day were found to be more for members (₹ 262.85) in comparison to non-members (₹ 251.61). This is in conformity with earlier studies carried out by Rao and Singh (1995a) and Tanwar *et al.* (2012). This is due to increased awareness among the members regarding the importance of proper feed for animals. In case of both members and non-members gross cost was highest for large farmers at ₹ 274.30 and ₹ 260.00, respectively and least for small farmers at ₹ 248.95 and ₹ 241.92, respectively. The fixed cost was found to be ₹ 31.47 in case of members and ₹ 30.19 in case of non-members. The total variable cost was found to be ₹ 232.67 and ₹ 221.43 per crossbred cow for members and non-members, respectively. Thus, fixed cost accounted for about 11.97 per cent for members and 11.68 per cent for non-members whereas variable cost accounted for 88.52 per cent for members and 88.00 per cent for non-members, respectively. Feed and fodder cost accounted for 75.53 per cent of the total variable cost followed by labour cost at 14.14 per cent for members whereas in case of non-members feed and fodder cost accounted for 75.84 per cent of the total variable cost followed by labour cost at 14.45 per cent. The per cent share of feed cost increased with increase in herd size category in both member and non-member groups.

**Table 5.9 Cost and returns of milk production from crossbred cow by groups across herd size categories in Andhra Pradesh**

(₹ /animal/day)

| Cost Components | Herd Size Category | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Small | | Medium | | Large | | Overall | |
| | M | NM | M | NM | M | NM | M | NM |
| Total Fixed Cost (TFC) | 30.86 (12.39) | 29.33 (12.12) | 31.21 (11.93) | 31.6 (12.42) | 31.99 (11.66) | 29.01 (11.16) | 31.47 (11.97) | 30.19 (11.68) |
| Green Fodder (F1) | 80.36 (49.79) | 74.50 (46.56) | 85.62 (49.34) | 78.46 (46.35) | 93.64 (50.57) | 81.56 (46.23) | 87.88 (50.01) | 77.90 (46.39) |
| Dry Fodder (F2) | 13.36 (8.28) | 13.89 (8.68) | 14.07 (8.11) | 14.83 (8.76) | 15.48 (8.36) | 15.46 (8.76) | 14.52 (8.26) | 14.67 (8.73) |
| Concentrate (F3) | 67.67 (41.93) | 71.61 (44.76) | 73.85 (42.55) | 75.98 (44.89) | 76.04 (41.07) | 79.39 (45.00) | 73.34 (41.73) | 75.36 (44.88) |
| Feed & Fodder cost (V1= F1+F2+F3) | 161.39 (74.00) | 160.00 (75.26) | 173.53 (75.34) | 169.27 (75.95) | 185.16 (76.41) | 176.41 (76.37) | 175.73 (75.53) | 167.92 (75.84) |
| Labour cost (V2) | 31.99 (14.67) | 30.93 (14.55) | 32.83 (14.25) | 32.38 (14.53) | 33.47 (13.81) | 32.78 (14.19) | 32.91 (14.14) | 31.99 (14.45) |
| Miscellaneous cost (V3) | 24.72 (11.33) | 21.66 (10.19) | 23.98 (10.41) | 21.23 (9.52) | 23.69 (9.77) | 21.81 (9.44) | 24.03 (10.33) | 21.52 (9.72) |
| Total variable cost (TVC=V1+V2+V3) | 218.09 (87.61) | 212.59 (87.88) | 230.34 (88.07) | 222.87 (87.58) | 242.31 (88.34) | 230.99 (88.84) | 232.67 (88.52) | 221.43 (88.00) |
| Gross cost (A= TFC+TVC) | 248.95 (100.00) | 241.92 (100.00) | 261.55 (100.00) | 254.47 (100.00) | 274.3 (100.00) | 260.00 (100.00) | 262.85 (100.00) | 251.61 (100.00) |
| Value of dung (B) | 3.98 | 3.4 | 4.16 | 3.71 | 4.5 | 4.05 | 4.26 | 3.69 |
| Net cost ( C= A-B) | 244.97 | 238.52 | 257.39 | 250.76 | 269.8 | 255.95 | 258.59 | 247.92 |
| Price of milk | 26.19 | 26.85 | 26.805 | 27.62 | 27.12 | 27.9 | 26.79 | 27.43 |
| Average milk production/animal/ day ( E ) (in litres) | 10.83 | 9.62 | 11.1 | 9.99 | 11.46 | 10.25 | 11.19 | 9.93 |
| Gross return (D) | 283.45 | 258.16 | 297.54 | 275.87 | 310.74 | 285.98 | 298.26 | 271.25 |
| Net return ( D-C ) | 38.48 | 19.65 | 40.15 | 25.11 | 40.94 | 30.03 | 39.67 | 23.33 |
| Cost/litre ( C/E ) | 22.63 | 24.81 | 23.19 | 25.10 | 23.54 | 24.97 | 23.10 | 24.97 |
| Return / litre | 3.55 | 2.04 | 3.62 | 2.51 | 3.57 | 2.93 | 3.54 | 2.35 |

*Figures in parentheses indicate the percentage with their respective totals*

M – Member, NM – Non-member

Small = 1-3 SAUs, Medium = 4-6 SAUs, Large = > 6 SAUs

The per litre cost of milk production in case of members (₹ 23.10) was lower than that of non-members (₹ 24.97) and this is in conformity with the findings of earlier

studies of Kairon (1992) and Meena (2008). In case of members, the cost per litre was found to be highest for large farmers (₹ 23.54) and was least for small farmers (₹ 22.63). Similarly, for non-members the cost per litre was highest for medium farmers (₹ 25.10) and least for small farmers (₹ 24.81). The net return per litre was more for member (₹ 3.54) than non-member (₹ 2.35) and it is in conformity with earlier studies of Shukla *et al.* (1995). The net return per litre in case of members was highest for medium farmers (₹ 3.62) and was least for small farmers (₹ 3.55). Similarly, in case of non-members the return per litre was highest for large farmers (₹ 2.93) and least for small farmers (₹ 2.04).

### 5.2.3 Cost and Returns of Milk Production from Buffalo in Andhra Pradesh

Table 5.10 shows that the average maintenance cost per day were found to be more for members (₹ 302.97) in comparison to non-members (₹ 283.96). This is in conformity with earlier studies carried out by Rao and Singh (1995) and Tanwar *et al.* (2012). In case of both members and non-members gross cost was highest for large farmers at ₹ 314.56 and ₹ 299.00, respectively and least for small farmers at ₹ 287.24 and ₹ 271.24, respectively. The fixed cost was found to be ₹ 30.39 in case of members and ₹ 26.68 in case of non-members. The total variable cost was found to be ₹ 272.58 and ₹ 257.28 per buffalo for members and non-members, respectively. Thus, fixed cost accounted for about 10.03 per cent for members and 9.40 per cent for non-members whereas variable cost accounted for 89.97 per cent for members and 90.60 per cent for non-members, respectively. Feed and fodder cost accounted for 74.15 per cent of the total variable cost followed by labour cost at 16.38 per cent for members whereas in case of non-members feed and fodder cost accounted for 75.00 per cent of the total variable cost followed by labour cost at 16.25 per cent. The per cent share of feed cost increased with increase in herd size category in both member and non-member groups.

The per litre cost of milk production in case of members (₹ 31.56) was lower than that of non-members (₹ 33.54) and this is in conformity with the findings of earlier studies of Kairon (1992), Shukla *et al.* (1995) and Meena (2008). In case of members, the cost per litre was found to be highest for large farmers (₹ 31.74) and was least for medium farmers (₹ 31.39). Similarly, for non-members the cost per litre was highest for large farmers (₹ 33.90) and least for medium farmers (₹ 33.10). The net return per litre was more for member (₹ 4.61) than non-member (₹ 3.28) and it is in conformity with earlier studies of Shukla *et al.* (1995). The net return per litre in case of members was highest for medium farmers (₹ 4.82) and was least for small farmers (₹ 4.09). Similarly, in case of non-members the return per litre was highest for medium farmers (₹ 3.89) and least for small farmers (₹ 2.38).

Return per litre of milk was more for buffalo when compared with that of local cow and crossbred cow. Hence, buffalo is more profitable than local cow and crossbred cow in the study area. This is in conformity with the earlier studies carried out by Rao

**Table 5.10 Cost and returns of milk production from buffalo by groups across herd size categories in Andhra Pradesh**

(₹ /animal/day)

| Cost Components | Small | | Medium | | Large | | Overall | |
|---|---|---|---|---|---|---|---|---|
| | M | NM | M | NM | M | NM | M | NM |
| Total Fixed Cost (TFC) | 29.40 (10.24) | 25.87 (9.54) | 29.77 (9.96) | 26.76 (9.38) | 31.40 (9.98) | 27.66 (9.25) | 30.39 (10.03) | 26.68 (9.40) |
| Green Fodder (F1) | 95.08 (50.16) | 90.59 (49.58) | 98.06 (49.12) | 95.30 (48.94) | 101.95 (48.36) | 97.86 (48.00) | 99.05 (49.01) | 94.35 (48.90) |
| Dry Fodder (F2) | 16.28 (8.59) | 15.15 (8.29) | 16.87 (8.45) | 16.00 (8.21) | 17.57 (8.33) | 16.83 (8.25) | 17.03 (8.43) | 15.92 (8.25) |
| Concentrate (F3) | 78.18 (41.25) | 76.96 (42.12) | 84.71 (42.43) | 83.43 (42.84) | 91.29 (43.30) | 89.21 (43.75) | 86.04 (42.57) | 82.69 (42.85) |
| Feed & Fodder cost (V1= F1+F2+F3) | 189.54 (73.51) | 182.70 (74.46) | 199.63 (74.18) | 194.72 (75.33) | 210.81 (74.45) | 203.90 (75.14) | 202.12 (74.15) | 192.96 (75.00) |
| Labour cost (V2) | 42.45 (16.46) | 40.69 (16.58) | 44.56 (16.56) | 41.88 (16.20) | 45.89 (16.20) | 43.16 (15.90) | 44.64 (16.38) | 41.80 (16.25) |
| Miscellaneous cost (V3) | 25.85 (10.02) | 21.98 (8.96) | 24.92 (9.26) | 21.91 (8.47) | 26.47 (9.35) | 24.30 (8.95) | 25.81 (9.47) | 22.53 (8.76) |
| Total variable cost (TVC=V1+V2+V3) | 257.84 (89.76) | 245.37 (90.46) | 269.10 (90.04) | 258.51 (90.62) | 283.16 (90.02) | 271.35 (90.75) | 272.58 (89.97) | 257.28 (90.60) |
| Gross cost (A= TFC+TVC) | 287.24 (100.00) | 271.24 (100.00) | 298.87 (100.00) | 285.27 (100.00) | 314.56 (100.00) | 299.00 (100.00) | 302.97 (100.00) | 283.96 (100.00) |
| Value of dung (B) | 3.65 | 3.33 | 3.98 | 3.72 | 4.15 | 4.09 | 3.98 | 3.68 |
| Net cost ( C= A-B) | 283.59 | 267.91 | 294.89 | 281.55 | 310.41 | 294.91 | 298.99 | 280.29 |
| Price of milk | 35.53 | 36.19 | 36.21 | 37.00 | 36.48 | 37.35 | 36.16 | 36.81 |
| Average milk production/animal/ day ( E ) (in litres) | 9.02 | 7.93 | 9.40 | 8.51 | 9.78 | 8.70 | 9.47 | 8.36 |
| Gross return (D) | 320.48 | 286.81 | 340.19 | 314.64 | 356.73 | 324.90 | 342.64 | 307.66 |
| Net return ( D-C ) | 36.90 | 18.90 | 45.31 | 33.09 | 46.32 | 29.99 | 43.64 | 27.38 |
| Cost/litre ( C/E ) | 31.44 | 33.81 | 31.39 | 33.10 | 31.74 | 33.90 | 31.56 | 33.54 |
| Return / litre | 4.09 | 2.38 | 4.82 | 3.89 | 4.74 | 3.45 | 4.61 | 3.28 |

*Figures in parentheses indicate the percentage with their respective totals*

M – Member, NM – Non-member

Small = 1-3 SAUs, Medium = 4-6 SAUs, Large = > 6 SAUs

(1991) and Meena (2008). Cost and returns of milk production for Guntur and Chittoor districts were also worked out which is presented in Appendix-2.

## 5.3 MILK PRODUCTION FUNCTION (INPUT-OUTPUT RELATIONSHIP)

The milk production is a complex biological phenomenon controlled by a number of factors**.** The milch animal is only a biological machine which converts roughages and crude protein into milk which is a nutritutious and essential food item for the human beings. The milk conversion process is, however, controlled by genetic and non-genetic factors. Type of breed and ability for milk secretion by individual animals are the important genetic agents. The non-genetic factors influencing the milk production are type and quantity of feeds fed, order of lactation, stage of lactation, herd size, labour utilisation, climatic conditions etc.

In the present study, Cobb-Douglas production function was selected based on appropriate sign and statistical significance of parameter estimates accompanied by highest coefficient of multiple determination ($R^2$).

The most important inputs in milk production were green fodder, dry fodder, concentrates and labour. Since, different types of feeds were used by individual dairy farmers, it was not possible to transform these inputs into standard comparable units. However, the price of each ingredient indirectly reflects the quality of the input. It was, therefore, thought appropriate to express these inputs in value terms instead of physical terms. Hence, value of green fodder, dry fodder, concentrates along with value of labour, miscellaneous expenses were taken as the main explanatory variables and value of milk for individual animals was considered as the dependent variable.

### 5.3.1 Milk production function for buffaloes

Table 5.11 presents the results of estimated Cobb-Douglas production function for buffaloes for the member and non-member groups. A close perusal of the table revealed that the coefficient of multiple determination ($R^2$) for the member group and non-member group were 0.65 and 0.73, respectively which indicated that 65 and 73 per cent of total variation in returns from milk were explained by the variables included in the selected regression model.

A further perusal of the table revealed that green fodder appeared to be an important variable influencing buffalo milk production. Its coefficient was positive and statistically significant at P<0.01 for member and at P<0.05 for non-member group. On an average, one per cent increase in the expenditure on green fodder resulted in an increase of 0.529 per cent in returns from milk in member and 1.40 per cent in non-member group.

The regression coefficients of dry fodder was found to be positive but statistically non-significant in both the member and non-member groups. This suggested that there was no impact of feeding dry fodder on returns from milk.

Among the feed inputs, expenditure on concentrate was observed to be the single most important variable to influence the returns from milk significantly (P<0.01). On an average, one per cent increase in the expenditure on concentrate resulted in an increase of 0.42 per cent in returns from milk in member and 0.34 per cent in non-member group. Relatively higher returns from milk for one per cent increase in the expenditure on concentrate in member group as compared to non-member group could be due to provision of balanced cattle feed made by dairy cooperatives to members.

**Table 5.11 Estimated parameters of production function of buffalo milk**

| Variables | Member | | Non-member | |
|---|---|---|---|---|
| | **Regression coefficients** | **Standard error** | **Regression coefficients** | **Standard error** |
| Intercept | 1.0466 | 0.6401 | 0.9954 | 1.1464 |
| Value of Green Fodder (X1) | 0.5295** | 0.1247 | 1.4002* | 0.2353 |
| Value of Dry Fodder (X2) | 0.2165 | 0.1162 | 0.0759 | 0.3082 |
| Value of Concentrate (X3) | 0.4287** | 0.1349 | 0.3461** | 0.1390 |
| Value of Labour (X4) | 0.1091** | 0.0438 | 0.0976** | 0.0457 |
| Miscellaneous expenses (X5) | 0.0263 | 0.0271 | 0.0364 | 0.0551 |
| $R^2$ | 0.65 | | 0.73 | |
| N | 129 | | 105 | |
| Chow test value | 16.15** | | | |

*Significant at P<0.05, **Significant at P<0.01

The value of labour input was found to have positive and significant (P<0.01) impact on returns from milk in both member and non-member groups. On an average, one per cent increase in the expenditure on labour resulted in an increase of 0.109 per cent in returns from milk in member group and 0.09 per cent in non-member group. The per cent increase in returns from milk for one per cent increase in labour was relatively more in member group as compared to nonmember group which could be due to better management by members of cooperative societies.

The regression coefficients of miscellaneous expenses were found to be positive but statistically non-significant in both the member and non-member groups. The expenditure on miscellaneous items, was, thus, found to have no impact on returns from milk.

The positive and significant impact of green fodder and concentrate on returns from milk were in conformity with the findings of the earlier studies conducted by Sharma (1984), Sharma and Singh (1993), Shiyani (1993), Dixit (1999) and Arun kumar (2003).

The results of Chow test clearly indicated that two functions for member and non-member groups differed significantly (P<0.01). A similar result was reported by Shiyani (1993).

### 5.3.2 Milk production function for crossbred cows

Table 5.12 presents the results of estimated Cobb-Douglas production function for crossbred cows for the member and non-member groups. A close perusal of the table revealed that the coefficient of multiple determination ($R^2$) for the member group and non-member group were 0.53 and 0.62, respectively which indicated that 53 and 62 per cent of total variation in returns from milk were explained by the variables included in the selected regression model.

A further perusal of the table revealed that green fodder appeared to be an important variable influencing crossbred cow milk production. Its coefficient was positive and statistically significant at P<0.01 for member and at P<0.05 for non-member group. On an average, one per cent increase in the expenditure on green fodder resulted in an increase of 1.007 per cent in returns from milk in member and 0.16 per cent in non-member group. The per cent increase in returns from milk for one per cent increase in the expenditure on green fodder was relatively more in member group as compared to nonmember group.

The regression coefficients of dry fodder was found to be positive but statistically non-significant in both the member and non-member groups. This suggested that there was no impact of feeding dry fodder on returns from milk.

Among the feed inputs, expenditure on concentrate was observed to be the single most important variable to influence the returns from milk significantly (P<0.05). On an average, one per cent increase in the expenditure on concentrate resulted in an increase of 0.21 per cent in returns from milk in member and 0.17 per cent in non-member group. Relatively higher returns from milk for one per cent increase in the expenditure on concentrate in member group as compared to non-member group could be due to provision of balanced cattle feed made by dairy cooperatives to members.

The value of labour input was found to be positive and statistically non-significant impact on returns from milk in both member and non-member groups.

The regression coefficients of miscellaneous expenses were found to be negative but statistically non-significant in both the member and non-member groups. The expenditure on miscellaneous items was thus, found to have no impact on returns from milk.

**Table 5.12 Estimated parameters of production function of crossbred cow milk**

| Independent variables | Member | | Non-member | |
|---|---|---|---|---|
| | **Regression coefficients** | **Standard error** | **Regression coefficients** | **Standard error** |
| Intercept | 3.9264** | 1.0322 | 1.5505* | 0.6868 |
| Value of Green Fodder (X1) | 1.0077** | 0.2162 | 0.1603* | 0.0448 |
| Value of Dry Fodder (X2) | 0.02091 | 0.1275 | 0.0751 | 0.0572 |
| Value of Concentrate (X3) | 0.2108* | 0.0959 | 0.1756* | 0.0762 |
| Value of Labour (X4) | 0.0166 | 0.0347 | 0.0798 | 0.0586 |
| Miscellaneous expenses (X5) | -0.046 | 0.0274 | -0.0494 | 0.0433 |
| $R^2$ | 0.53 | | 0.62 | |
| N | 160 | | 95 | |
| Chow test value | 11.57** | | | |

*Significant at P<0.05, **Significant at P<0.01

The regression coefficients of green fodder and concentrate indicated a positive and significant impact on returns from milk. Similar findings were reported by Dixit (1999), Sinha and Singh (1999) and Kumar (2003).

The results of Chow test clearly indicated that two functions for member and non-member group differed significantly (P<0.01) which was in agreement with the findings of Shiyani (1993).

### 5.3.3 Milk production function for local cows for chittoor district

Table 5.13 presents the results of estimated Cobb-Douglas production function for local cows for the member and non-member groups. A close perusal of the table revealed that the coefficient of multiple determination ($R^2$) for the member group and non-member group were 0.69 and 0.75, respectively, which indicated that 69 and 75 per cent of total variation in returns from milk were explained by the variables included in the selected regression model.

A further perusal of the table revealed that green fodder appeared to be an important variable influencing local cow milk production. Its coefficient was positive and statistically significant at P<0.01 for member and non-member group. On an average, one per cent increase in the expenditure on green fodder resulted in an increase of 1.09 per cent in returns from milk in member and 0.65 per cent in non-member group. The per

cent increase in returns from milk for one per cent increase in the expenditure on green fodder was relatively more in member group as compared to non-member group.

Expenditure on dry fodder appeared to be second most important variable significantly influencing returns from milk. Regression coefficients of dry fodder were positive and statistically significant (P<0.05) in both the member and non-member groups. On an average, one per cent increase in the expenditure on dry fodder resulted in an increase of 0.22 per cent in returns from milk in member and 0.24 per cent in non-member group. The per cent increase in returns from milk was relatively more in non-member group as compared to member group which could possibly be due to higher quantity of dry fodder fed to milch animals by non-member group.

**Table 5.13 Estimated parameters of production function of local cow milk**

| Independent variables | Member | | Non-member | |
|---|---|---|---|---|
| | Regression coefficients | Standard error | Regression coefficients | Standard error |
| Intercept | 1.9755** | 0.2719 | 1.8625 | 1.6518 |
| Value of Green Fodder (X1) | 1.0901** | 0.3591 | 0.6517** | 0.2356 |
| Value of Dry Fodder (X2) | 0.2255* | 0.0894 | 0.2499* | 0.0936 |
| Value of Concentrate (X3) | 0.1869 | 0.2026 | 0.1857 | 0.2033 |
| Value of Labour (X4) | -0.0219 | 0.0995 | -0.0693 | 0.1264 |
| Miscellaneous expenses (X5) | 0.0541 | 0.0912 | 0.0178 | 0.1403 |
| R2 | 0.69 | | 0.75 | |
| N | 50 | | 27 | |

*Significant at P<0.05, **Significant at P<0.01

The value of labour input was found to be negative and statistically non-significant impact on returns from milk in both member and non-member groups.

The regression coefficients of miscellaneous expenses were found to be positive but statistically non-significant in both the member and non-member groups. The expenditure on miscellaneous items was thus, found to have no impact on returns from milk.

## 5.4 MARKETED SURPLUS AND DISPOSAL PATTERN OF MILK

### 5.4.1 Marketed surplus of milk

Milk, unlike most other farm products, is perishable in nature and as such requires quick disposal or conversion into milk products. Therefore, it is of vital importance to examine the production, consumption and marketed surplus of milk on different herd size categories. Moreover, there is also need to identify the category of milk producers who contribute maximum share to the marketed surplus of milk. An attempt has been made in the present section to present the production, consumption and marketed surplus of milk by the member and non-member households (Table 5.14).

A close perusal of Table 5.14 revealed that, overall average milk production was higher for member households (42.15 litres) as compared to non-member households (24.99 litres). This could be due to the rearing of superior quality of animals and adoption of better management practices. Rao (1991), Sharma (1991), Kairon (1992), Shukla *et al.* (1995), Kumar and Sharma (1999), Ashalatha *et al.* (2004), Meena (2008) and Ravishankara (2014) also reported higher milk production in the programme area / beneficiary households / member households as compared to non-programme area / non-beneficiary households / non-member households.

Among various herd size categories, the average milk production per household was lowest in small herd size category (17.63 litres) and highest in large herd size category (61.79 litres) across member households whereas it was observed to be lowest in small herd size category (14.23 litres) and highest in large herd size category (24.99 litres) across non-member households. The average milk production per household increases with increase in the herd size in both the member and non-member households. Similar findings were observed in the earlier studies conducted by Sharma (1991), Meena (2008) and Ravishankara (2014).

A perusal of the Table 5.14 revealed that overall average milk consumption per day per household was lower in the member group (1.51 litres) than non-member group (2.06 litres). It may be observed that average per cent consumption of milk to total production per day per household was lower in member households (3.58 per cent) than the non-member households (8.25 per cent). The relatively lower per cent milk consumption in member households could be due to generate more marketed surplus in view of remunerative prices being offered to milk producer members.

Among various herd size categories, the average milk consumption per day per household was lowest in small herd size category and highest in large herd size category in both the member and non-member groups. Further, the level of milk consumption increases with increase in herd size in both the member and non-member groups. Similar findings were also reported by Sharma (1991), Meena (2008) and Ravishankara (2014).

The study revealed that average quantity of marketed surplus of milk per day per household was higher in the member group (40.64 litres) as compared to the non-member

group (22.93 litres). The per cent marketed surplus of milk to total production was higher in the member group (96.42 per cent) as compared to the non-member group (91.75 per cent) as presented in the Table 5.14. The higher per cent marketed surplus of milk observed in member group could be attributed to better marketing facilities together with remunerative price being offered to milk producers. The observations made in the present study are in conformity with the findings of Rao (1991), Sharma (1991), Kairon (1992), Shukla *et al.* (1995), Kumar and Sharma (1999), Ashalatha *et al.* (2004), Meena (2008) and Ravishankara (2014) who also reported the absolute quantity of marketed surplus of milk to total production to be higher in the programme area/ beneficiary households/member households than the non-programme area/ non-beneficiary households/nonmember households.

Among various herd size categories, the average daily marketed surplus of milk was lowest in small herd size category (16.42 litres) and highest in large herd size category (60.02 litres) across member households. In the case of non-member households, it was also lowest in small herd size category (12.38 litres) and highest in large herd size category (33.97 litres). Further, the per cent marketed surplus of milk to total production was also observed to be increase with increase in herd size categories in both the member and non-member groups. Similar findings were observed in the earlier studies conducted by Sharma (1991), Meena (2008) and Ravishankara (2014).

**Table 5.14 Average production, consumption and marketed surplus of milk by groups across herd size categories.**

(Litres/day/household)

| Herd Size Category | Member | | | Non-member | | |
|---|---|---|---|---|---|---|
| | Total production | Consumption | Marketed Surplus | Total production | Consumption | Marketed Surplus |
| Small | 17.63 (100.00) | 1.21 (6.86) | 16.42 (93.14) | 14.23 (100.00) | 1.85 (13.00) | 12.38 (87.00) |
| Medium | 33.63 (100.00) | 1.50 (4.46) | 32.13 (95.54) | 26.99 (100.00) | 2.12 (7.85) | 24.87 (92.15) |
| Large | 61.79 (100.00) | 1.77 (2.86) | 60.02 (97.14) | 36.22 (100.00) | 2.25 (6.25) | 33.97 (93.79) |
| Overall | 42.15 (100.00) | 1.51 (3.58) | 40.64 (96.42) | 24.99 (100.00) | 2.06 (8.25) | 22.93 (91.75) |

*Figures in parentheses indicate percentage of average milk production.*

### 5.4.2 Disposal pattern of milk

The success of any enterprise largely depends on availability of marketing facilities to the producers for disposal of their produce, especially for that enterprise whose produce is highly perishable. An efficient market structure provides remunerative price to the producer and makes produce available at a reasonable price to the ultimate consumer. An efficient market makes the price spread narrow between consumers and

producers by economising the handling operations and reducing the margin of the middlemen.

During present investigation, it was observed that both organised and unorganised agencies were operational in the study area. The organized sector includes co-operative societies and private dairies while unorganized sector includes consumer directly, milk vendors, tea shops, hotels and restaurants, etc.

Table 5.15 depicts the disposal pattern of milk among both member and non-member group households in the study area. A close perusal of table revealed that out of total quantity of milk disposed off per day by the member households, 96.21 per cent was disposed to dairy cooperatives followed by 2.84 per cent to milk vendors, 1.03 per cent to tea shops and only 0.91 per cent to consumers directly. As far as category wise disposal of milk is concerned, small farmers disposed off 92.63 per cent to co-operatives, 2.86 per cent to milk vendors, 2.31 per cent to tea shops and 2.19 per cent to consumers directly. Similarly, the medium farmers disposed off 93.53 per cent to dairy cooperatives followed by 3.92 per cent to milk vendors, 1.34 per cent to tea shops and 1.21 per cent to consumers directly. Whereas large farmers disposed off 96.10 per cent to dairy cooperatives followed by 2.42 per cent to milk vendors, 0.78 per cent to tea shops and 0.70 per cent to consumers directly. Member households were disposed off their milk mainly to dairy cooperative societies and they are selling their milk to private dairies. This is due to provision of proper input services and better remunerative prices offered by the dairy cooperatives in the study area.

As far as place of sale is concerned, mostly milk is disposed off within the village (96.12 per cent) followed by around 3.88 per cent outside the village. This is due to presence of dairy cooperatives in the village itself and reduction in transportation cost.

As far as terms and conditions of sale is concerned, the member households disposed off their milk mainly on contract basis (95.21 per cent) followed by immediate cash (3.88 per cent) and credit (only 0.91 per cent).

A close perusal of Table 5.15 revealed that out of total quantity of milk disposed off per day by the non-member households, 80.50 per cent was disposed to dairy cooperatives followed by 12.88 per cent to private dairies, 2.49 per cent to milk vendors, 2.11 per cent to tea shops and 2.03 per cent to consumers directly. As far as category wise disposal of milk is concerned, small farmers disposed off 73.19 per cent to co-operatives, 18.17 per cent to private dairies, 4.12 per cent to milk vendors, 3.55 per cent to tea shops and 0.97 per cent to consumers directly. Similarly, the medium farmers disposed off 82.75 per cent to dairy cooperatives followed by 10.78 per cent to private dairies, 2.25 per cent to milk vendors and directly to consumers and 1.97 per cent to tea shops. Whereas large farmers disposed off 81.51 per cent to dairy cooperatives followed by 12.81 per cent to private dairies, 2.30 per cent to consumers, 1.85 per cent to milk vendors and 1.53 per cent to tea shops. Non-member households were disposed off their milk mainly to dairy cooperative societies and private dairies.

**Table 5.15 Disposal pattern of milk among member and non-member groups**

**(litres/day/household)**

| Mode of disposal | Members | | | | Non-Members | | | |
|---|---|---|---|---|---|---|---|---|
| | **Small** | **Medium** | **Large** | **Oveall** | **Small** | **Medium** | **Large** | **Oveall** |
| Total quantity disposed (litres/day) | 16.42 (100.00) | 32.13 (100.00) | 60.02 (100.00) | 40.64 (100.00) | 12.38 (100.00) | 24.87 (100.00) | 33.97 (100.00) | 22.93 (100.00) |
| Organised sector | | | | | | | | |
| 1. Dairy cooperative societies | 15.21 (92.63) | 30.05 (93.53) | 57.68 (96.10) | 38.70 (95.21) | 9.06 (73.19) | 20.58 (82.75) | 27.69 (81.51) | 18.46 (80.50) |
| 2. Private dairy | 0 (0.00) | 0 (0.00) | 0 (0.00) | 0.00 (0.00) | 2.25 (18.17) | 2.68 (10.78) | 4.35 (12.81) | 2.95 (12.88) |
| Unorganised sectors | | | | | | | | |
| 3. Milk vendor | 0.47 (2.86) | 1.26 (3.92) | 1.45 (2.42) | 1.16 (2.84) | 0.51 (4.12) | 0.56 (2.25) | 0.63 (1.85) | 0.57 (2.49) |
| 4. directly to consumers | 0.36 (2.19) | 0.39 (1.21) | 0.42 (0.70) | 0.37 (0.91) | 0.12 (0.97) | 0.56 (2.25) | 0.78 (2.30) | 0.47 (2.03) |
| 5.Tea shops and others | 0.38 (2.31) | 0.43 (1.34) | 0.47 (0.78) | 0.42 (1.03) | 0.44 (3.55) | 0.49 (1.97) | 0.52 (1.53) | 0.48 (2.11) |
| Place of sale | | | | | | | | |
| Sale within the village (1+2+4) | 15.57 (94.82) | 30.44 (94.74) | 58.10 (96.80) | 39.07 (96.12) | 11.43 (92.33) | 23.82 (95.78) | 32.82 (96.61) | 21.88 (95.41) |
| Sale outside the village (3+5) | 0.85 (5.18) | 1.69 (5.26) | 1.92 (3.20) | 1.5755 (3.88) | 0.95 (7.67) | 1.05 (4.22) | 1.15 (3.39) | 1.05 (4.59) |
| Terms and conditions of sale | | | | | | | | |
| Immediate cash (3+5) | 0.85 (5.18) | 1.69 (5.26) | 1.92 (3.20) | 1.58 (3.88) | 0.95 (7.67) | 1.05 (4.22) | 1.15 ((3.39) | 1.05 (4.59) |
| Contract (1+2) | 15.21 (92.63) | 30.05 (93.53) | 57.68 (96.10) | 38.70 (95.21) | 11.31 (91.36) | 23.26 (93.53) | 32.04 (94.32) | 21.41 (93.37) |
| Credit (4) | 0.36 (2.19) | 0.39 (1.21) | 0.42 (0.70) | 0.37 (0.91) | 0.12 (0.97) | 0.56 (2.25) | 0.78 (2.30) | 0.47 (2.03) |

*Figures in parentheses indicate the percentage*

As far as place of sale is concerned, mostly milk is disposed off within the village (95.41 per cent) followed by around 4.59 per cent outside the village. This is due to presence of dairy cooperatives in the village itself and reduction in transportation cost.

As far as terms and conditions of sale is concerned, the non-member households disposed off their milk mainly on contract basis (93.37 per cent) followed by immediate cash (4.59 per cent) and credit (2.03 per cent).

## 5.5 IMPACT OF DAIRY COOPERATIVES ON FARMER'S INCOME

### 5.5.1 Factors influencing membership in dairy cooperatives (Binary logit model)

Estimates of binary logit regression are presented in Table 5.16. The parameters of this model can be interpreted as the effects on the probability of taking membership in dairy cooperatives of an infinitesimal change in each independent continuous variable and the discrete change in the probability for dummy variables.

The study revealed that the most important determinant of membership in co-operatives is the distance to milk collection centre (DMCC). The estimated coefficient of the variable is negative which indicates that as the distance from the milk collection centre increases by 1 km., the probability of membership of household in dairy co-operative decreases by 1.04 (Table 5.16).

The co-efficient of dummy variable of the veterinary services, (D = 1 if provided, 0 otherwise) turned out to be positive and significant. The regression results indicate that when veterinary services are provided to the farmers, they are about 0.19 times more interested to take membership in dairy co-operatives.

The coefficient of current procurement price came out to be positive and significant clearly indicating that higher prices paid by DCS facilitates the membership of the farmers. The role of price factors has also been brought out by Sharma *et al.* (2009).

Another important factor of membership in dairy cooperative is the extent of social participation. Results indicate that the farmers that are socially more active by way of being member of any social organization like panchayat, religious group, political organization, are more likely to be member of the dairy cooperatives. For an increase in the social participation score by one unit, *ceteris paribus*, the likelihood of co-operative membership goes up by 0.67 times. Social capital has been captured by Sharma *et al.* (2009) in terms of a dummy variable.

The coefficient of herd size (no.) came out to be positive and significant clearly indicating that an increase in herd size by one unit, *ceteris paribus*, the likelihood of co-operative membership goes up by 0.7 times.

The coefficient of age of household head came out to be negative but its influence was non-significant on membership in dairy cooperatives.

Some of the variables (education of household head and land ownership) were not significantly associated with membership in dairy cooperatives in the study area.

**Table 5.16 Binary Logit Estimates of the membership in dairy cooperatives**

| Independent variables | Coefficient estimates | Standard error |
|---|---|---|
| Constant | 0.7334 | 2.3696 |
| Age (years) | -0.00375 | 0.02979 |
| Social Participation | 0.6752* | 0.2363 |
| Herd size (No.) | 0.708** | 0.1509 |
| Veterinary services (yes=1; No=0) | 0.1923** | 0.0570 |
| Price | 0.0877* | 0.0426 |
| Distance to milk collection centre (km) | -1.0424** | 0.4938 |
| Number of observations | 160 | |
| log likelihood function | -84.7753 | |
| Restricted log likelihood | -110.9035 | |
| $Chi^2$ | 52.26 | |

Significant at *p <0.05, **p <0.01

Note: The dependent variable is membership in dairy cooperatives (1 for members, 0 for non-members)

### 5.5.2 Impact of dairy cooperatives on net income and milk yield of dairy animals

The second stage model estimated the net income from dairy and milk yield by generating Inverse Mills Ratio (IMR) of this binary logit model and including it as an explanatory variable in the estimation of impact regressions. Following the standard Heckman model, the Mills ratio was included as an explanatory variable to control for self-selection bias in the second stage OLS model. The results for each of the two outcome variables are discussed below:

***Milk Yield***

The regression results of dairy cooperatives on milk yield are presented in Table 5.17. The regression coefficient of the dummy variable for membership is positive and significant, this suggests that productivity of milch animals on households who took membership in dairy cooperatives is significantly higher.

The relation effect as captured through IMR, it came out to be positive and significant in case of member households implies that those who took membership in dairy cooperatives obtain a higher impact variable than a random drawing from the population of farmers with a comparable set of characteristics would get. Similarly, the regression coefficient of IMR for non-members came out to be positive but non-

significant means those who are not a member of dairy cooperatives get lower impact variable than the rest of the population of farmers with a comparable set of characteristics drawn randomly.

The regression coefficient of dummy variable for the provision of veterinary services came out to be positive and significant influence on the productivity of milch animals.

The regression coefficient of distance from market came out to be negative but not significant. As the distance from market (DM) increases, the access to inputs, like veterinary medicine, feed etc. becomes more difficult and hence yield is adversely affected. The role of provisioning of veterinary services becomes particularly important in such situation which has a favourable influence on productivity of milch animals.

The regression coefficients of herd size (SAUs) came out to be negative and significant implies that on the small holder production systems, where resource availability is a limiting factor, the productivity of milch animals tends to decrease with increase in the stock of animals.

The effect of three personal characteristics of household head included in the model was found to be positive though non-significant. Higher education and social participation enhances awareness and capability of household to adopt improved techniques of production, thus, positively affecting productivity. The coefficient of age variable came out be negative and non-significant implies that younger generation tends to be more receptive to improved techniques of dairy farming and hence age and productivity would be inversely related. The positive coefficient of age is perhaps suggestive of better milk yield on households who have more experience in dairying as reflected from their higher age.

***Net Income***

The net income of the farmers from milk production was significantly higher in case of co-operative members as compared to non-members. The regression results of dairy cooperatives on net income are presented in Table 5.17.

The regression coefficient of the dummy variable for membership is positive and significant, this suggests that net income of households who took membership in dairy cooperatives is significantly higher.

The regression coefficients of herd size (SAUs) came out to be positive and significant implies that the net income tends to increases with increase in the stock of animals.

The regression coefficient of dummy variable for the provision of veterinary services came out be positive and significant that means as provision of veterinary services by dairy cooperatives increase, then productivity of milch animals will be more and hence there is increase in the net income.

The regression coefficients of procurement prices offered by dairy cooperatives came out to be positive and significant for net income from milk production.

The control variables other than price, SAUs, membership and provision of veterinary services also have the expected relationship with net income. Enhancement in education and social participation status has a positive effect on net income while the distance from market (DM) constraints the input availability adversely affecting net income. The coefficient of age variable is negative but significant implies that young farmers have more influence on increasing net income.

**Table 5.17 Impact of dairy cooperatives on net income and milk yield of dairy animals**

| **Independent variables** | **Income** | | **Yield** | |
|---|---|---|---|---|
| | **Regression coefficients** | **Standard error** | **Regression coefficients** | **Standard error** |
| Constant | 43.5990** | 10.025 | 9.3679* | 1.4814 |
| Age | -0.2602* | 0.1246 | -0.0196 | 0.0182 |
| Education score | 0.9445 | 0.6319 | 0.0550 | 0.0934 |
| Membership | 1.8386* | 0.6940 | 0.5095** | 0.2500 |
| Social Participation | 0.6259 | 1.7256 | 0.1508 | 0.2585 |
| Distance to main market | -0.0191 | 0.0274 | -0.0016 | 0.0040 |
| Herd size (SAUs) | 2.6986* | 1.1361 | -0.5276** | 0.1693 |
| Veterinary services | 5.7235* | 2.4072 | 1.0533** | 0.3545 |
| Price | 0.7390** | 0.1726 | 0.0439 | 0.0255 |
| IMR_ Member | 32.3502* | 13.5539 | 7.0953** | 1.9112 |
| IMR_ Non-Member | 23.7984 | 13.2172 | 3.2165 | 2.0039 |
| Number of observations | 160 | | 160 | |
| $R^2$ | 0.40 | | 0.26 | |

Significant at *p <0.05, **p <0.01

# CHAPTER -6

# SUMMARY AND CONCLUSIONS

# 6. SUMMARY AND CONCLUSIONS

India is the largest producer of milk among the world's milk producing nations with an annual output of 155.49 million tonnes, contributing about 18.5 per cent in the global milk production (NDDB, 2017). Dairy development in India has been acknowledged world over as one of the modern India's most successful developmental programme. In the wake of new world trade regime ushered in by the World Trade Organization (WTO), cooperatives are in search of a new direction and a new strategy for their survival and growth. In India, cooperatives are used as a potential tool for all round development of human society, especially of its rural sector. The institutional mechanism of dairy cooperatives are used as a potential tool in increasing the milk production, improving the nutritional standards of the people, generating employment opportunities, improving income levels as well as reducing income inequalities in rural areas, especially for landless labourers, small and marginal farmers.

Hence, keeping in view the above facts, the present study entitled **"Impact of Dairy Co-operatives on the Income of Rural Households in Andhra Pradesh"** has been undertaken with the following specific objectives:

1. To analyse the economics of milk production among the member and non-member groups.
2. To determine the disposal pattern and marketed surplus of milk in the study region.
3. To assess the impact of dairy cooperatives on farmer's income in the study area.

The study was conducted in Andhra Pradesh. In the state, Guntur and Chittoor districts were purposively selected for the study. From each district two mandals constituting highest and lowest milk procurement were purposively selected and from each mandal, two village cooperatives were selected randomly. Multistage sampling technique was used for data collection. In total, 160 dairy farmers which comprised of 80 members and 80 non-members were selected for the study. A complete enumeration of all the selected 160 households with respect to milch bovine stock and operational holding etc. was made. In order to have comparative analysis across herd size categories of both member and non-member respondents, post-stratification of households was done with cumulative square root method of stratification with milch animals as the basis of classification of households into three categories, viz., Small (1-3 SAUs), Medium (4-6 SAUs) and Large (> 6 SAUs) herd size categories.

Primary data was collected by using well-structured pre-tested schedule during the months of November, 2017 to February, 2018 by personal interview method. The data were scrutinized, computerized and analysed systematically by adopting a standard analytical framework to meet the different objectives of the study. The cost and returns of milk production, productivity, marketed surplus and disposal pattern of milk were studied

with the help of tabular analysis. Chow test was employed to test the hypothesis of equality between coefficients obtained from production functions of member and non-member groups. In order to know the variables responsible for difference between two functions of member and non-member groups, functional analysis was carried out. To analyse the factors influencing membership in dairy cooperatives, Binary Logit model was fitted. The Inverse Mills ratio obtained from first stage regression was used to correct for the self-selection bias in the second stage regression analyzing the impact of cooperatives on milk yield of milch animals and net income from dairying. The two impact equations were estimated using Ordinary Least Square (OLS) regression analysis.

**Salient Research Findings:**

- The proportion of small, medium, and large herd size categories were 23.75, 32.50, and 43.75 per cent among the member households and 33.75, 41.25 and 25 per cent among the non-member households, respectively.
- The average milch SAU/Farm were higher for members (5.84) as compared to non-member group (3.84).
- The overall average family size of member group dairy farmers was 4.32 which were higher than non-member dairy farmers as their overall average family size was 3.94.
- Maximum percentage of respondents, both members (28.75 per cent) and non-members (28.75 per cent) had studied up to secondary level education.
- In case of member group, overall, 47.50 per cent of the households were adopting agriculture as main occupation, while dairy farming was adopted as main occupation by 38.75 per cent of the households as against 38.75 per cent of the households were adopting agriculture as main occupation and 22.50 per cent of households adopting dairy farming as main occupation in case of non-member group.
- The total number of milch crossbred cow for members was 160 (56.14 per cent) which was more than non-members i.e 95 (55.88 per cent). Similarly, the total milch local cows was found to be 50 (60.20 per cent) and 27 (57.40 per cent) for members and non-members, respectively. The total milch buffaloes was found to be 129 (54.20 per cent) and 105 (53.03 per cent) for members and non-members, respectively.
- Overall average land holding in non -member group (5.25 acres) was higher than member group dairy farmers (3.82 acres). The area under fodder crop was found to be 1.01 acres (28.13 per cent) for members as against 0.56 acres (10.18 per cent) for non-members.
- The average daily milk yield for local cow in case of large farmers was found to be 6.44 litres for members and 5.87 litres for non-members while for crossbred cow, it was found to be 11.19 litres for members and 9.93 litres for non-members, respectively. Similarly, for buffalo it was found to be 9.47 litres for members and 8.36 litres for non-members, respectively.

- The green fodder in the study area comprised of Napier grass, Jowar, Berseem, Green grasses, Dhaincha and cowpea tops. Dry fodders consisted of Wheat straw, Paddy straw and Jowar straw. Concentrate were generally homemade comprising of various proportions of grains, pulse husks, rice bran etc. Groundnut cake was also given. Balanced concentrate feed was given in the form of ***"Sangam dhana"*** supplied by the dairy cooperatives. In the study area it is a common practice to take only buffaloes for grazing.
- Overall average daily quantity of green fodder, dry fodder and concentrates fed per milch local cow were 15.65 kg, 5.40 kg and 2.98 kg for member group as against 14.36 kg, 5.22 kg and 2.97 kg for non-member group. However, for crossbred cows the overall average daily quantity of green fodder, dry fodder and concentrates fed per milch cow were observed to be 21.97 kg, 4.84 kg and 3.67 kg for member group which was relatively higher than the corresponding figures of 19.47 kg, 4.89 kg and 3.77 kg for non-member group. Similarly, overall average daily quantity of green fodder, dry fodder and concentrates fed per milch buffalo were 24.76 kg, 5.68 kg and 4.30 kg for member group as against 23.59 kg, 5.31 kg and 4.13 kg for non-member group.
- The average maintenance cost per day for local cow was found to be more for members (₹ 208.38) in comparison to non-members (₹ 200.10). Fixed cost accounted for about 12.26 per cent for members and 12.18 per cent for non-members whereas variable cost accounted for 88.30 per cent for members and 87.82 per cent for non-members, respectively. Feed and fodder cost accounted for 75.26 per cent of the total variable cost followed by labour cost at 12.50 per cent for members whereas in case of non-members feed and fodder cost accounted for 75.56 per cent of the total variable cost followed by labour cost at 12.29 per cent.
- The per litre cost of milk production for local cow in case of members (₹ 31.71) was lower than that of non-members (₹ 33.43). The net return per litre was more for member (₹ 1.26) than non-member (₹ 0.33).
- The average maintenance cost per day for crossbred cow was found to be more for members (₹ 262.85) in comparison to non-members (₹ 251.61). This is due to increased awareness among the members regarding the importance of proper feed for animals. Fixed cost accounted for about 11.97 per cent for members and 11.68 per cent for non-members whereas variable cost accounted for 88.52 per cent for members and 88.00 per cent for non-members, respectively. Feed and fodder cost accounted for 75.53 per cent of the total variable cost followed by labour cost at 14.14 per cent for members whereas in case of non-members feed and fodder cost accounted for 75.84 per cent of the total variable cost followed by labour cost at 14.45 per cent. The per cent share of feed cost increased with increase in herd size category in both member and non-member groups.
- The per litre cost of milk production for crossbred cow in case of members (₹ 23.10) was lower than that of non-members (₹ 24.97). The net return per litre was more for member (₹ 3.54) than non-member (₹ 2.35).
- The average maintenance cost per day for buffalo was found to be more for members (₹ 302.97) in comparison to non-members (₹ 283.96). Fixed cost

accounted for about 10.03 per cent for members and 9.40 per cent for non-members whereas variable cost accounted for 89.97 per cent for members and 90.60 per cent for non-members. Feed and fodder cost accounted for 74.15 per cent of the total variable cost followed by labour cost at 16.38 per cent for members whereas, in case of non-members feed and fodder cost accounted for 75.00 per cent of the total variable cost followed by labour cost at 16.25 per cent. The per cent share of feed cost increased with increase in herd size category in both member and non-member groups.

- The per litre cost of milk production for buffalo in case of members (₹ 31.56) was lower than that of non-members (₹ 33.54). The net return per litre was more for member (₹ 4.61) than non-member (₹ 3.28).
- The regression coefficients of green fodder, concentrate and labour had positive and significant influence on returns from buffalo milk in both the member and non-member groups which indicated that returns from buffalo milk increased with an increase in the value of green fodder, concentrate and labour. The coefficients of dry fodder and miscellaneous expenses had positive but non-significant influence on returns from milk. The results of Chow test clearly revealed that the production functions of buffalo milk between member and non-member groups differed significantly ($P<0.01$).
- The regression coefficients of green fodder and concentrate had positive and significant influence on returns from crossbred cow milk in member and non-member groups. However, value of dry fodder and labour had positive but non-significant influence on returns from cow milk. The miscellaneous expenses had negative but non-significant influence on returns from milk. The results of Chow test clearly revealed that the production functions of crossbred milk between member and non-member groups differed significantly ($P<0.01$).
- The regression coefficients of green fodder and dry fodder had positive and significant influence on returns from local cow milk in member and non-member groups. However, value of concentrate and miscellaneous expenses had positive but non-significant influence on returns from cow milk. The value of labour had negative but non-significant influence on returns from milk.
- Overall average milk production was higher for member households (42.15 litres) as compared to non-member households (24.99 litres). This could be due to the rearing of superior quality of animals and adoption of better management practices.
- Overall average milk consumption per day per household was lower in the member group (1.51 litres) than non-member group (2.06 litres). The average per cent consumption of milk to total production per day per household was lower in member households (3.58 per cent) than the non-member households (8.25 per cent). The relatively lower per cent milk consumption in member households leading to relatively higher marketed surplus could be attributed to remunerative price being offered to milk producer members of dairy cooperatives.
- The average quantity of marketed surplus of milk per day per household was higher in the member group (40.64 litres) as compared to the non-member group

(22.93 litres). The per cent marketed surplus of milk to total production was higher in the member group (96.42 per cent) as compared to the non-member group (91.75 per cent) which could be attributed to better marketing facilities together with remunerative price being offered to milk producers. The per cent marketed surplus of milk to total production was also observed to be increase with increase in herd size categories in both the member and non-member groups.

- Out of total quantity of milk disposed off per day by the member households, 96.21 per cent was disposed to dairy cooperatives followed by 2.84 per cent to milk vendors, 1.03 per cent to tea shops and only 0.91 per cent to consumers directly. Similarly, for non-member households, 80.50 per cent was disposed to dairy cooperatives followed by 12.88 per cent to private dairies, 2.49 per cent to milk vendors, 2.11 per cent to tea shops and only 2.03 per cent to consumers directly.
- As far as place of sale is concerned, mostly milk is disposed off within the village around 96.12 per cent by members and around 95.41 per cent by non-members. Whereas around 4.59 per cent by members and around 3.88 per cent by non-members disposing their milk outside the village.
- As far as terms and conditions of sale is concerned, the member households disposed off their milk mainly on contract basis (95.21 per cent) followed by immediate cash (3.88 per cent) and credit (0.91 per cent). Whereas the non-member households disposed off their milk mainly on contract basis (93.37 per cent) followed by immediate cash (4.59 per cent) and credit (2.03 per cent).
- Disposal pattern of marketed surplus among both member and non-member group in the study area had shown preference for organized agencies to dispose off their produce.
- The important determinants of membership in dairy cooperatives were the distance to milk collection centre (DMCC), provision of veterinary services, herd size (No.), procurement price of milk and social participation score of the dairy farmer. The estimated coefficient of the DMCC variable is negative which indicates that as the distance from the milk collection centre increases by 1 km., the probability of membership of household in dairy co-operative decreases by 1.04. The co-efficient of dummy variable of the veterinary services, (D = 1 if provided, 0 = otherwise) turned out to be positive and significant. The regression results indicate that when veterinary services are provided to the farmers, they are about 0.19 times more interested to take membership in dairy co-operatives.
- The economic incentives reflected in prices of milk received by the producers also had an important bearing on the membership in dairy cooperatives. The coefficient of current procurement price came out to be positive and significant, clearly indicating that higher prices paid by DCS facilitates the membership of the farmers. Social characteristics of household head also played important role in taking membership in dairy cooperatives, it was found that for an increase in the social participation score by one unit, *ceteris paribus*, the likelihood of co-operative membership goes up by 0.67 times.

- The regression coefficient of dummy variable for the provision of veterinary services came out be positive and significant influence on the productivity of milch animals. This is due to the provision of proper veterinary services by the dairy cooperatives to the member farmers. The net income from milk production was positively influenced by the membership, herd size, provision of veterinary services and the procurement prices of milk. But on the small holder production systems, where resource availability was a limiting factor, the productivity tends to decrease with increase in the stock of animals.
- Enhancement in education and social participation status has a positive effect on productivity and net income while the distance from market (DM) constraints the input availability adversely affecting these two outcome variables.

**Suggestions and Policy Implications**

The findings of present study would be of practical significance for the researchers, extension personnel, policy makers, planners, administrators and dairy farmers so as to take rational decisions for the benefit of members of dairy co-operative societies as well as promote co-operative movement in the field of dairying in Andhra Pradesh in general and for the dairy cooperatives in Guntur and Chittoor districts in particular.

- The cost of milk production obtained in the present study suggested that buffalo milk production is relatively more profitable than local cow and crossbred cow in the study area. Thus, sound economic plan exists for persuading both the member and non-member households to continue buffalo rearing to enhance their income. Hence, adequate attention should be paid to promote buffalo upgradation programme.
- Most of the dairy farmers are not aware about productivity of inputs that will be used in the process of milk production as found in the present study. The use of green fodder, concentrate and labour in buffalo milk production were found to be over utilized in both the groups. Therefore, use of these inputs should be reduced in order to get the maximum returns from buffalo milk production while in case of local and crossbred cows, use of concentrate feeding should be increased to get more returns from cow milk production as it was underutilized.
- The milk productivity levels of animals should be enhanced through sustained breed improvement programmes in order to get high returns from local cow, crossbred cow and buffalo milk production.
- Most of the milk producers in the study area facing the problem of high cost of quality inputs and less availability of required green fodder. Therefore, the dairy cooperatives should take adequate planning to supply the inputs at subsidized rates.
- From the study it was concluded that the cost of milk production decreases with herd size. Cost per litre of milk was found to be less for large herd size category farmers in both member and non-member groups. The reason behind this conclusion was that large herd size farmers were experienced enough regarding

the nutritional requirements and maintenance of the dairy animals thereby the productivity of animals were high in case of large herd size of farmers. Therefore, if the cost has to be minimized then officials should promote training and education among the farmers.

- Disposal pattern of marketed surplus among both member and non-member group in the study area had shown preference for organized agencies mainly dairy cooperatives to dispose off their produce. But still some quantity of milk is disposed to unorganized sectors. The reason behind this conclusion was that in case of organized agencies the price of milk is mainly determined by the percentage fat content of the milk incentives for better quality milk and penalties for not meeting minimum acceptable standards were prevalent in the area. In case of unorganized agencies, no such practice is followed for determining the price of the milk hence, the milk is sold according to market forces like supply, demand and season.
- The study revealed that provision of veterinary services can condition the increase in membership, number and productivity of dairy animals, net dairy income of the milk producers and hence, milk procurement of the cooperatives.
- The study revealed that there is a positive impact of dairy cooperatives on the productivity of dairy animals and net income of the member households. The reason behind this conclusion was that provision of veterinary services and higher remunerative prices of milk offered by the dairy cooperatives to its members. Thus, steps should be taken to bring greater number of milk producers in the cooperative network by making them aware about the benefits of the cooperative programme.

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# APPENDICES

# APPENDIX-1

## APPENDIX-1A

**Table 1.1 Category-wise distribution of sample households across herd size categories of Guntur district**

(Numbers)

| Particulars | Herd-size category | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Members | | | | Non-members | | | |
| | Small (1-3 SAUs) | Medium (4-6 SAUs) | Large (> 6 SAUs) | Total | Small (1-3 SAUs) | Medium (4-6 SAUs) | Large (> 6 SAUs) | Total |
| Farms | 12 (30.00) | 13 (32.50) | 15 (37.50) | 40 (100.00) | 15 (37.50) | 17 (42.50) | 8 (20.00) | 40 (100.00) |
| SAU/Farm | 2.99 | 5.77 | 9.51 | 6.34 | 2.70 | 4.87 | 7.03 | 4.49 |
| Milch SAU/Farm | 2.44 | 4.67 | 7.49 | 5.06 | 2.23 | 3.78 | 5.39 | 3.52 |

*Figures in parentheses indicate percentage of row total*

**Table 1.2 Category-wise distribution of sample households across herd size categories of Chittoor district**

(Numbers)

| Particulars | Herd-size category | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Members | | | | Non-members | | | |
| | Small (1-3 SAUs) | Medium (4-6 SAUs) | Large (≥ 6 SAUs) | Total | Small (1-3 SAUs) | Medium (4-6 SAUs) | Large (≥ 6 SAUs) | Total |
| Farms | 7 (17.50) | 13 (32.50) | 20 (50.00) | 40 (100.00) | 12 (30.00) | 16 (40.00) | 12 (30.00) | 40 (100.00) |
| SAU/Farm | 2.89 | 5.71 | 11.09 | 7.90 | 2.82 | 4.92 | 7.58 | 5.09 |
| Milch SAU/Farm | 2.51 | 4.87 | 9.22 | 6.63 | 2.32 | 4.14 | 6.09 | 4.18 |

*Figures in parentheses indicate percentage of row total*

## APPENDIX-1B

**Table 1.3 Average family size and its composition across different herd size categories of Guntur district**

| Herd Size Categories | Family composition | | | | | | | | Average Family Size | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Adult (> 18 years) | | | | Children (≤ 18 years) | | | | | |
| | Male | | Female | | Male | | Female | | | |
| | M | NM | M | NM | M | NM | M | NM | M | NM |
| Small (1-3 SAUs) | 1.67 (43.60) | 1.50 (39.16) | 1.25 (32.64) | 1.4 (36.84) | 0.58 (15.14) | 0.47 (12.28) | 0.33 (8.62) | 0.4 (10.53) | 3.83 (100) | 3.80 (100) |
| Medium (4-6 SAUs) | 1.85 (42.91) | 1.53 (37.14) | 1.54 (35.68) | 1.35 (32.86) | 0.62 (14.27) | 0.88 (21.43) | 0.31 (7.14) | 0.35 (8.57) | 4.31 (100) | 4.12 (100) |
| Large (> 6 SAUs) | 1.87 (40.58) | 1.75 (42.42) | 1.6 (34.78) | 1.63 (39.39) | 0.8 (17.39) | 0.25 (6.06) | 0.33 (7.25) | 0.5 (12.12) | 4.60 (100) | 4.13 (100) |
| Overall | 1.8 (42.11) | 1.58 (39.38) | 1.48 (34.50) | 1.43 (35.63) | 0.68 (15.79) | 0.6 (15.00) | 0.33 (7.60) | 0.4 (10.00) | 4.28 (100) | 4.00 (100) |

*Figures in parentheses indicate percentage* M-Member, NM-Non-member

**Table 1.4 Average family size and its composition across different herd size categories of Chittoor district**

| Herd Size Categories | Family composition | | | | | | | | Average Family Size | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Adult (> 18 years) | | | | Children (≤ 18 years) | | | | | |
| | Male | | Female | | Male | | Female | | | |
| | M | NM | M | NM | M | NM | M | NM | M | NM |
| Small (1-3 SAUs) | 1.55 (39.24) | 1.73 (48.72) | 1.35 (34.18) | 1.18 (33.33) | 0.6 (15.19) | 0.36 (10.26) | 0.45 (11.39) | 0.27 (7.69) | 3.95 (100) | 3.55 (100) |
| Medium (4-6 SAUs) | 1.85 (46.15) | 1.50 (40.30) | 1.46 (36.54) | 1.44 (38.81) | 0.38 (9.62) | 0.28 (7.46) | 0.31 (7.69) | 0.5 (13.43) | 4.00 (100) | 3.72 (100) |
| Large ( 6 SAUs) | 2.00 (46.67) | 1.82 (46.51) | 1.71 (40) | 1.36 (34.88) | 0.43 (10.00) | 0.27 (6.98) | 0.14 (3.33) | 0.45 (11.63) | 4.29 (100) | 3.91 (100) |
| Overall | 1.60 (39.75) | 1.65 (44.30) | 1.57 (39.13) | 1.35 (36.24) | 0.5 (12.42) | 0.3 (8.05) | 0.35 (8.70) | 0.425 (11.41) | 4.03 (100) | 3.73 (100) |

*Figures in parentheses indicate percentage* M-Member, NM-Non-member

**APPENDIX-1C**

**Table 1.5 Educational status of heads of sample households of Guntur district**

| Educational score | Members | | | | Non-members | | | |
|---|---|---|---|---|---|---|---|---|
| | Small | Medium | Large | Overall | Small | Medium | Large | Overall |
| 0 (Illiterate) | 2 (16.67) | 2 (15.38) | 1 (6.67) | 5 (12.5) | 0 (0) | 2 (11.76) | 0 (0) | 2 (5) |
| 1 (Primary) | 4 (33.33) | 3 (23.08) | 3 (20) | 10 (25) | 2 (13.33) | 6 (35.29) | 4 (50) | 12 (30) |
| 2 (Secondary) | 3 (25) | 5 (38.46) | 7 (46.67) | 15 (37.5) | 6 (40) | 5 (29.42) | 2 (25) | 13 (32.5) |
| 3 (Higher secondary) | 3 (25) | 3 (23.08) | 2 (13.33) | 8 (20) | 4 (26.67) | 3 (17.65) | 1 (12.5) | 8 (20) |
| 4 (Graduation & above) | 0 (0) | 0 (0) | 2 (13.33) | 2 (5) | 3 (20) | 1 (5.88) | 1 (12.5) | 5 (12.5) |
| Total | 12 (100) | 13 (100) | 15 (100) | 40 (100) | 15 (100) | 17 (100) | 8 (100) | 40 (100) |

*Figures in parentheses indicate percentage of column total*

**Table 1.6 Educational status of heads of sample households of Chittoor district**

| Educational score | Members | | | | Non-members | | | |
|---|---|---|---|---|---|---|---|---|
| | Small | Medium | Large | Overall | Small | Medium | Large | Overall |
| 0 (Illiterate) | 2 (28.57) | 4 (30.77) | 2 (10.00) | 8 (20) | 3 (27.27) | 3 (16.67) | 1 (9.09) | 7 (17.50) |
| 1 (Primary) | 2 (28.57) | 1 (7.69) | 5 (25) | 8 (20) | 3 (27.27) | 3 (16.67) | 3 (27.27) | 9 (22.50) |
| 2 (Secondary) | 2 (28.57) | 3 (23.08) | 3 (15.00) | 8 (20) | 3 (27.27) | 3 (16.67) | 4 (36.36) | 10 (25) |
| 3 (Higher secondary) | 1 (14.29) | 4 (30.77) | 6 (30) | 11 (27.50) | 1 (9.09) | 7 (38.89) | 1 (9.09) | 9 (22.50) |
| 4 (Graduation & above) | 0 (0.00) | 1 (7.69) | 4 (20.00) | 5 (12.50) | 1 (9.09) | 2 (11.11) | 2 (18.18) | 5 (12.5) |
| Total | 7 (100) | 13 (100) | 20 (100) | 40 (100) | 11 (100) | 18 (100) | 11 (100) | 40 (100) |

*Figures in parentheses indicate percentage of column total*

## APPENDIX-1D

**Table 1.7 Occupational status of heads of sample households of Guntur district**

| Occupation | | Members | | | | Non-members | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **Small** | **Medium** | **Large** | **Overall** | **Small** | **Medium** | **Large** | **Overall** |
| Main | Agriculture | 8 (66.67) | 7 (53.85) | 5 (33.33) | 20 (50.00) | 7 (46.67) | 7 (41.18) | 2 (25.00) | 16 (40.00) |
| | Dairy | 3 (25.00) | 5 (38.46) | 8 (53.33) | 16 (40.00) | 2 (13.33) | 3 (17.65) | 4 (50.00) | 9 (22.50) |
| | Agricultural labour | - | - | - | - | - | - | - | - |
| | Business | 1 (8.33) | 1 (7.69) | - | 2 (5.00) | 2 (13.33) | 5 (29.41) | 2 (25.00) | 9 (22.50) |
| | Rural artisans | | | 1 (6.67) | 1 (2.50) | | 1 (5.88) | | 1 (2.50) |
| | Services | - | - | 1 (6.67) | 1 (2.50) | 3 (20.00) | - | - | 3 (7.50) |
| | Others | - | - | - | - | 1 (6.67) | 1 (5.88) | - | 2 (5.00) |
| | Total | 12 (100.00) | 13 (100.00) | 15 (100.00) | 40 (100.00) | 15 (100.00) | 17 (100.00) | 8 (100.00) | 40 (100.00) |
| Subsidiary | Agriculture | 3 (25.00) | 5 (38.46) | 4 (26.67) | 12 (30.00) | - | 3 (17.65) | 2 (25.00) | 5 (12.50) |
| | Dairy | 9 (75.00) | 8 (61.54) | 6 (40.00) | 23 (57.50) | 6 (40.00) | 7 (41.18) | 4 (50.00) | 17 (42.50) |
| | Agricultural labour | - | - | - | - | 3 (20.00) | 2 (11.76) | - | 5 (12.50) |
| | Business | - | - | 3 (20.00) | 3 (7.50) | 1 (6.67) | 1 (5.88) | 1 (12.50) | 3 (7.50) |
| | Rural artisans | - | - | - | - | 3 (20.00) | 2 (11.76) | - | 5 (12.50) |
| | Services | - | - | 1 (6.67) | 1 (2.50) | 2 (13.33) | 2 (11.76) | 1 (12.50) | 5 (12.50) |
| | Others | - | - | 1 (6.67) | 1 (2.50) | - | - | - | - |
| | Total | 12 (100.00) | 13 (100.00) | 15 (100.00) | 40 (100.00) | 15 (100.00) | 17 (100.00) | 8 (100.00) | 40 (100.00) |

*Figures in parentheses indicate percentage of column total*

## Table 1.8 Occupational status of heads of sample households of Chittoor district

| Occupation | | Members | | | | Non-members | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Small | Medium | Large | Overall | Small | Medium | Large | Overall |
| Main | Agriculture | 2 (28.57) | 4 (30.77) | 5 (25.00) | 11 (27.50) | 5 (41.67) | 8 (50.00) | 2 (16.67) | 15 (37.50) |
| | Dairy | 4 (57.14) | 7 (53.85) | 11 (55.00) | 22 (55.00) | 1 (8.33) | 3 (18.75) | 5 (41.67) | 9.00 (22.50) |
| | Agricultural labour | - | - | - | - | 2 (16.67) | 2 (12.50) | 1 (8.33) | 5.00 (12.50) |
| | Business | - | 1 (7.69) | 4 (20.00) | 5 (12.50) | 3 (25.00) | 3 (18.75) | 2 (16.67) | 8.00 (20.00) |
| | Rural artisans | 1 (14.29) | - | - | 1 (2.50) | 1 (8.33) | - | 1 (8.33) | 2.00 (5.00) |
| | Services | - | - | - | - | - | - | 1 (8.33) | 1.00 (2.50) |
| | Others | - | 1 (7.69) | - | 1 (2.50) | - | - | - | - |
| | Total | 7 (100.00) | 13 (100.00) | 20 (100.00) | 40 (100.00) | 12 (100.00) | 16 (100.00) | 12 (100.00) | 40.00 (100.00) |
| Subsidiary | Agriculture | 3 (42.86) | 4 (30.77) | 6 (30.00) | 13 (32.50) | 4 (33.33) | 5 (31.25) | 3 (25.00) | 12.00 (30.00) |
| | Dairy | 2 (28.57) | 3 (23.08) | 5 (25.00) | 10 (25.00) | 5 (41.67) | 6 (37.50) | 4 (33.33) | 15.00 (37.50) |
| | Agricultural labour | 2 (28.57) | 2 (15.38) | 4 (20.00) | 8 (20.00) | 1 (8.33) | 2 (12.50) | 2 (16.67) | 5.00 (12.50) |
| | Business | - | 2 (15.38) | 1 (5.00) | 3 (7.50) | - | 2 (12.50) | 3 (25.00) | 5.00 (12.50) |
| | Rural artisans | - | - | 3 (15.00) | 3 (7.50) | 2 (16.67) | 1 (6.25) | - | 3.00 (7.50) |
| | Services | - | 2 (15.38) | 1 (5.00) | 3 (7.50) | - | - | - | - |
| | Others | - | - | - | - | - | - | - | - |
| | Total | 7 (100.00) | 13 (100.00) | 20 (100.00) | 40 (100.00) | 12 (100.00) | 16 (100.00) | 12 (100.00) | 40.00 (100.00) |

*Figures in parentheses indicate percentage of column total*

**APPENDIX-1E**

**Table 1.9 Average land holdings and area under fodder crop of sample households of Guntur district**

| Herd size Category | Average land holdings (acres) | | Area under fodder crop (%) | |
|---|---|---|---|---|
| | M | NM | M | NM |
| Small | 2.93 | 5 | 25.6 | 4.6 |
| Medium | 2.85 | 5.29 | 35.09 | 6.43 |
| Large | 3.69 | 5.4 | 27.64 | 9.26 |
| Overall | 3.05 | 5.24 | 30.49 | 6.11 |

**Table 1.10 Average land holdings and area under fodder crop of sample households of Chittoor district**

| Herd size Category | Average land holdings (acres) | | Area under fodder crop (%) | |
|---|---|---|---|---|
| | M | NM | M | NM |
| Small | 3.45 | 4.25 | 22.9 | 15.06 |
| Medium | 4.33 | 5.19 | 26.56 | 13.87 |
| Large | 5.28 | 6.04 | 25.19 | 15.07 |
| Overall | 4.58 | 5.26 | 25.76 | 14.26 |

**APPENDIX-1F**

**Table 1.11 Herd composition by groups across herd size categories of Guntur district**

| Membership | Animal | Herd Size Category | Milch | Heifer | Calf | | Total |
|---|---|---|---|---|---|---|---|
| | | | | | (≤ 1 year) | (1-2 years) | |
| Member | Crossbred cow | Small | 3 (50.00) | 0 (0.00) | 2 (40.00) | 1 (16.67) | 6 (100) |
| | | Medium | 13 (52.00) | 2 (8.00) | 10 (40.00) | 0 (0.00) | 25 (100) |
| | | Large | 28 (50.91) | 3 (5.45) | 19 (34.55) | 5 (9.09) | 55 (100) |
| | | Overall | 44 (51.20) | 5 (5.80) | 31 (36.00) | 6 (7.00) | 86 (100) |
| | Buffalo | Small | 21 (53.85) | 0 (0.00) | 16 (41.03) | 2 (5.13) | 39 (100) |
| | | Medium | 32 (54.24) | 3 (5.08) | 22 (37.29) | 2 (3.39) | 59 (100) |
| | | Large | 54 (52.94) | 9 (8.82) | 32 (31.37) | 7 (6.86) | 102 (100) |
| | | Overall | 107 (53.50) | 12 (6.00) | 70 (35.00) | 11 (5.50) | 200 (100) |
| Non-member | Crossbred cow | Small | 2 (40.00) | 1 (20.00) | 1 (20.00) | 1 (20.00) | 5 (100) |
| | | Medium | 9 (50.00) | 0 (0.00) | 7 (38.89) | 2 (11.11) | 18 (100) |
| | | Large | 9 (50.00) | 0 (0.00) | 8 (44.44) | 1 (5.56) | 18 (100) |
| | | Overall | 20 (48.78) | 1 (2.44) | 16 (39.02) | 4 (9.76) | 41 (100) |
| | Buffalo | Small | 27 (57.45) | 1 (2.13) | 15 (31.91) | 4 (8.51) | 47 (100) |
| | | Medium | 40 (48.78) | 3 (3.66) | 29 (35.37) | 10 (12.20) | 82 (100) |
| | | Large | 23 (51.11) | 5 (11.11) | 10 (22.22) | 7 (15.56) | 45 (100) |
| | | Overall | 90 (51.72) | 9 (5.17) | 54 (31.03) | 21 (12.07) | 174 (100) |

*Figures in parentheses indicate percentage of row total*

**Table 1.12 Herd composition by groups across herd size categories of Chittoor district**

| Membership | Animal | Herd Size category | Milch | Heifer | Calf | | Total |
|---|---|---|---|---|---|---|---|
| | | | | | (≤1 year) | (1-2 years) | |
| Member | Local cow | Small | 5 (83.30) | 0 (0.00) | 1 (16.70) | 0 (0.00) | 6 (100) |
| | | Medium | 13 (56.50) | 2 (8.70) | 6 (26.10) | 2 (8.70) | 23 (100) |
| | | Large | 32 (59.30) | 4 (7.40) | 12 (22.20) | 6 (11.10) | 54 (100) |
| | | Overall | 50 (60.20) | 6 (7.20) | 19 (22.90) | 8 (9.60) | 83 (100) |
| | Crossbred cow | Small | 7 (53.80) | 1 (7.70) | 5 (38.50) | 0 (0.00) | 13 (100) |
| | | Medium | 28 (60.90) | 1 (2.20) | 16 (34.80) | 1 (2.20) | 46 (100) |
| | | Large | 81 (57.90) | 5 (3.60) | 42 (30.00) | 12 (8.60) | 140 (100) |
| | | Overall | 116 (58.30) | 7 (3.50) | 63 (31.70) | 13 (6.50) | 199 (100) |
| | Buffalo | Small | 1 (100.00) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 1 (100) |
| | | Medium | 4 (80.00) | 0 (0.00) | 0 (0.00) | 1 (20.00) | 5 (100) |
| | | Large | 17 (53.10) | 1 (3.10) | 13 (40.60) | 1 (3.10) | 32 (100) |
| | | Overall | 22 (57.90) | 1 (2.60) | 13 (34.20) | 2 (5.30) | 38 (100) |
| Non-member | Local cow | Small | 4 (80.00) | 0 (0.00) | 1 (20.00) | 0 (0.00) | 5 (100) |
| | | Medium | 10 (62.50) | 1 (6.30) | 3 (18.80) | 2 (12.50) | 16 (100) |
| | | Large | 13 (50.00) | 3 (11.50) | 7 (26.90) | 3 (11.50) | 26 (100) |
| | | Overall | 27 (57.40) | 4 (8.50) | 11 (23.40) | 5 (10.60) | 47 (100) |
| | Crossbred cow | Small | 11 (45.80) | 2 (8.30) | 10 (41.70) | 1 (4.20) | 24 (100) |
| | | Medium | 36 (63.20) | 2 (3.50) | 10 (17.50) | 9 (15.80) | 57 (100) |
| | | Large | 28 (58.30) | 4 (8.30) | 14 (29.20) | 2 (4.20) | 48 (100) |
| | | Overall | 75 (58.10) | 8 (6.20) | 34 (26.40) | 12 (9.30) | 129 (100) |
| | Buffalo | Small | 3 (100) | 0 (0.00) | 0 (0.00) | 0 (0.00) | 3 (100) |
| | | Medium | 5 (55.60) | 2 (22.20) | 2 (22.20) | 0 (0.00) | 9 (100) |
| | | Large | 7 (58.30) | 0 (0.00) | 3 (25.00) | 2 (16.70) | 12 (100) |
| | | Overall | 15 (62.50) | 2 (8.30) | 5 (20.80) | 2 (8.30) | 24 (100) |

*Figures in parentheses indicate percentage of row total*

**APPENDIX-1G**

**Table 1.13 Average intake of feed and fodder fed to the animals across member and non-member groups of Guntur district**

(kg/animal/day)

| Type of feed and fodder | Animal Type | Herd Size Category | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Small | | Medium | | Large | | Overall | |
| | | M | NM | M | NM | M | NM | M | NM |
| Green Fodder | Buffalo | 27.69 | 26.46 | 28.65 | 27.85 | 29.69 | 28.26 | 28.75 | 27.41 |
| | Crossbred | 17.25 | 16.98 | 19.46 | 17.67 | 21.93 | 17.81 | 19.72 | 17.44 |
| Dry Fodder | Buffalo | 5.88 | 5.53 | 6.11 | 5.72 | 6.42 | 6.05 | 6.16 | 5.72 |
| | Crossbred | 4.16 | 4.08 | 4.45 | 4.38 | 4.76 | 4.59 | 4.48 | 4.31 |
| concentrate | Buffalo | 4.56 | 4.43 | 4.99 | 4.67 | 5.50 | 5.03 | 5.05 | 4.65 |
| | Crossbred | 3.26 | 3.54 | 3.74 | 3.86 | 3.82 | 3.99 | 3.63 | 3.77 |

M – Member, NM – Non-member

**Table 1.14 Average intake of feed and fodder fed to the animals across member and non-member groups of Chittoor district**

(kg/animal/day)

| Type of feed and fodder | Animal Type | Herd Size Category | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Small | | Medium | | Large | | Overall | |
| | | M | NM | M | NM | M | NM | M | NM |
| Green Fodder | Local cow | 15.14 | 14.08 | 15.42 | 14.25 | 15.98 | 14.79 | 15.65 | 14.36 |
| | Crossbred | 21.93 | 20.27 | 22.35 | 21.56 | 23.89 | 22.97 | 23.05 | 21.60 |
| | Buffalo | 19.85 | 18.83 | 20.38 | 19.8 | 21.29 | 20.67 | 20.74 | 19.77 |
| Dry Fodder | Local cow | 5.04 | 4.95 | 5.38 | 5.26 | 5.54 | 5.43 | 5.40 | 5.22 |
| | Crossbred | 4.58 | 4.36 | 4.76 | 4.89 | 5.18 | 5.07 | 4.94 | 4.79 |
| | Buffalo | 4.97 | 4.57 | 5.13 | 4.94 | 5.29 | 5.17 | 5.18 | 4.90 |
| concentrate | Local cow | 2.69 | 2.71 | 2.87 | 2.96 | 3.16 | 3.29 | 2.98 | 2.98 |
| | Crossbred | 3.51 | 3.62 | 3.69 | 3.76 | 3.78 | 3.95 | 3.70 | 3.78 |
| | Buffalo | 3.26 | 3.27 | 3.48 | 3.67 | 3.63 | 3.89 | 3.52 | 3.62 |

M – Member, NM – Non-member

**APPENDIX-1H**

**Figure 1.1 Average daily milk yield of milch animals by groups across herd size categories of Guntur district**

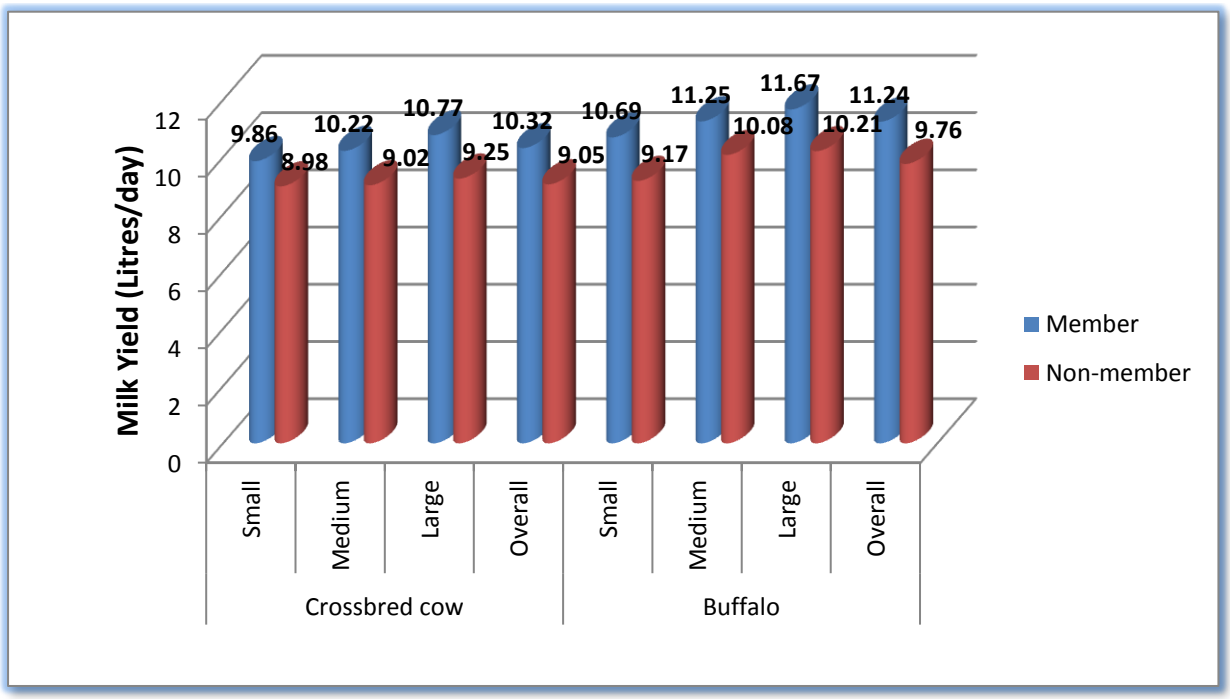
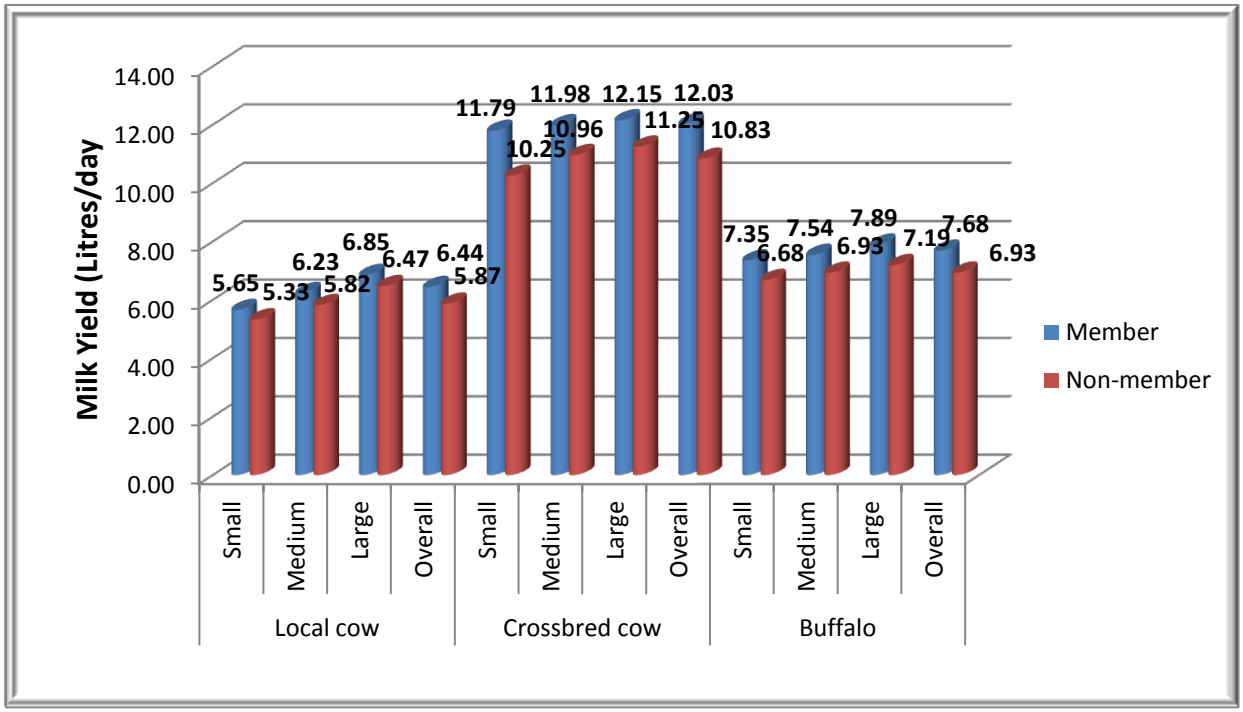



**Figure 1.2 Average daily milk yield of milch animals by groups across herd size categories of Chittoor district**



## APPENDIX-2

**Table 2.1: Cost and returns of milk production for crossbred cow by groups across herd size categories in Guntur district**

**(₹ /animal/day)**

| Cost Components | Small | | Medium | | Large | | Overall | |
|---|---|---|---|---|---|---|---|---|
| | M | NM | M | NM | M | NM | M | NM |
| Total Fixed Cost (TFC) | 27.34 (11.83) | 25.47 (11.08) | 29.89 (11.95) | 27.67 (11.48) | 31.52 (11.97) | 26.19 (10.78) | 29.74 (12.08) | 26.55 (11.19) |
| Green Fodder (F1) | 69.00 (47.04) | 67.92 (44.99) | 77.84 (46.89) | 70.68 (43.90) | 87.72 (49.17) | 71.24 (43.23) | 78.89 (47.86) | 69.76 (44.15) |
| Dry Fodder (F2) | 12.48 (8.51) | 12.24 (8.11) | 13.35 (8.04) | 13.14 (8.16) | 14.28 (8.00) | 13.77 (8.36) | 13.44 (8.15) | 12.93 (8.18) |
| Concentrate (F3) | 65.2 (44.45) | 70.80 (46.90) | 74.80 (45.06) | 77.20 (47.94) | 76.40 (42.83) | 79.80 (48.42) | 72.52 (43.99) | 75.32 (47.67) |
| Feed & Fodder cost (V1= F1+F2+F3) | 146.68 (71.99) | 150.96 (73.88) | 165.99 (75.36) | 161.02 (75.47) | 178.4 (76.95) | 164.81 (76.00) | 164.85 (75.05) | 158.01 (75.00) |
| Labour cost (V2) | 31.85 (15.63) | 30.39 (14.87) | 32.29 (14.66) | 32.07 (15.03) | 33.46 (14.43) | 32.77 (15.11) | 32.60 (14.84) | 31.58 (14.99) |
| Miscellaneous cost (V3) | 25.22 (12.38) | 22.99 (11.25) | 21.98 (9.98) | 20.26 (9.50) | 19.98 (8.62) | 19.28 (8.89) | 22.20 (10.11) | 21.09 (10.01) |
| Total variable cost (TVC= V1+V2+V3) | 203.75 (88.17) | 204.34 (88.92) | 220.26 (88.05) | 213.35 (88.52) | 231.84 (88.03) | 216.86 (89.22) | 219.65 (89.22) | 210.67 (88.81) |
| Gross cost (A= TFC+TVC) | 231.09 (100.00) | 229.81 (100.00) | 250.15 (100.00) | 241.02 (100.00) | 263.36 (100.00) | 243.05 (100.00) | 246.20 (100.00) | 237.22 (100.00) |
| Value of dung (B) | 3.56 | 3.05 | 3.76 | 3.45 | 4.02 | 3.98 | 3.80 | 3.41 |
| Net cost ( C= A-B) | 227.53 | 226.76 | 246.39 | 237.57 | 259.34 | 239.07 | 242.40 | 233.82 |
| Price of milk | 26.05 | 26.59 | 26.86 | 27.98 | 27.36 | 28.16 | 26.80 | 27.49 |
| Average milk production/animal/ day ( E ) | 9.86 | 8.98 | 10.22 | 9.02 | 10.77 | 9.25 | 10.32 | 9.05 |
| Gross return (D) | 256.85 | 238.78 | 274.51 | 252.38 | 294.67 | 260.48 | 276.77 | 248.90 |
| Net return ( D-C ) | 29.32 | 12.02 | 28.12 | 14.81 | 35.33 | 21.42 | 34.37 | 15.08 |
| Cost/litre ( C/E ) | 23.08 | 25.25 | 24.11 | 26.34 | 24.08 | 25.84 | 23.49 | 25.83 |
| Return / litre | 2.97 | 1.34 | 2.75 | 1.64 | 3.28 | 2.32 | 3.33 | 1.67 |

*Figures in parentheses indicate the percentage with their respective totals*

M – Member, NM – Non-member

**Table 2.2: Cost and returns of milk production for crossbred cow by groups across herd size categories in Chittoor district**

**(₹ /animal/day)**

| Cost Components | Small | | Medium | | Large | | Overall | |
|---|---|---|---|---|---|---|---|---|
| | M | NM | M | NM | M | NM | M | NM |
| Total Fixed Cost (TFC) | 34.37 (12.88) | 33.19 (13.07) | 32.53 (11.92) | 35.53 (13.26) | 32.46 (11.38) | 31.82 (11.49) | 32.82 (11.80) | 33.72 (12.65) |
| Green Fodder (F1) | 91.72 (52.09) | 81.08 (47.96) | 93.40 (51.58) | 86.24 (48.58) | 99.56 (51.88) | 91.88 (48.87) | 96.19 (51.82) | 86.38 (48.50) |
| Dry Fodder (F2) | 14.23 (8.08) | 15.54 (9.19) | 14.78 (8.16) | 16.51 (9.30) | 16.68 (8.69) | 17.14 (9.12) | 15.63 (8.42) | 16.41 (9.21) |
| Concentrate (F3) | 70.14 (39.83) | 72.42 (42.84) | 72.89 (40.26) | 74.76 (42.12) | 75.68 (39.43) | 78.98 (42.01) | 73.80 (39.76) | 75.32 (42.29) |
| Feed & Fodder cost (V1= F1+F2+F3) | 176.09 (75.76) | 169.04 (76.55) | 181.07 (75.32) | 177.51 (76.38) | 191.92 (75.92) | 188.00 (76.69) | 185.62 (75.70) | 178.12 (76.53) |
| Labour cost (V2) | 32.12 (13.82) | 31.47 (14.25) | 33.36 (13.88) | 32.69 (14.07) | 33.47 (13.24) | 32.79 (13.38) | 33.20 (13.54) | 32.35 (13.90) |
| Miscellaneous cost (V3) | 24.22 (10.42) | 20.32 (9.20) | 25.98 (10.81) | 22.19 (9.55) | 27.39 (10.84) | 24.34 (9.93) | 26.38 (10.76) | 22.27 (9.57) |
| Total variable cost (TVC= V1+V2+V3) | 232.43 (87.12) | 220.83 (86.93) | 240.41 (88.08) | 232.39 (86.74) | 252.78 (88.62) | 245.13 (88.51) | 245.20 (88.20) | 232.74 (87.35) |
| Gross cost (A= TFC+TVC) | 266.8 (100.00) | 254.02 (100.00) | 272.94 (100.00) | 267.92 (100.00) | 285.24 (100.00) | 276.95 (100.00) | 278.02 (100.00) | 266.46 (100.00) |
| Value of dung (B) | 4.39 | 3.75 | 4.55 | 3.97 | 4.98 | 4.12 | 4.74 | 3.95 |
| Net cost ( C= A-B) | 262.41 | 250.27 | 268.39 | 263.95 | 280.26 | 272.83 | 273.28 | 262.51 |
| Price of milk | 26.32 | 27.11 | 26.75 | 27.25 | 26.87 | 27.64 | 26.73 | 27.33 |
| Average milk production/animal/day ( E ) | 11.79 | 10.25 | 11.98 | 10.96 | 12.15 | 11.25 | 12.03 | 10.83 |
| Gross return (D) | 310.31 | 277.88 | 320.47 | 298.66 | 326.47 | 310.95 | 321.67 | 296.04 |
| Net return ( D-C ) | 47.90 | 27.61 | 52.08 | 34.71 | 46.21 | 38.12 | 48.39 | 33.53 |
| Cost/litre ( C/E ) | 22.26 | 24.42 | 22.40 | 24.08 | 23.07 | 24.25 | 22.71 | 24.23 |
| Return / litre | 4.06 | 2.69 | 4.35 | 3.17 | 3.80 | 3.39 | 4.02 | 3.09 |

*Figures in parentheses indicate the percentage with their respective totals*

M – Member, NM – Non-member

**Table 2.3: Cost and returns of milk production for buffalo by groups across herd size categories in Guntur district**

**(₹ /animal/day)**

| Cost Components | Small | | Medium | | Large | | Overall | |
|---|---|---|---|---|---|---|---|---|
| | M | NM | M | NM | M | NM | M | NM |
| Total Fixed Cost (TFC) | 35.65 (10.88) | 32.28 (10.49) | 36.68 (10.67) | 32.96 (10.28) | 37.98 (10.46) | 33.29 (9.93) | 36.86 (10.65) | 32.77 (10.28) |
| Green Fodder (F1) | 110.76 (50.44) | 105.85 (50.18) | 114.60 (49.24) | 111.4 (50.18) | 118.74 (47.88) | 113.04 (48.77) | 115.00 (49.04) | 109.65 (49.88) |
| Dry Fodder (F2) | 17.65 (8.04) | 16.59 (7.86) | 18.34 (7.88) | 17.17 (7.73) | 19.27 (7.77) | 18.14 (7.83) | 18.48 (7.88) | 17.15 (7.80) |
| Concentrate (F3) | 91.16 (41.52) | 88.52 (41.96) | 99.81 (42.88) | 93.45 (42.09) | 109.98 (44.35) | 100.62 (43.41) | 101.03 (43.08) | 93.04 (42.32) |
| Feed & Fodder cost (V1= F1+F2+F3) | 219.57 (75.19) | 210.96 (76.56) | 232.75 (75.80) | 222.02 (77.17) | 247.99 (76.24) | 231.80 (76.73) | 234.51 (75.80) | 219.83 (76.86) |
| Labour cost (V2) | 45.12 (15.45) | 43.26 (15.70) | 47.46 (15.46) | 43.49 (15.12) | 49.89 (15.34) | 45.95 (15.21) | 47.67 (15.41) | 43.90 (15.35) |
| Miscellaneous cost (V3) | 27.34 (9.36) | 21.32 (7.74) | 26.85 (8.74) | 22.19 (7.71) | 27.39 (8.42) | 24.34 (8.06) | 27.20 (8.79) | 22.29 (7.79) |
| Total variable cost (TVC= V1+V2+V3) | 292.03 (89.12) | 275.54 (89.51) | 307.06 (89.33) | 287.7 (89.72) | 325.27 (89.54) | 302.09 (90.07) | 309.38 (89.35) | 286.02 (89.72) |
| Gross cost (A= TFC+TVC) | 327.68 (100.00) | 307.82 (100.00) | 343.74 (100.00) | 320.66 (100.00) | 363.25 (100.00) | 335.38 (100.00) | 346.24 (100.00) | 318.79 (100.00) |
| Value of dung (B) | 4.18 | 3.67 | 4.29 | 3.98 | 4.32 | 4.12 | 4.27 | 3.89 |
| Net cost ( C= A-B) | 323.5 | 304.15 | 339.45 | 316.68 | 358.93 | 331.26 | 341.97 | 314.90 |
| Price of milk | 36.46 | 37.25 | 36.86 | 37.64 | 36.98 | 37.84 | 36.79 | 37.53 |
| Average milk production/animal/day ( E ) | 10.69 | 9.17 | 11.25 | 10.08 | 11.67 | 10.21 | 11.24 | 9.76 |
| Gross return (D) | 389.76 | 341.58 | 414.68 | 379.41 | 431.56 | 386.35 | 413.45 | 366.51 |
| Net return ( D-C ) | 66.26 | 37.43 | 75.23 | 62.73 | 72.63 | 55.09 | 71.48 | 51.61 |
| Cost/litre ( C/E ) | 30.26 | 33.17 | 30.17 | 31.42 | 30.76 | 32.44 | 30.43 | 32.25 |
| Return / litre | 6.20 | 4.08 | 6.69 | 6.22 | 6.22 | 5.40 | 6.36 | 5.29 |

*Figures in parentheses indicate the percentage with their respective totals*

M – Member, NM – Non-member

**Table 2.4: Cost and returns of milk production for buffalo by groups across herd size categories in Chittoor district**

**(₹ /animal/day)**

| Cost Components | Small | | Medium | | Large | | Overall | |
|---|---|---|---|---|---|---|---|---|
| | M | NM | M | NM | M | NM | M | NM |
| Total Fixed Cost (TFC) | 23.15 (9.38) | 19.46 (8.29) | 22.85 (9.00) | 20.56 (8.23) | 24.82 (9.34) | 22.02 (8.38) | 23.89 (9.35) | 20.67 (8.30) |
| Green Fodder (F1) | 79.40 (49.78) | 75.32 (48.77) | 81.52 (48.96) | 79.2 (47.31) | 85.16 (49.05) | 82.68 (46.98) | 82.97 (49.14) | 79.08 (47.61) |
| Dry Fodder (F2) | 14.91 (9.35) | 13.71 (8.88) | 15.39 (9.24) | 14.82 (8.85) | 15.87 (9.14) | 15.51 (8.81) | 15.55 (9.21) | 14.69 (8.85) |
| Concentrate (F3) | 65.2 (40.88) | 65.40 (42.35) | 69.60 (41.80) | 73.40 (43.84) | 72.60 (41.81) | 77.80 (44.21) | 70.33 (41.65) | 72.32 (43.54) |
| Feed & Fodder cost (V1= F1+F2+F3) | 159.51 (71.32) | 154.43 (71.76) | 166.51 (72.04) | 167.42 (73.01) | 173.63 (72.03) | 175.99 (73.15) | 168.85 (71.92) | 166.09 (72.70) |
| Labour cost (V2) | 39.78 (17.79) | 38.12 (17.71) | 41.65 (18.02) | 40.27 (17.56) | 41.88 (17.37) | 40.36 (16.77) | 41.44 (17.65) | 39.65 (17.36) |
| Miscellaneous cost (V3) | 24.35 (10.89) | 22.64 (10.52) | 22.98 (9.94) | 21.62 (9.43) | 25.54 (10.60) | 24.25 (10.08) | 24.50 (10.44) | 22.72 (9.94) |
| Total variable cost (TVC= V1+V2+V3) | 223.64 (90.62) | 215.19 (91.71) | 231.14 (91.00) | 229.31 (91.77) | 241.05 (90.66) | 240.6 (91.62) | 234.78 (91.91) | 228.46 (91.70) |
| Gross cost (A= TFC+TVC) | 246.79 (100.00) | 234.65 (100.00) | 253.99 (100.00) | 249.87 (100.00) | 265.87 (100.00) | 262.62 (100.00) | 255.45 (100.00) | 249.13 (100.00) |
| Value of dung (B) | 3.12 | 2.98 | 3.67 | 3.45 | 3.98 | 4.06 | 3.73 | 3.49 |
| Net cost ( C= A-B) | 243.67 | 231.67 | 250.32 | 246.42 | 261.89 | 258.56 | 251.72 | 245.64 |
| Price of milk | 34.6 | 35.13 | 35.56 | 36.35 | 35.97 | 36.85 | 35.60 | 36.13 |
| Average milk production/animal/day ( E ) | 7.35 | 6.68 | 7.54 | 6.93 | 7.89 | 7.19 | 7.68 | 6.93 |
| Gross return (D) | 254.31 | 234.67 | 268.12 | 251.91 | 283.80 | 264.95 | 273.45 | 250.52 |
| Net return ( D-C ) | 10.64 | 3.00 | 17.80 | 5.49 | 21.91 | 6.39 | 21.73 | 4.88 |
| Cost/litre ( C/E ) | 33.15 | 34.68 | 33.20 | 35.56 | 33.19 | 35.96 | 32.77 | 35.43 |
| Return / litre | 1.45 | 0.45 | 2.36 | 0.79 | 2.78 | 0.89 | 2.83 | 0.70 |

*Figures in parentheses indicate the percentage with their respective totals*

M – Member, NM – Non-member

# APPENDIX-3

## IMPACT OF DAIRY COOPERATIVES ON THE INCOME OF RURAL HOUSEHOLDS IN ANDHRA PRADESH

M.Sc. Dissertation Work,

Division of Dairy Economics, Statistics and Management,

ICAR-National Dairy Research Institute, Karnal-132001 (Haryana)

M.Sc. Scholar – P. Lakshmi priya

## INTERVIEW SCHEDULE

Serial No……

Respondent no:…….

Date:……

### SECTION-I

### A. GENERAL PROFILE OF SAMPLE HOUSEHOLD:

1. District:…… Mandal:……. Village:…….
2. Name of DCS:……
3. Name of Respondent:……(Member/Non-member),

S/o……

4. Year of membership (for member):……
5. Distance between home and DCS (Km):……
6. Farmer category : Marginal/Small/Semi-Medium/ Medium / Large
7. Family size (No.): …… Adult: M……. F……..

   Children (<18 yrs.): M….. ….F……Total:…….

### B. OCCUPATION:

| Sl. No. | Relation with the respondent | Age # | Sex @ M / F | Occupation | | Education* |
|---|---|---|---|---|---|---|
| | | | | Main | Subsidiary | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

# 1 = Upto 25yrs, 2 = 26-35yrs, 3 = 36-45yrs, 4 = 46-55yrs, 5 = 56-65yrs, 6 = Above 65 yrs

@ M- Male, F- Female

* 0- Illiterate, 1- Primary, 2- Middle, 3- High school, 4- Higher secondary, 5- Graduation and above.

**C. LAND HOLDING (ha):**

| Particulars | Irrigated | Unirrigated | Total |
|---|---|---|---|
| Owned | | | |
| Leased in | | | |
| Leased out | | | |
| Operational | | | |
| Under fodder crop | | | |

**D. CROPPING PATTERN:**

| Season / Crop | Area (Ha.) | Quantity produced | Value (₹ ) | By-product | Value (₹ ) |
|---|---|---|---|---|---|
| Kharif / Rainy<br>1.<br>2.<br>3.<br>4.<br>5. | | | | | |
| Rabi / Winter<br>1.<br>2.<br>3.<br>4.<br>5. | | | | | |
| Summer<br>1.<br>2.<br>3.<br>4.<br>5. | | | | | |

**E.LIVESTOCK INVENTORY:**

| Classification | | Cross Breed | | | Local cow | | | Buffalo | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | Value/ *animal*(₹ ) | Total value | No. | Value/ Animal(₹ ) | Total Value | No. | Value/ Animal(₹ ) | Total Value |
| | In milk | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Adult | Dry | | | | | | | | | |
| Heifers | Pregnant | | | | | | | | | |
| | Non-pregnant | | | | | | | | | |
| Young stock | Male < 1 year | | | | | | | | | |
| | Male 1-2 year | | | | | | | | | |
| | Female < 1 year | | | | | | | | | |
| | Female 1-2 year | | | | | | | | | |
| Drought animals | | | | | | | | | | |

**SECTION II**

**F. <u>FIXED INVESTMENT IN DAIRY ENTERPRISE:</u>**

| Particulars | | No. | Years of purchase | Purchase/ original value (₹ ) | Present value (₹ ) | Period used (yrs.) | Expected life (yrs.) | Annual repair (₹ ) |
|---|---|---|---|---|---|---|---|---|
| Cattle shed | Kaccha | | | | | | | |
| | Pacca | | | | | | | |
| Store for feed/fodder | | | | | | | | |
| Chaff cutter shed | Kaccha | | | | | | | |
| | Pacca | | | | | | | |
| Chaff cutter | Power | | | | | | | |
| | Manual | | | | | | | |
| Manager | | | | | | | | |
| Bullock cart | | | | | | | | |
| Water cans | | | | | | | | |
| Milk cans | | | | | | | | |
| Basket for lifting dung | | | | | | | | |
| Buckets | | | | | | | | |
| Measuring set | | | | | | | | |
| Iron Chain | | | | | | | | |
| Ropes | | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Water pump | | | | | | | |
| Gunny bags | | | | | | | |
| Spade | | | | | | | |
| Sickle | | | | | | | |
| Axes | | | | | | | |
| Others | | | | | | | |

**G. <u>DETAILS OF RECURRING EXPENDITURE:</u>**

| Type of expenditure | No. (Qty.) | Rate/Unit | Amount (₹ ) |
|---|---|---|---|
| Service charges | | | |
| a)Natural service | | | |
| b) A.I. | | | |
| Veterinary charges | | | |
| a) Medicines | | | |
| b) Vaccination | | | |
| c) Doctor charge | | | |
| d) Other (specify)/sanitary | | | |
| Miscellaneous charges | | | |
| a) Interest on loan | | | |
| b) Electricity | | | |
| c) Fuel (diesel/petrol) | | | |
| d) Water | | | |
| e) Identification tags | | | |
| f) Ropes, gunny bags, brooms | | | |
| g) Baskets, stationery charges | | | |
| h) Other | | | |
| Municipal/ other taxes | | | |
| a) Stall | | | |
| b) Animals | | | |
| Insurance charges | | | |
| a) Farm vehicle insurance | | | |
| b) Animal insurance | | | |
| c) Fire and hazard insurance | | | |
| d) Others | | | |
| TOTAL | | | |

## H. FEED AND FODDER FED PER ANIMAL PER DAY:

| Particulars | | In milk | Dry | PregnantHeifer | Total |
|---|---|---|---|---|---|
| Total no. of animals | | | | | |
| Green Fodder | Name | | | | |
| | Source | | | | |
| | Qty. (kgs.) | | | | |
| | Rate (₹ ) | | | | |
| | Amount (₹ ) | | | | |
| Dry Fodder | Name | | | | |
| | Source | | | | |
| | Qty. (kgs.) | | | | |
| | Rate (₹ ) | | | | |
| | Amount (₹ ) | | | | |
| Concentrate | Name | | | | |
| | Source | | | | |
| | Qty. (kgs.) | | | | |
| | Rate (₹ ) | | | | |
| | Amount (₹ ) | | | | |
| Mineral Mixture | Name | | | | |
| | Source | | | | |
| | Qty. (kgs.) | | | | |
| | Rate (₹ ) | | | | |
| | Amount (₹ ) | | | | |

## SECTION III

## I.MILK PRODUCTION, CONSUMPTION AND SALE: (Per Day Per Household)

| Total milk production of household (Lts.) | Household milk Consumption (Lts.) | Total Milk Sold (Lts.) | Sale Price of milk (₹ /Lts.) |
|---|---|---|---|
| | | | |

## J. MARKETED SURPLUS:-

| To whom sold | Quantity | Rate | Total value (₹ ) |
|---|---|---|---|
| 0-DCS | | | |
| 1-Door to door | | | |
| 2- Milk vendor | | | |
| 3- Tea shop | | | |
| 4- direct to consumers | | | |
| 5- Any other | | | |
| Total marketed surplus | | | |

**k. DISPOSAL PATTERN:-**

| Dimension | Items | |
|---|---|---|
| Place of sale | Sale within the village | |
| | Sale outside the village | |
| Terms and condition of sale | Immediate cash | |
| | Contract | |
| | Credit | |

**SECTION IV**

**L. INCOME FROM DAIRY ANIMAL PER HOUSEHOLD:**

| Sl.No | Item of Income | | Quantity | Rate/Unit (₹ ) | Total (₹ ) | Remarks if any. |
|---|---|---|---|---|---|---|
| 1 | Milk | Crossbred | | | | |
| | | Local cow | | | | |
| | | Buffalo | | | | |
| 2 | Dung | Crossbred | | | | |
| | | Local cow | | | | |
| | | Buffalo | | | | |
| 3 | Sale of Animal | Crossbred | | | | |
| | | Local cow | | | | |
| | | Buffalo | | | | |
| | | Others | | | | |
| 4 | Hiring out bullock labour | | | | | |
| | TOTAL | | | | | |

**M. INCOME FROM OTHER SOURCES PER HOUSEHOLD:**

| Sl. No. | Source of income | | Quantity | Price / unit (₹ ) | Value (₹ ) |
|---|---|---|---|---|---|
| 1. | Hired labour | Male | | | |
| | | Female | | | |
| | | Child | | | |
| 2. | Off-farm income (due to renting of farm assets and land) | | | | |
| 3. | Non-farm income (from other activities like business, private and Govt.employed) | | | | |
| 4. | Income from any other Govt. scheme | | | | |

| | | | | |
|---|---|---|---|---|
| 5. | Sale of farm produce (cereals, vegetables, fruits etc.) | | | |
| 6. | Poultry | | | |
| 7. | Goat rearing | | | |
| | TOTAL | | | |

**N. <u>SOCIAL PARTICIPATION</u>:**

**<u>Have you been Associated with any of the following Organisation?</u>**

| Sl.No. | Name of the organization | Scores | Members | | How Many Years | Office Bearer | |
|---|---|---|---|---|---|---|---|
| | | | Present | Past | | Present | Past |
| 1. | Milk Co-operative Society | | | | | | |
| 2. | Primary Agricultural Co-operative Credit Society | | | | | | |
| 3. | Any other Co-operative society | | | | | | |
| 4. | Gram Panchayat | | | | | | |
| 5. | Panchayat Samiti | | | | | | |
| 6. | Zila Parishad | | | | | | |
| 7. | Religious Committee | | | | | | |
| 8. | Political Organization | | | | | | |
| 9. | Mahila Mandal | | | | | | |
| 10. | Rural Youth Club | | | | | | |
| 11. | District Kisan Welfare Club | | | | | | |
| 12. | Public Health Tool Service | | | | | | |
| 13. | Self Help Group | | | | | | |
| 14. | Farmers Association (FDG, FIG, Commodity Association) | | | | | | |
| 15. | Religious Institution | | | | | | |
| 16. | Any Other (Specify) | | | | | | |