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Effect of Holistic Adoption of Dairy Farming Technologies on Households Farm Income of Small and Marginal Farmers: A Study of Telangana

Ch. Ramya Sri^{1*} and K. Suhasini¹

¹*Professor Jayashankar Telangana State Agricultural University (PJTSAU), Department of Agricultural Economics, Rajendranagar, 500 030, Hyderabad, India.*

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Dairy farming provides an excellent opportunity for self-employment of unemployed youth. It is also an important source of income generation for small and marginal farmers and agricultural labourers. Since agriculture is mostly seasonal, there is a possibility of finding employment throughout the year for many persons through dairy farming and landless labourers. Dairy farming in India is more of subsidiary activity represented by plurality of small holder dairy farmers and entrepreneurs. The value of milk alone is well above Rs.35 thousand crores and livestock contributes nearly 5% to National GDP, accounting for more than 25% of agricultural GDP (Planning Commission, 2010). Cluster sampling technique is adopted for identification of three clusters, which are mutually homogeneous but internally heterogeneous. Three clusters included three mandals of Khammam district i.e., Mudigonda, Kusumanchi, Nelakondapalli are selected for the study. The income from dairy farming is surpassing the income from crop production enterprises and the risk is less compared to crop. The dairy animals are not improved breeds, so improved breeds and cross-bred suitable dairy units will enhance the income from dairy. Even though the farmers have both livestock and dairy enterprises, there is a lack of integration to the

^{*}Corresponding author: E-mail: ramya7153@gmail.com;

extent of 50% of the sampled farmers. Such awareness has to be created. There is capital crunch created faced by marginal and small farmers, credit support and technical support would enhance the household income. Need for Government role in improving the supply of inputs and services to dairy farmers/beneficiaries at their doorsteps with minimum cost by promoting milk co-operatives which maintain the milk chilling and processing centres and play a remunerative price within a stipulated time. Developing viable farmer's cooperatives societies/federations like: milk producers' cooperative societies at village and district levels, federations, boards and corporations is needed.

Keywords: Cluster sampling; cooperative societies; household income; milk chilling centers.

1. INTRODUCTION

In India, the dairy sector is closely interwoven as an integral part of agriculture and it has also been a source of livelihood of the weaker sections of rural communities. In dairying, a change that is taking place is shift from the non-monetary inputs to monetary inputs, due to the decreasing size of land holdings and shrinking common property resources [1,2]. The cost plays an important role in economic viability of a dairy enterprise. It is a critical economic indicator for milk producers, consumers and policy makers to provide an effective linkage between the milk producers and consumers for fixing the price of milk rationally. Generally, a milk producer can increase dairy income in two ways viz: either by increasing the milk production or by reducing cost of milk production [3,4].

As per Economic Survey 2015-16, milk production in India has risen by a historic 6.25% to reach 146.3 million tonnes (MT) in 2014-15 against 137.7 MT in 2013-14, marginally higher than the target of 145.8 MT (Indiastat, 2015). This is the highest growth rate achieved in the past surpassing the previous high rate of 5.7% in 2006-07.

In India demand lead growth of milk production and increasing its supply is the only way to curb food inflation or the country to be self-sufficient (Lagos and Intodia, 2015) Working Group of the Planning Commission, Government of India 11th Five Year Plan in 2007 also had drawn attention to the need of enhancing growth rate in milk production and support overall growth of livestock and rural economy [5-7]. Hence, this higher growth in milk production is in the direction of fulfilling the growing domestic demand for milk.

Dairying is recognized as an important source of income for small and marginal farmers in India, since on an average 22-26 per cent of the income of the rural households is contributed by

milk. A large majority of milk producers have one or two milch animals and account for about 70 per cent of milk production. Low capital intensity, short operating cycle, steady returns make dairying a preferred livelihood activity among the small and marginal farmers. Lack of other lucrative and alternate employment opportunities in the villages often make dairying the only viable option for many villagers. It helps to improve the status of rural masses especially weaker sections, consisting of small and marginal farmers, landless labourers and women of low-income families.

1.1 Statement of the Problem

1.1.1 Justification of the study

This study therefore, focused to assess whether holistic adoption of dairy husbandry practices had brought changes to the targeted farmers on livelihoods and income. Additionally, the study also investigated on factors influencing trained dairy farmers to practice what they were taught at Telangana. The findings from this study form a basis and add knowledge to various stakeholders of the dairy sub-sector in assessing the influence of farmers' training in enhancing adoption of the improved dairy husbandry practices to trained farmers, but also form a basis of noticeable and measurable behaviour changed in the activity performance using knowledge and skills gained by trained farmers when they are back in their roles.

The main objective of the study was to assess the influence of farmers' training on enhancing holistic adoption of the improved dairy husbandry practices among trained farmers. The specific objectives of the study were to: identify improved dairy husbandry practices taught to small scale dairy farmers; determine the extent to which improved dairy husbandry skills taught are practiced by the dairy farmers; and determine socioeconomic factors influencing trained farmers to effectively practice and adopt

improved dairy husbandry skills they learned. The questions then are:

Which improved dairy husbandry practices were taught to dairy farmers?

To what extent are the taught improved dairy husbandry practices?

3) What are the socioeconomic factors influencing trained farmers to practice improved dairy husbandry practices?

4) What suggestions could be put forward to enhance holistic adoption and use of improved dairy husbandry practices by trained farm in the study area?

These attributes would have captured the real essence and objectives of the work.

2. MATERIALS AND METHODS

The primary data required for economics of dairy farming adopted by small and marginal farmers will be obtained from the selected sample farmers by interview method through a pre-tested questionnaire. Further, the necessary secondary data required for sampling purpose will be gathered from the official records maintained at the Village Revenue Office / Mandal Revenue Office / District-Joint Director of Agriculture Office. Suitable statistical measures i.e., Cluster sampling technique and Logistic regression will be employed to arrive at valid results and conclusions.

Cluster sampling technique is adopted for identification of three clusters, which are mutually homogeneous but internally heterogeneous. Three clusters included three mandals of Khammam district i.e. Mudigonda, Kusumanchi and Nelakondapalli are selected for the study. In each cluster, 15 small and 15 marginal farmers were randomly selected for the study who happened to grow different crops. Thus, making a sample of 90 farmers under 45 marginal and 45 small farmers. Among the cluster mandals, one village from each selected cluster ensuring heterogeneity in the village, where maximum numbers of dairy farmers under small and marginal category were there and are selected.

2.1 Tools of Analysis

2.1.1 Break –even- analysis

To estimate the profitability in milk production, the break-even analysis was employed.

2.1.2 Break-even output

It is the output at which there is neither profit nor loss. It is calculated by using the following formula.

$$\text{BEO (In litres)} = F/P-V$$

Where,

F = Total fixed cost per animal

P = Price per litre of milk

V = Variable cost per litre of milk

Margin of safety = Average milk yield in litres per animal/farm

Break - even output in litres per animal /farm

$$\text{Benefit cost ratio} = \frac{\text{Gross returns}}{\text{Total cost}}$$

2.2 Logit Model

Logit model is based on the logistic cumulative distribution function and its results are thus not sensitive to the distribution sample attributes when estimated by maximum likelihood. The study assumed a logistic distribution of the error term. Therefore, in this study the logit model is used to analyze the factors influencing selection of dairy farming as an integral part of farming system. The farmers are grouped based on their level of integration. Even though they have both crop and dairy enterprises some or not really integrated. Integrated farms are those crop byproducts are used in dairy units and dairy byproduct is used in the field. This model differs from the probit model which assumes a normal distribution of the error term. The dependent variable is the decision to integrate dairy and crop enterprises. The dependent variable is binary thus, 1= for who is integrating dairy with crop and 0 = for who is not integrating.

$$P_i = \frac{1}{1 + e^{-Z_i}} = \frac{1}{1 + e^{-(\alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n)}}$$

Where denotes the probability that a farmer integrates dairy and crop enterprises is the. Z_i is factors influencing dairy (X_i)

3. RESULTS AND DISCUSSION

3.1 Family Size

The structure of family of the sample in respect of male, female and children and family labour

available was presented in Table 1. The average size of selected small and marginal farm families was 3.53 and 3.42 members respectively. It was observed that there is not much variation with respect to number of male, female and children among the selected farm families. The average number of family members available for working on the farm was 0.98 in small farms and 0.99 in marginal farms. It can be inferred that the nuclear families became predominant in the study area.

3.2 Ownership of Land Holdings - Small and Marginal Farmers

The average land holding size of marginal farmers was 0.62ha. in particularly, 0.66ha dry land, 0.6ha irrigated land and 0.62 was irrigated cum dry land. The average size of land holding of selected small farmers was 1.42ha of which 1.33ha was dry land, 1.56 ha was irrigated land and 1.37 was irrigated cum dry land owned and practiced in study area. The composition and extent of land under irrigated and dry condition indicates the economic status and standard of living of the sample farmers.

3.3 Mean Number and Age of Dairy Units Owned by Sample Farmers

The average no. of dairy animals possessed by small farmers are 1.32 units and marginal farmers are 1.47 units as indicated in Table respectively. It can be understood that there is no difference in number of dairy units owned by both categories.

The mean age of dairy animals was presented in Table (3). Average age of overall milch animals was 7.78 years for pooled farmers sample. The average age in marginal farmers category who possessed one dairy unit is 8.01 years and 7.8 years in small farmers category. The average age in case of three dairy animals reared was 9 years and 9.25 years in marginal and small category farmers respectively. It can be understood that those who have three dairy animals seemed to be experienced in dairy farming.

The Value of milch animals were presented in Table (4). The average value of single dairy unit was (Rs. 32611.11) possessed by marginal farmers. The dairy animal average value was Rs. 36155.29 in case of small farmers. The values of dairy animals cross the single, double and triple

units reared by small and marginal categories were ranging from Rs.30000 to Rs 37279.

These animals are not totally cross bred or improved breeds but seemed to be purely indigenous.

3.4 To Find out the Share of Income from Dairy Farming in the Total Farm Income

The share of income from dairy were worked out and presented in Table 6. From cluster-1 (Kusumanchi) the total household income for paddy and single dairy unit was found to be Rs.64209.52. From this amount the share of net returns from single dairy unit and paddy was found to be 58% and 42% for marginal farmers. In case of small farmers, the total household income was found to be Rs.70100. From this amount the share of net returns from single dairy unit and paddy was found to be 54% and 46% for small farmers respectively. In case of marginal farmers, the total household income for paddy and two dairy unit was found to be Rs 83038.1. From this amount the share of net returns from two dairy unit and paddy was found to be 52% and 48% respectively. In case of small farmers, the total household income for paddy and two dairy unit was found to be Rs 91756.67. From this amount, the share of net returns from two dairy unit and paddy was found to be 57% and 43% respectively. In case of marginal farmers, the total household income for paddy and three dairy unit was found to be Rs. 76758.34. The share of of net returns from single dairy unit and paddy was found to be 37% and 63% respectively.

From cluster-2 (Neelakondapalli) the total household income were worked out and presented in Table 6. It is observed that total household income for cotton and single dairy unit was found to be Rs.58053.7. From this amount, the share of net returns from single dairy unit and cotton was found to be 42% and 58% for marginal farmers respectively. In case of small farmers, the total household income for cotton and single dairy unit was found to be Rs. 38793.5. From this amount, the share of net returns from single dairy unit and cotton was found to be 57% and 43% respectively. The total household income for cotton and two dairy unit was found to be Rs. 91756.67. The share of net returns from two dairy unit and cotton was found to 52% and 48% for marginal farmers.

Table 1. Family composition and family labor contribution of sample marginal and small dairy farmers

Particulars		Marginal farmers		Small farmers	
		Average number	Percent	Average number	Percent
1.Family composition	a. Male	1.00	32.84	1.00	31.03
	b. Female	1.00	32.84	0.95	29.65
	c. Children	1.42	34.30	1.58	39.31
	Total	3.42	100	3.53	100
2.Farm family workers	a. Male	0.68	68.88	0.65	66.65
	b. Female	0.31	31.11	0.33	33.33
	Total	0.99	100	0.98	100

Table 2. Farm holding particulars of sample marginal and small farmers in Khammam district

S. No	Particulars	Marginal farmers	Small farmers
		Average area (ha)	Average area (ha)
1	Dry land	0.66	1.33
2	Irrigated land	0.60	1.56
3	Irrigated + Dry	0.62	1.37
	Overall average	0.62	1.42

Table 3. Average no. of dairy animals owned by marginal and farmers (No of animals)

Marginal	Small	Pooled farmers
1.47	1.32	1.4

Table 4. Mean age of the dairy unit possessed by small and marginal farmers

Size Group	One dairy Unit	Two dairy Units	Three dairy Units	Over all
	Average Age (No of years)			
Marginal	8.01	7	9	7.83
Small	7.80	6.57	9.25	7.74
Pooled	7.91	6.81	9.2	7.78

Table 5. Mean value of the dairy units possessed by small and marginal farmers (Rs./ Unit)

Size Group	One dairy unit	Two dairy units	Three dairy unit	Over all
	Average value of each dairy unit (Rs./ Unit)			
Marginal	32928.57	31666.66	30000	32611.11
Small	37279.41	32083.33	32708.25	36155.29
Grand Total	35072.46	31833.33	32166.6	34363.29

From cluster-3 (Mudigonda) the total household income were worked out and presented in Table 6. It is observed that total household income for chilli and single dairy unit was found to be Rs.57949.51. From this amount, the share of net returns from single dairy unit and chilli was found to be 52% and 42% for marginal farmers. In case of small farmers the total household income for chilli and single dairy unit was found to be Rs 44087.04. From this amount, the share of net returns found to be 50% for both single dairy unit

and chilli. In case of marginal farmers, total household income for chilli and two dairy unit was found to be Rs 71468.89. From this amount, the share of net returns from two dairy unit and chilli was found to be 51% and 49% for marginal farmers. In case of small farmers, total household income for chilli and two dairy unit was found to be Rs 369461.7. From this amount, the share of net returns from two dairy unit and chilli was found to be 52% and 48% respectively. The total household income for chilli and three

dairy unit was found to be 17525.33 for marginal farmers. From this amount, the share of net returns from three dairy unit and chilli was found to be 51% and 49% for marginal farmers. In case of small farmers, the total household income for chilli and three dairy unit was found to be Rs.44842.5 for marginal farmers. From this amount, the share of net returns from three dairy unit and chilli was found to be Rs.46% and 54% for marginal farmers respectively.

Table (7) indicates that most of the small farmers (42.22%) sold milk to milk vendor –consumers followed by directly to consumers (31.11%) and sale through co-operative milk society-Consumers (26.66%). In case of marginal farmers, same as small farmers (44.44%) sold milk to milk vendors-consumers followed by direct sale to consumers (28.88%) and sale through co-operatives milk society-consumers (26.66%). Thus mostly farmers sold their milk to the milk vendors on the sample farms which was due to easiest way of selling milk to the person who approach the farmers at their door step as compared to fetching the milk for sale to a distant co-operative milk society or directly to the consumers at their homes. Regular visit of milk vendor to the dairy farmers homes to collect milk was the major reason of sale through them.

Table 8 indicates that Price realized for the dairy enterprise under taken is considered as key to success. Table 8 represents the average price received from different marketing channels adopted on the sample farms. In case of marginal farmers, maximum price of milk was obtained from channel through milk vendors (₹44.66) followed by co-operative milk society (₹42.66) and direct sale (₹38). However, like marginal farmers small farmers also receive highest price from milk vendors (₹46) followed by co-operatives (₹42.66) and direct sale (₹40).

3.5 Results of Logit Analysis

3.5.1 Off-farm income

Off-farm income had a positive significant impact in integrating both crop and dairy. It demonstrated that if farm income increased by 1 unit, the probability of adopting crop and dairy increased by 0.0002 units.

3.5.2 Land size

Land size had a negative significant impact integrating both crop and dairy. It demonstrated

that if land size increased by 1 unit, the probability of adopting crop and dairy decreased by 1.74 units.

3.5.3 Credit access

Credit access had a negative significant impact integrating both crop and dairy. It demonstrated that if Credit asset increased by 1 unit, the probability of adopting crop and dairy decreased by 6.38 units.

3.5.4 Extension services

Extension services had a positive significant impact in integrating both crop and dairy. It demonstrated that if increased by 1 unit, the probability of adopting crop and dairy increased by 5.36 units.

The factors that influence dairy were significant in influencing the decision to integrate dairy and crop enterprises as presented in Table 9 and these were: gender, off-farm income, land size, labour, credit access, extension services, awareness on the benefits of integration, If the gender of the household head is male, the chances of integration of dairy and crop enterprises increased by 0.66 times but it's not significant. Even though dairy is looked after by female member of the family, decision making for integration of dairy was with male members. However, if an increase in the land size by 1 unit, it decreases the integration by 1.745 times. This is probably due to the fact that households have a lower supply of labour and this labour may not be channeled towards integrating the two enterprises since integration for labour is less demanding and costly if they have to work on both crop and dairy. Most dairy enterprises requires availability of house hold labour This is owed to the fact that extension services educate the farmers on various farm aspects such as crop residue utilization, manure utilization, labour utilization and other farm practices which then prompt the farmer to integrate towards dairy. Increased access to extension services by the farmer leads to an increase in the decision to integrate by 5.363. Hence, they have a positive effect on dairy. Credit access is decreased by 6.387 so, farmers are unable to get any credit for integrating crop and dairy enterprise, since it has a negative effect. Land size also decreases integration by 1.745. Off-farm income has a positive effect on dairy, it is increased by .0002.

Table 6. To find out the share of income from dairy farming in the total farm income

	Crop Net returns Rs/ha	Net returns Single dairy unit	Total Household Income	Crop Net returns Rs/ha	Net returns Two dairy unit	Total Household Income	Crop Net returns Rs/ha	Net returns Three dairy unit	Total Household Income
Cluster 1 / Kusumanchi	Marginal farmers								
	26933.33(42)	37276.19(58)	64209.52(100)	39771.43(48)	43266.67(52)	83038.1(100)	28758.34(37)	48000(63)	76758.34(100)
	Small Farmers								
	32320(46)	37780(54)	70100(100)	39040(43)	52716.67(57)	91756.67(100)	-	-	-
Cluster 2/ Neelakondapalli	Marginal farmers								
	33714(42)	24339.7(58)	58053.7(100)	42291.66(48)	45346.67(52)	87638.33(100)	-	-	-
	Small farmers								
	16741.66(43)	22051.89(57)	38793.55(100)	-	-	-	-	-	-
Cluster 3/ Mudigonda	Marginal farmers								
	27585.71(48)	30363.18(52)	57949.51(100)	34933.33(49)	36535.56(51)	71468.89(100)	16000(49)	15253.33(51)	17525.33(100)
	Small farmers								
	21950(50)	22137.04(50)	44087.04(100)	30920(48)	33854.17(52)	369491.7(100)	24380(54)	20462.5(46)	26426.25(100)

Table 7. Milk marketing channel utilized by the dairy farmers

S. No	Milk marketing channels	Marginal farmers		Small farmers	
		Number	percent	Number	Percent
1	Producer-Milk Vendor-Consumers	20	44.44	19	42.22
2	Producer-Co-operative society-Consumers	12	26.66	12	26.66
3	Producer-Direct Sale-Consumers	14	28.88	14	31.11
	Total	45	100	45	100

Table 8. Average price received by the producer

S. No	Particulars	Marginal	Small
1.	Milk vendor	44.66	46
2.	Co-operative milk society	42.66	42.66
3.	Direct sale	38	40
4.	Total	125.32	128.66

Table 9. Estimation of logistic regression of Factors influencing the decision of farmers to integrated crop and dairy two ways

Variables	Coefficients(β)	Odds ratio	Standard error	$p < z $
Constant	0.647	1.91	6.122	0.915
Gender(X_1)	0.812	2.25	1.866	0.663
Off farm income(X_2)	0.0002	1.00	0.0001	0.024**
Land size(X_3)	-1.745	0.17	0.976	0.073*
Labor(X_4)	-5.519	0.00	2.602	0.033
Credit access(X_5)	-6.387	0.00	2.530	0.011***
Extension services (X_6)	5.362	213.15	2.507	0.032**
Awareness on the benefits of integration (X_7)	0.060	1.06	1.288	0.962

Note: * indicates 10% level of significance ** indicates 5% level of significance and *** indicates level of significance at 1%

4. CONCLUSION

The important reason for failure in dairy farming is fatal diseases which sometimes lead to death of animal. Unless there is adequate health care programme and or risk coverage through Livestock Insurance Scheme or any such other suitable measures, dairy farming cannot be run successfully. Need for identifying such technologies, which demand less capital, less time and minimum operations. Exploring the possibilities of providing loans at the lowest interest rates with subsidies for dairy development activities. Gradual improvement of existing indigenous breeds of animals, gradual removal of useless stock and replacement with high yielding superior quality animals, gradual manipulation in husbandry practice for improving animal productivity and adoption of biotechnological interventions in feed and fodder, reproduction and growth aspects. Need for Government role in improving the supply of inputs and service to dairy farmers / beneficiaries at their doorsteps with minimum cost. Need for

developing viable farmer's cooperatives societies / federations like, milk producer's cooperative societies at village and district levels, federations, boards and corporations. Need for extension services from the Government, Agriculture Universities, R&D institutions, federations and corporations, besides mobilization of various input services from various agencies.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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