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Krishna Murthy A
Department of Rural
Development, Sri
Krishnadevaraya University,
Anantapur, Andhra Pradesh,
India

Muninarayanappa M
Department of Rural
Development, Sri
Krishnadevaraya University,
Anantapur, Andhra Pradesh,
India

Identification of profitable crop and livestock integrated farming systems for small and marginal farmers in Kurnool district of Andhra Pradesh

Krishna Murthy A and Muninarayanappa M

Abstract

Agriculture and livestock integration provide scope for profitability and sustainability of the farming systems. To get sustainable income for the small and marginal farmers a suitable farming system with combination of crops and livestock is very much needed. A study was conducted to identify a profitable and suitable farming systems under major farming situations of Kurnool district. Farming system consisting of seasonal crops along with dairy, sheep and poultry was found most profitable than cultivation of crops alone. The farming system with red gram + dairy + sheep was found profitable in rainfed black soils with BCR of 2.11. Similarly, red gram + dairy (1.94) and maize + sorghum + dairy + sheep + poultry (1.87) were found most profitable farming systems in rainfed red soils and irrigated black soils respectively. The present study recommended suitable and profitable farming system for small and marginal farmers in Kurnool district.

Keywords: Identification, livestock, farming, marginal, BCR

Introduction

Indian agriculture consisting of 115 million operational holdings in which 80% are marginal and small farmers. The operational farm holding in India is declining and over 85 million out of 105 million are below the size of 1 ha. The decrease in per capita availability of land in our country is due to increasing population (Manjunatha *et al.* 2014)^[4].

On an average 49.7% of the household income comes from farming and the small and marginal farmers possessing less than 1 ha of land. The households having less than 0.01ha land are getting 32% of their income from farming, farmers having up to 0.4ha of land are getting 26% of their income from farming and 44% of income from farming those having 0.41 to 1ha of land. The small and marginal farmers in India cultivate only 44% of the area and producing 60% of food grains includes 40% wheat, 29% of coarse cereals and 27% of pulses and over 50% of fruits and vegetable production.

Kurnool district of Andhra Pradesh located in scarce rainfall zone with 630mm annual rainfall is having 10.2lakh ha of total cultivable land. The soils in the district are predominantly black cotton soils (7.66lakh ha), followed by red soils (2.05lakh ha) and other soils (0.51lakh ha). Marginal holdings constitute 40% and small farmers have 28% of the total land holdings in the district. Kurnool district is having livestock population consisting 4.09lakh cattle (8.9%), 4.1lakh buffaloes (6.4%), 15.04lakh sheep (11.11%), 5.05lakh goats (11.13%) and 12.01 lakh poultry (1.47%).

Indian economy is heavily reliant on agriculture and livestock and two-thirds of rural families depend on livestock for their livelihood (Chouhan J K *et al.* 2022). It is evident from different studies that the crop and livestock integration provide ample scope for small and marginal farmers to increase the productivity, profitability, employment generation, food and nutritional security and ultimately agricultural sustainability (Panda M *et al.* 2022)^[5]. Several studies have conducted to assess the farming systems in different agroclimatic zones at different districts of Andhra Pradesh (Gopinath *et al.* 2012, Raju *et al.* 2017 and Rao S H *et al.* 2019)^[1, 3, 6]. Since data on crop – livestock farming systems is not available for Kurnool district, the present study was conducted on “Sustainable livelihoods for small and marginal farmers through agriculture and livestock activities – A study on farming systems in Kurnool district” with the following objectives

- To identify major agriculture and livestock farming systems in major farming situations of Kurnool district.

Corresponding Author:
Krishna Murthy A
Department of Rural
Development, Sri
Krishnadevaraya University,
Anantapur, Andhra Pradesh,
India

- To analyse the crop and livestock components in major farming systems.
- To analyse the economics of the farming systems for profitability
- To evolve suitable crop-livestock based farming systems for major farming situations of Kurnool district.

Materials and Methods

Selection of Villages and respondents

Among the 12 major farming situations, three major farming situations viz. Rainfed Black Soils, Rainfed Red Soils and Irrigated Black soils has been selected purposively for the study. Three villages have been selected randomly from each farming situation covering a total of 9 villages to identify viable farming systems. 30 farmers from each village consisting of two or more agriculture and livestock activities were selected randomly for this study. Data was collected from a total of 270 respondents representing three major situations.

Tools of data collection

A semi-structured schedule was designed to collect the required information from the sample regarding their socio-economic profile, factors involved in adoption of integrated

farming systems, different components and their management, economic indicators of crops and livestock, sustainability indicators and problems involved in farming systems. Few case studies have documented from each farming situation.

Research Design and Statistical analysis

‘Ex-post facto’ design was used for this study. Benefit Cost Ratio (BCR) was calculated for each farming system to assess the profitability. Appropriate statistical tools and techniques such as percentages and averages were used for analyzing the data.

Results and Discussion

Identification of farming systems

Various crop and livestock components which include crops, dairy, sheep & goat and poultry rearing were identified in the major farming situations in Kurnool district among the sample respondents consisting of small and marginal farmers (table 1). As many as eight farming systems were identified in rainfed red soils and seven farming systems each were observed in rainfed black soils and irrigated black soils. Dairy was one of the most common activities observed in majority of farming systems.

Table 1: Farming systems practiced by the sample respondents in the study area

S.No	Farming systems	Irrigated Black soils N=90	Rainfed Black soils N=90	Rainfed Red Soils N=90
1	Crops	23 (25.6)	19 (21.1)	20 (22.2)
2	Crops + Dairy	32 (35.6)	16 (17.8)	26 (28.9)
3	Crop + Dairy + Poultry	14 (15.6)	10 (11.1)	17 (18.9)
4	Crop + Dairy + Sheep & Goat	3 (3.3)	12 (13.3)	10 (11.1)
5	Crop + Dairy + S&G + Poultry	13 (14.4)	24 (26.7)	12 (13.3)
6	Crop + Poultry	3 (3.3)	4 (4.4)	1 (1.1)
7	Crop + Sheep + Poultry	2(2.2)	5 (5.6)	2 (2.2)
8	Crop + S&G	0	0	2 (2.2)
	Total	90 (100)	90 (100)	90 (100)

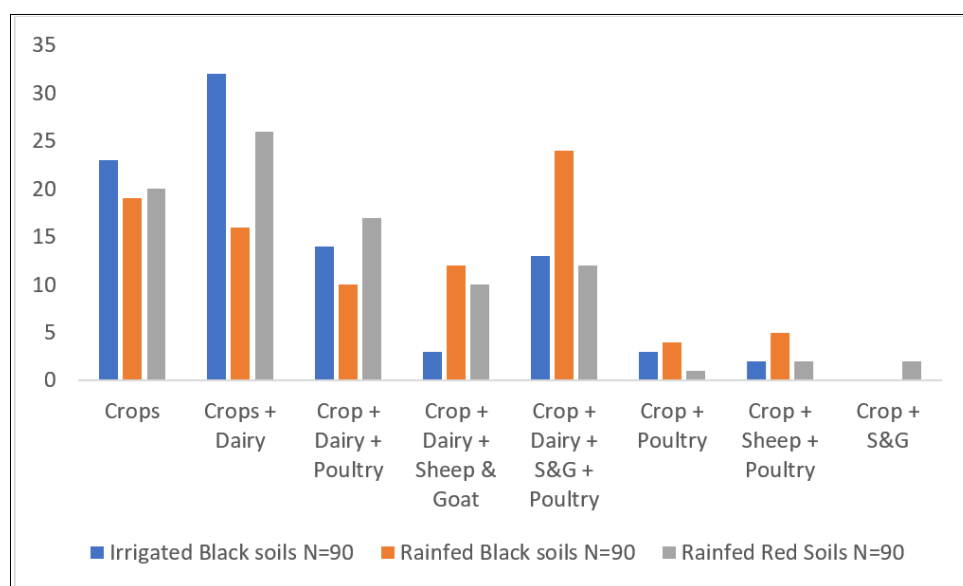


Fig 1: Showing the farming systems existing in the major farming situations of Kurnool district

Major farming systems in rainfed black soils

A total of seven farming systems viz FS-I: crops alone (21.1%), FS-II: Crops + Dairy (17.8%), FS-III: Crops + Dairy + Poultry (11.1%), FS-IV: Crops + Dairy + Sheep & Goat

(13.3%), FS-V: Crops + Dairy + Sheep & Goat + Poultry (26.7%), FS-VI: Crops + Poultry (4.4%) and FS-VII: Crops + Sheep & Goat + Poultry (5.6%) were practiced by the sample respondents of Rainfed black soils. A sample of 10 or more

respondents practicing any of the seven farming systems were considered as major farming systems for further analysis. The major farming systems identified in the rainfed black soils of Kurnool district were Crops + Dairy + Sheep & Goat + Poultry (FS-IV: 24 No), followed by Crops alone (FS-I: 19 No), Crops + Dairy (FS-II: 16 No), Crops + Dairy + Sheep & Goat (FS-IV:12 No) and Crops + Dairy + Poultry (FS-III: 10 No).

Major farming systems in rainfed red soils

A total of eight farming systems in rainfed red soils of Kurnool district viz FS-I: crops alone (22.2%), FS-II: Crops + Dairy (28.9%), FS-III: Crops + Dairy + Poultry (18.9%), FS-IV: Crops + Dairy + Sheep & Goat (11.1%), FS-V: Crops + Dairy + Sheep & Goat + Poultry (13.3%), FS-VI: Crops + Poultry (1.1%), FS-VII: Crops + Sheep & Goat + Poultry (2.2%) and FS-VIII: Crops + Sheep & Goat (2.2%) were practiced by the sample respondents of Rainfed black soils. A sample of 10 or more respondents practicing any of the seven farming systems were considered as major farming systems for further analysis. The major farming systems identified in the rainfed black soils of Kurnool district were Crops + Dairy (FS-II: 26 No) followed by Crops alone (FS-I:20 No), Crops + Dairy + Poultry (FS-III: 17 No), Crops + Dairy + Sheep & Goat + Poultry (FS-IV: 12 No) and Crops + Dairy + Sheep & Goat (FS-IV: 10 No).

Major farming systems in rainfed black soils

A view from the table 2 confirmed a total of seven farming systems viz FS-I: crops alone (25.6%), FS-II: Crops + Dairy (35.6%), FS-III: Crops + Dairy + Poultry (15.6%), FS-IV: Crops + Dairy + Sheep & Goat (3.3%), FS-V: Crops + Dairy + Sheep & Goat + Poultry (14.4%), FS-VI: Crops + Poultry

(3.3%) and FS-VII: Crops + Sheep & Goat + Poultry (2.2%) were practiced by the sample respondents of Rainfed black soils. A sample of 10 or more respondents practicing any of the seven farming systems were considered as major farming systems for further analysis. The major farming systems identified in the rainfed black soils of Kurnool district were Crops + Dairy (FS-II: 32 No) followed by Crops alone (FS-I:23 No), Crops + Dairy + Poultry (FS-III: 14 No) and Crops + Dairy + Sheep & Goat + Poultry (FS-IV: 13 No).

Components of major farming systems of Rainfed Black Soils

The components included in major farming systems in Rainfed black soils along with area/units are presented in table 2. The results revealed that, the average cultivated area under Bengal gram was highest in FS-II (1.85ha) followed by FS-I (1.41ha), FS-IV (0.53ha), FS-III (0.42ha) and FS-V (0.35ha). Sorghum was the other crop cultivated in all farming systems and the average area was highest in FS-V (1.17ha) followed FS-III (0.65ha), FS-IV (0.62ha), FS-II (0.53ha) and FS-I (0.24ha). The average cultivated area of red gram was 0.64ha in FS-III followed by FS-I (0.29ha), FS-II (0.23ha), FS-V (0.2ha) and FS-IV (0.13ha). Black gram crop also cultivated in all major farming systems except FS-I during kharif and rabi seasons. The area under black gram was highest in FS-II (0.38ha) followed by FS-V (0.27ha), FS-I (0.24ha), FS-IV (0.2ha) and FS-III (0.16ha). The average number of dairy animals were highest in FS-II (8.44) followed by FS-III (8.1), FS-IV (7.08) and FS-V (6.25). Poultry was common in FS-III (18.7) and FS-V (21). Sheep was an important component observed in FS-IV (50.6) and FS-V (19.3).

Table 2: Components of major farming systems in rainfed black soils

Farming system	No. of respondents	Components
FS-I	19	Red gram (0.29ha), sorghum (0.24) and Bengal gram (1.41ha)
FS-II	16	Red gram (0.23ha), black gram (0.38), Bengal gram (1.85ha), sorghum (0.53ha) and Dairy (8.44no)
FS-III	10	Red gram (0.64ha), black gram (0.16ha), sorghum (0.65ha), Bengal gram (0.42ha), dairy (8.1no) and poultry (18.7no)
FS-IV	12	Red gram (0.13ha), black gram (0.2ha), sorghum (0.62), Bengal gram (0.53ha), dairy (7.08no) and sheep (50.6no)
FS-V	24	Red gram (0.2ha), Black gram (0.27ha), Sorghum (1.17ha), Bengal gram (0.35ha), dairy (6.25no), sheep (19.3no) and Poultry (21no)

Components in major farming systems of Rainfed Red soils

Different components of the major farming systems in rainfed red soils presented in table 3. Indicated that red gram was the major crop on all farming systems. The average area under red gram is highest in FS-II (1.32ha) followed by FS-I (1.24ha), FS-III (1.11ha), FS-V (1.02ha) and FS-IV (0.88ha). The other crops grown in all major farming systems were Groundnut, castor, cotton and Seteria. Seteria was cultivated as intercrop in red gram which was highest in FS-V (0.17ha). Groundnut was another major crop cultivated after red gram. The average cultivated land under groundnut was highest in FS-V (0.8ha) followed by FS-IV (0.56ha), FS-II (0.45ha), FS-III (0.4ha) and FS-I (0.3ha). The groundnut haulms were used as feed for livestock. Castor crop was also observed in all

farming systems and the highest area cultivated was in FS-IV (0.44ha) followed by FS-V (0.3ha), FS-I (0.14ha), FS-III (0.09ha) and FS-II (0.02ha). Cotton which grown usually in black soils also now being cultivated in red soils under rainfed conditions due to its high market price. It was observed in all major farming systems. The average area cultivated under cotton was highest in FS-I (0.6ha) followed by FS-V (0.23ha), FS-III (0.21ha) and each 0.14ha in FS-II and FS-IV. Dairy, Sheep and Poultry was the major livestock in farming systems. The average dairy animals were highest in FS-IV (8.8) followed by FS-III (8.24), FS-II (7.69) and FS-V (7.42). Sheep was another livestock component which can be reared by utilizing crop residues. Sheep was observed in FS-IV (10.4) and FS-V (11.92). Backyard poultry was observed in FS-III (9) and FS-V (16).

Table 3: Components of major farming systems in rainfed red soils

Farming system	No. of respondents	Components
FS-I	20	Red gram (1.24ha), Groundnut (0.3ha), castor (0.14ha), cotton (0.6ha) and Seteria (0.08ha)
FS-II	26	Red gram (1.32ha), Groundnut (0.45ha), castor (0.02ha), cotton (0.14ha) and Seteria (0.08ha) and dairy (7.69no)
FS-III	17	Red gram (1.11ha), Groundnut (0.4ha), castor (0.09ha), cotton (0.21ha) and Seteria (0.14ha), dairy (8.24no) and poultry (9no)
FS-IV	10	Red gram (0.88ha), Groundnut (0.56ha), castor (0.44ha), cotton (0.14ha) and Seteria (0.12ha), dairy (8.8no) and sheep (10.4no)
FS-V	12	Red gram (1.02ha), Groundnut (0.8ha), castor (0.3ha), cotton (0.23ha), Seteria (0.17ha), dairy (7.42no), sheep (11.92no) and Poultry (16no)

Components in major farming systems of irrigated black soils:

The components of the major farming systems in irrigated black soils is presented in table 4 indicated that paddy crop was the predominant crop in all major farming systems. The average cultivated area under paddy crop was highest in FS-I (1.6ha) followed by FS-II (1.18ha), FS-III (0.92ha) and FS-V (0.7ha). black gram was another crop cultivated in all major farming systems during kharif and rabi seasons. The average area under black gram was highest in FS-III (1.92ha) followed by FS-I (0.66ha), FS-II (0.62ha) and FS-V (0.5ha). sorghum crop was also observed in all major farming systems which

was highest in FS-III (0.91ha) followed by FS-II (0.4ha), FS-V (0.18ha) and FS-I (0.12ha). maize crop was highest in FS-V (0.95ha) followed by FS-II (0.35ha), FS-III (0.27ha) and FS-I (0.12ha). Bengal gram crop was also observed in FS-II (0.26ha) and FS-III (0.06ha) which was cultivated during rabi season. The crop residues like paddy straw, stovers of sorghum and maize and haulms from black gram. The highest number of dairy animals were observed in FS-III (8.23) followed by FS-II (7.06) and FS-I (6.43). along with dairy, poultry was observed in FS-III (15) and FS-V (16). Sheep was observed in FS-V (9.92) in which the other components viz dairy, poultry along with crops were included.

Table 4: Components of major farming systems in irrigated black soils

Farming system	No. of respondents	Components
FS-I	23	Paddy (1.6ha), maize (0.12ha), blackgram (0.66ha) and sorghum (0.12ha)
FS-II	32	Paddy (1.18ha), maize (0.35ha), blackgram (0.62ha), sorghum (0.4ha), bengalgram (0.26ha) and dairy (7.06no)
FS-III	14	Paddy (0.92ha), maize (0.27ha), blackgram (1.92ha), sorghum (0.91ha), bengalgram (0.06ha), dairy (6.43no) and poultry (15no)
FS-V	13	Paddy (0.7ha), maize (0.95ha), blackgram (0.5ha), sorghum (0.18ha), dairy (8.23no), sheep (9.92no) and Poultry (16no)

Comparative economic analysis of major farming systems:

The particulars on consolidated economics of the major farming systems under different farming situations is presented in table 5. The data clearly indicated that among the major farming systems in rainfed black soils, the profitability of the farming systems was observed in FS-V (1.91) followed by FS-IV (1.90), FS-III (1.71), FS-II (1.70) and FS-I (1.50). The lowest profitability was observed in the farming system involved the crops only whereas inclusion of the livestock components greatly influenced the profitability of the farming system.

Similarly, among the major farming systems in rainfed red soils, highest profitability was observed in FS-II (1.82) followed by FS-III (1.71), FS-V (1.56), FS-IV (1.55) and FS-I (1.25). unlike in the rainfed black soils, the increase in the livestock components had no influence in the profitability of the farming system. This may be due to increase in the cost of production as the crop residues of pulses were not available in sufficient quantities to feed the livestock. Whereas the highest profitability in the farming system involved the dairy as only component is due to effective resource use efficiency through

grazing.

Among the four major farming systems in irrigated black soils, highest profitability was observed in FS-V (1.84) involved the livestock components viz. dairy, sheep and poultry along with crops followed by FS-II (1.71), FS-III (1.26) and FS-I (1.21). The abundant availability of the crop residues to feed the livestock in the irrigated black soils had greatly influenced the profitability.

The major farming systems observed in the major farming situations of Kurnool district cannot be compared with each other due to specific demographic features of the respective farming situations. However, a critical look at the farming systems suggested that FS-V, FS-II and FS-I of the rainfed black soils, rainfed red soils and irrigated black soils respectively were most profitable farming systems. The FS-I which comprises only crop was the least profitable system in all the three major farming situation of Kurnool district. The findings of the study were in accordance with Rao S H *et al.* 2019 revealed existing farming systems in Srikakulam, Vijayanagaram and Vishakhapatnam districts.

Table 5: Comparative economics of the major farming systems in the study area

S. No.	Farming system	Total variable costs	Total fixed cost	Total cost	Gross income	Net Returns	Net returns over	BCR
Rainfed Black Soils								
1	FS-I	₹ 69,048.00	₹ 24,521.00	₹ 93,569.00	₹ 1,40,419.00	₹ 46,850.00	₹ 71,371.00	1.5
2	FS-II	₹ 1,58,114.00	₹ 36,750.00	₹ 1,94,864.00	₹ 3,29,537.00	₹ 1,34,673.00	₹ 1,71,423.00	1.7
3	FS-III	₹ 1,25,945.00	₹ 28,140.00	₹ 1,54,085.00	₹ 2,64,000.00	₹ 1,09,915.00	₹ 1,38,055.00	1.71
4	FS-IV	₹ 2,14,896.00	₹ 22,250.00	₹ 2,37,146.00	₹ 4,50,495.00	₹ 2,13,349.00	₹ 2,35,599.00	1.9
5	FS-V	₹ 1,80,058.00	₹ 29,750.00	₹ 2,09,808.00	₹ 4,01,518.00	₹ 1,91,710.00	₹ 2,21,460.00	1.91
Rainfed Red Soils								
1	FS-I	₹ 70,251.00	₹ 30,300.00	₹ 1,00,551.00	₹ 1,26,053.00	₹ 25,502.00	₹ 55,802.00	1.25
2	FS-II	₹ 1,03,855.00	₹ 30,023.00	₹ 1,33,878.00	₹ 2,43,942.00	₹ 1,10,064.00	₹ 1,40,087.00	1.82
3	FS-III	₹ 1,09,445.00	₹ 29,294.00	₹ 1,38,739.00	₹ 2,37,904.00	₹ 99,165.00	₹ 1,28,459.00	1.71
4	FS-IV	₹ 1,96,030.00	₹ 32,160.00	₹ 2,28,190.00	₹ 3,54,820.00	₹ 1,26,630.00	₹ 1,58,790.00	1.55
5	FS-V	₹ 2,18,029.00	₹ 37,750.00	₹ 2,55,779.00	₹ 3,99,830.00	₹ 1,44,051.00	₹ 1,81,801.00	1.56
Irrigated Black Soils								
1	FS-I	₹ 2,05,873.00	₹ 60,521.00	₹ 2,66,394.00	₹ 3,22,550.00	₹ 56,156.00	₹ 1,16,677.00	1.21
2	FS-II	₹ 2,38,962.00	₹ 66,993.80	₹ 2,84,862.00	₹ 4,88,348.00	₹ 2,03,486.00	₹ 2,49,386.00	1.71
3	FS-III	₹ 3,65,706.00	₹ 1,54,130.00	₹ 5,19,836.00	₹ 6,54,220.00	₹ 1,34,384.00	₹ 2,88,514.00	1.26
4	FS-V	₹ 2,31,628.00	₹ 56,511.80	₹ 2,88,140.00	₹ 5,31,335.00	₹ 2,43,195.00	₹ 2,99,707.00	1.84

Table 6: Profitable crop – livestock farming systems in major farming situations of Kurnool district

S.No	Farming system	Total cost	Gross income	Net income	BCR
Rainfed Black Soils					
1	Redgram + Dairy + Sheep	₹ 76,022.00	₹ 1,60,224.00	₹ 84,202.00	2.11
2	Sorghum + Dairy + Sheep	₹ 90,668.00	₹ 1,84,501.00	₹ 93,833.00	2.03
3	Redgram + Dairy + Sheep + Poultry	₹ 1,11,295.00	₹ 2,24,615.00	₹ 1,13,321.00	2.02
4	Redgram + Dairy	₹ 45,031.00	₹ 89,114.00	₹ 44,082.00	1.98
5	Bengalgram + Dairy + Sheep + Poultry	₹ 1,27,580.00	₹ 2,43,975.00	₹ 1,16,395.00	1.91
Rainfed Red Soils					
1	Redgram + Dairy	₹ 70,482.00	₹ 1,36,861.00	₹ 66,380.00	1.94
2	Redgram + Dairy + Poultry	₹ 68,034.00	₹ 1,29,296.00	₹ 61,262.00	1.9
3	Groundnut + Dairy	₹ 81,262.00	₹ 1,52,068.00	₹ 70,805.00	1.87
4	Redgram + Dairy + Sheep + Poultry	₹ 1,38,192.00	₹ 2,49,436.00	₹ 1,11,245.00	1.81
5	Cotton + Dairy + Sheep + Poultry	₹ 1,21,929.00	₹ 2,19,613.00	₹ 97,684.00	1.8
Irrigated Black Soils					
1	Maize + Sorghum + Dairy + Sheep + Poultry	₹ 2,09,548.00	₹ 3,91,481.00	₹ 1,81,934.00	1.87
2	Maize + Sorghum + Dairy + Sheep	₹ 2,07,834.00	₹ 3,85,447.00	₹ 1,77,614.00	1.85
3	Paddy + Sorghum + Dairy + Sheep + Poultry	₹ 2,11,592.00	₹ 3,88,812.00	₹ 1,77,220.00	1.84
4	Paddy + Blackgram + Dairy + Sheep	₹ 2,11,592.00	₹ 3,88,812.00	₹ 1,77,220.00	1.84
5	Paddy + Sorghum + Dairy + Sheep	₹ 2,09,877.00	₹ 3,82,777.00	₹ 1,72,900.00	1.82

Evaluation of suitable crop – livestock farming system for major farming situations

Different crops have cultivated in different farming systems of major farming systems in Kurnool district. To evaluate the profitable crop and livestock farming system, cost economics have worked out for cultivation of crop for 1ha with 5 no dairy animals, 10 no sheep / ram lambs and 10 no. poultry and the five most profitable systems were presented in table 6.

The data clearly indicated that among the farming systems in rainfed black soils, farming system comprising redgram crop along with dairy and sheep as livestock components was found to be profitable with BCR of 2.11. Similarly, in rainfed red soils, the farming system comprising redgram + dairy (1.94) was found profitable and among the farming systems in irrigated black soils, the farming system consisting of maize + sorghum + dairy + sheep + poultry (1.87) was found profitable.

Conclusions

The present study revealed the profitable farming systems of small and marginal farmers in major farming situations of Kurnool district viz. rainfed black soils, rainfed red soils and

irrigated black soils. The farming systems with seasonal crops along with dairy and sheep in integrated farming system were found profitable than cultivation of crops alone. The identified farming systems are completely based on the prevailing agroclimatic situations of the study area and hence the recommendations can be adopted the small and marginal farmers of Kurnool district.

References

- Gopinath KA, Srinivasarao Ch, Chary GR, Dixit S, Osman M, *et al.* Improving the productivity of rainfed farming systems of small and marginal farmers in Adilabad district, Telangana. Indian Journal of Dryland Agricultural Research and Development. 2014;29(1):52-56.
- Jitendra Kumar Chauhan, Meena BS, Meena HR, Champak Bhakat, Upadhyay AD, Biswajit Lahiri, *et al.* Assessment of livelihood security and diversification of tribal dairy farmers in NEH region of India. Indian Res. J Ext. Edu. 2022;22(3):182-187.
- Kaviraju S, Sredevi S, Goverdhan M, Pasha Md. L. Charecterization of farming systems- A case study in

Medak district of Telangasna state. Agricultural Economics Research Review. 2017;30(Conference number):327

4. Manjunatha SB, Shivmurthy D, Satyareddi AS, Nagraj MV, Basavesha KN. Integrated farming system- An holistic approach: A review. Research and Reviews: Journal of Agriculture and Allied Sciences. 2014;3(4):30-38.
5. Monalisha Panda, Souvik Nandi, Upasana Sahoo, Masina Sairam. Integrated farming system for agriculture sustainability. Indian Journal of Natural Sciences, 2022;13(71):41310-41315
6. Srinivasa Rao H, Subba Rao DV, Radha Y, Srinivasa Rao V, Rambabu P. Profitability of major farming systems in north coastal zone of Andhra Pradesh. International Journal of Agriculture Sciences. 2019;11(11):8500-8500.