*The Andhra Agric. J* 63 (4): 957-961, 2016

# An economic Analysis of Redgram and Redgram based Cropping Systems in Prakasam district of Andhra Pradesh

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**ABSTRACT**

The study was conducted on economics of redgram and redgram based cropping systems in Prakasam District of Andhra Pradesh during the year 2014-15. A sample size of 120 farmers were selected using multiple stage random sampling method. The collected data were subjected to tabular analysis to estimate cost concepts and various farm income measures. The results revealed that cost of cultivation was more in redgram sole cropping system than intercropping systems. This is mainly due to increased application of FYM & fertilizers and plant protection chemicals, because of the incidence of more pests and disease in redgram sole cropping system. Gross returns, net returns, return per rupee of expenditure were found to be more in redgram + greengram cropping system with high price of both component crops and less total cost of cultivation.

**Key words :** Cost, Cropping systems, Income, Price, Redgram.

Redgram is an important pulse crop, commonly known as pigeon pea. Globally pigeonpea (*Cajanus cajan* (L.) Millsp) is the fifth most important pulse crop. It is mainly grown in developing countries by resource-poor farmers in drought prone areas and on degraded soils. Redgram crop is a multipurpose leguminous crop used as food, fuel wood and fodder for the small-scale farmers in subsistence agriculture (Tabo *et al.*, 1995; Egbe, 2005). Because of having versatile, compatable and stable nature of redgram, it is suitable for inter-cropping with different crops *viz*., cotton, sorghum, pearl millet, greengram, blackgram, castor, maize, soyabean, groundnut and it increases production and maintains soil fertility.

In Andhra Pradesh, most of the area under redgram is cultivated as rainfed monocrop and as intercrop in black soils. Intercropping is an old cropping practice, possibly as old as the settled agriculture, and is widespread especially in low – input cropping systems. Intercropping can provide numerous benefits to cropping systems through increasing total yield and land use efficiency (Dhima et al., 2007) and improving yield stability of cropping systems (Lithourgidis *et al*., 2006). The present investigation has been conducted to compare and to determine the cropping system which produces maximum fabourable impact on income of sample farmers in the study area and to know the impact of intercropping on cost of cultivation, various cost components and farm income measures of redgram and redgram based cropping systems.

## MATERIAL AND METHODS

### Sampling and Data Collection

Prakasam district of Andhra Pradesh state was selected purposively as redgram was extensively grown in the district covering an area of 53,000 ha and 48,000 tonnes of production during the year 2013-2014. A pretested schedule was used to collect the requisite information from the sample farmers through survey method. Secondary data were collected from different resources of the district. In Prakasam district, all the mandals were listed out in the descending order of magnitude of the area under redgram cultivation and top three mandals were selected purposively. Similarly, top four villages with maximum area under redgram cultivation from each of the selected mandals were selected. From each village, 10 farmers were selected randomly with five farmers cultivating redgram as sole crop and another five farmers practicing redgram based cropping systems making 40 farmers from each selected mandal. Thus in Prakasam district, three mandals, twelve villages and 120 farmers constituting 60 farmers cultivating redgram sole crop and 60 farmers practising redgram based cropping systems were selected for

the study. The 60 farmers practising redgram based cropping systems were classified into four identified redgram based cropping systems viz., redgram + bajra, redgram + greengram, redgram + castor and redgram + sorghum (fodder) cropping systems with 30, 10, 10 and 10 farmers respectively.

**Analytical frame work**

**Tabular analysis**

The cost concepts developed by CACP were used to assess the extent of cost of cultivation and the costs were calculated on per hectare basis.

Cost $A_1$: It includes all actual expenses, both in cash and kind incurred in cultivation of redgram. It could be accounted as the

Sum of Value of hired human labour
+ Charges of both hired and owned machine labour
+ Value of both hired and owned bullock labour
+ Value of owned and purchased seeds
+ Value of fertilizers
+ Value of insecticides and pesticides
+ Value of manure (both owned and purchased)
+ Land revenue and other taxes
+ Interest on working capital
+ Depreciation on farm implements and farm buildings

Cost $A_2$ = Cost A1 + Rent paid for leased in land

Cost $B_1$ = Cost A2 + Interest on value of owned fixed capital (excluding land)

Cost $B_2$ = Cost B1 + Rental value of owned land

Cost $C_1$ = Cost B1 + Imputed value of family labour

Cost $C_2$ = Cost B2 + Imputed value of family labour

Cost $C_3$ (Total cost) = Cost C2 + 10 per cent of cost C2 to account for the value of management input of the farmer.

Cost of production = Cost $C_3$ / Yield per hectare

The various farm business measures are analysed as follows:

Farm business income = Gross income- Cost $A_1$ or Cost $A_2$ in case of leased in land.

Owned farm business income = Gross returns-Cost $A_2$

Family labour income = Gross income - Cost $B_2$

Farm investment income = Net income + Imputed Rental value of owned land + Interest on owned fixed capital.

Gross income = Value of total output (main product + by-product)

Net income = Gross income – Total cost of cultivation (Cost $C_3$)

**RESULTS AND DISCUSSION**

Cost of cultivation for redgram and redgram based cropping systems according to cost concepts viz., Cost $A_1$, Cost $B_1$, Cost $B_2$, Cost $C_1$, Cost $C_2$ and Cost $C_3$ was presented in Table1.

Cost $A_1$ includes all variable costs (excluding the imputed value of family labour) plus land revenue and other taxes plus interest on working capital plus depreciation. Per hectare Cost $A_1$ was found to be Rs 39692, Rs 33644, Rs25465, Rs29592 and Rs23442 respectively in redgram sole cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system. It indicates that cost $A_1$ was more in redgram sole cropping system which is mainly due to increased application of FYM & fertilizers and plant protection chemicals than other cropping systems. The Per hectare FYM & fertilizers costs accounted to Rs 11945, Rs 5896, Rs 6955, Rs 3621 and Rs 4807 respectively for redgram sole cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system. The plant protection chemicals costs per hectare were Rs 5482, Rs 3660, Rs 2633, Rs 2546 and Rs 1807 respectively in redgram sole cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system. Lack of awareness about the package of practices and rise in prices of inputs might be responsible for high operational cost in redgram sole crop.

Rajkumar (2007) conducted similar study on economics of redgram based cropping systems in Karnataka, which revealed that per hectare total variable cost was high in redgram sole cropping system (Rs 11,114.81/ha) followed by redgram + soyabean cropping system (Rs 11,056.28/ha) and redgram + blackgram cropping system (Rs l0,960.90/ha).

Cost $B_1$ for redgram sole cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system was Rs 40571.19, Rs 35244.88, Rs 27158.15, Rs 30928.00 and Rs 24332.20 respectively. Cost $B_2$ was Rs 47865.39, Rs 41391.55, Rs 33733.15,

Table 1. Cost concepts-wise cost of cultivation of Redgram and Redgram based cropping systems (Rs./ha).

| S.No. | Particulars | Redgram | | Redgram+bajra | | Redgram+greengram | | Redgram+castor | | Redgram+sorghum | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cost | % to totalcost | Cost | % to totalcost | Cost | % to totalcost | Cost | % to totalcost | Cost | % to totalcost |
| 1. | Human labour | 8800.00 | 16.62 | 10357.41 | 22.69 | 5349.09 | 14.32 | 9370.63 | 23.24 | 6550.80 | 18.45 |
| 2. | Machine labour | 8307.40 | 15.69 | 8390.25 | 18.38 | 7371.18 | 19.73 | 12082.70 | 29.97 | 7880.40 | 22.20 |
| 3. | Bullock labour | 2073.38 | 3.91 | 2772.44 | 6.07 | 1000.00 | 2.67 | - | | - | |
| 4. | Seeds | 713.37 | 1.34 | 867.50 | 1.90 | 861.43 | 2.30 | 835.66 | 2.07 | 555.60 | 1.56 |
| 5. | Manures& fertilizers | 11945.48 | 22.56 | 5896.00 | 12.91 | 6954.60 | 18.62 | 3621.20 | 8.98 | 4806.90 | 13.54 |
| 6. | Plant protection chemicals | 5481.94 | 10.35 | 3660.26 | 8.02 | 2633.33 | 7.05 | 2545.80 | 6.31 | 1806.90 | 5.09 |
| 7. | Land revenue and other taxes | 125.00 | 0.23 | 190.38 | 0.41 | 190.62 | 0.51 | 191.25 | 0.47 | 187.50 | 0.52 |
| 8. | Interest on working capital | 751.47 | 1.41 | 590.08 | 1.29 | 487.75 | 1.30 | 579.36 | 1.43 | 425.84 | 1.19 |
| 9. | Depreciation | 1493.58 | 2.82 | 919.64 | 2.01 | 617.03 | 1.65 | 365.00 | 0.90 | 1228.00 | 3.45 |
| | Cost $A_1$ (1-9) | 39692 | 74.99 | 33643.84 | 73.72 | 25465.05 | 68.18 | 29591.60 | 73.42 | 23441.94 | 66.04 |
| 10. | Interest on fixed capital | 878.78 | 1.66 | 1601.04 | 3.50 | 1693.10 | 4.53 | 1336.50 | 3.31 | 890.30 | 2.50 |
| | Cost B1 (1-10) | 40571.19 | 76.65 | 35244.88 | 77.22 | 27158.15 | 72.72 | 30928.00 | 76.73 | 24332.20 | 68.55 |
| 11. | Rental value of owned land | 7294.20 | 13.78 | 6146.67 | 13.46 | 6575.00 | 17.60 | 5200.00 | 12.90 | 7675.00 | 21.62 |
| | cost B2 (1-11) | 47865.39 | 90.43 | 41391.55 | 90.69 | 33733.15 | 90.32 | 36128.00 | 89.63 | 32007.24 | 90.17 |
| 12. | Imputed value of family labour | 251.43 | 0.47 | 96.88 | 0.21 | 218.00 | 0.58 | 512.23 | 1.27 | 260.42 | 0.73 |
| | Cost C1 ( Cost $B_1$+12) | 40822.63 | 77.12 | 35341.76 | 77.44 | 27376.15 | 73.30 | 31440.00 | 78.00 | 24592.66 | 69.28 |
| | Cost C2 ( Cost $B_2$+12) | 48116.82 | 90.90 | 41488.43 | 90.90 | 33951.15 | 90.90 | 36640.00 | 90.90 | 32267.66 | 90.91 |
| 13. | 10 percent value of cost C2 | 4811.68 | 9.10 | 4148.84 | 9.10 | 3395.11 | 9.10 | 3664.00 | 9.10 | 3226.76 | 9.09 |
| | Cost $C_3$ ( Cost $C_2$+ 13) | 52928.51 | 100.00 | 45637.28 | 100.00 | 37346.27 | 100.00 | 40304.37 | 100.00 | 35494.42 | 100.00 |

Source: Field Survey

Rs 36128.00 and Rs 32007.24 respectively in sole cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system. It can be observed that cost $B_2$ more in redgram sole cropping system compared to other cropping systems as Cost $A_1$ is highest in this cropping system.

It can also be found that Cost $C_1$ for redgram sole cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system was Rs 40822.63, Rs 35341.76, Rs 27376.15, Rs 31440.00 and Rs 24592.66 respectively. Cost $C_2$ was Rs 48116.82 in redgram sole cropping system, Rs 41488.43 in redgram + bajra cropping system, Rs 33951.15 in redgram + greengram cropping system, Rs 36640.00 in redgram + castor cropping system and Rs 32267.66 in redgram + sorghum cropping system. Cost $C_3$ was Rs 52928.51 in redgram sole cropping system, Rs 45637.28 in redgram + bajra cropping system, Rs 37346.27 in redgram + greengram cropping system, Rs 40304.37 in redgram + castor cropping system and Rs 35494.42 in redgram + sorghum cropping system. From table.1, it can be observed that Cost $C_1$, Cost $C_2$ and Cost $C_3$ were more in redgram sole cropping system. In other words, the total cost of cultivation as per cost concepts was highest in redgram sole cropping system compared to other cropping systems.

**FARM BUSINESS ANALYSIS**

Efficiency of farm business for any type of enterprise is measured by using farm business analysis. The various measures of farm business analysis, return per rupee of expenditure, cost of production per quintal yield were calculated and presented in Table 2. It can be observed from the table, the farm business income was Rs 20621, Rs 21156, Rs 37394, Rs 28466 and Rs 29231 respectively for redgram sole cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system. The farm business income was high in redgram + greengram cropping system (Rs 37394) due to high price of intercrop yield (greengram) compared to other cropping systems.

Family labour income was Rs12448, Rs13408, Rs29126, Rs21929, and Rs20666 respectively for redgram sole cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram +sorghum cropping system. Farm investment income was Rs5605 in redgram sole cropping system, Rs16910 in redgram + bajra cropping system, Rs27424 in redgram + greengram cropping system,Rs19602 in redgram + castor cropping system and Rs18329 in redgram + sorghum cropping system. This revealed that both the family labour income and farm investment income were more in redgram + greengram cropping system compared to other cropping systems.

Gross returns were Rs 57400, Rs 54800, Rs 62860, Rs 58058 and Rs 52673 on sole redgram cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system respectively. It indicated that the gross returns were more in redgram + greengram cropping system which was due to high prices and also good yields of both component crops.

The net income was Rs4475, Rs9162, Rs25513, Rs17753, and Rs17179 in redgram sole cropping system, redgram+bajra cropping system, redgram+greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system respectively. It was found that the redgram + greengram cropping system derived maximum net income (Rs25513).The attributed reason was that farmers were getting good yield associated with the two crops in the system and also high price (Rs5500) of intercrop (greengram) yield. Mittal *et al*. (1996) found that the net returns from the Pigeonpea + Greengram intercropping system was significantly higher over pure redgram sole crop. The Redgram + castor cropping system was ranked second (Rs17753) with respect to maximum net income in the study area.

The return per rupee of expenditure was 1.19, 1.20, 1.85, 1.44 and 1.48 for redgram sole cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system respectively. The cost of production per quintal yield of redgram and redgram based cropping systems was Rs 6803, Rs 5836, Rs 4515,

Table 2. Farm business analysis and unit cost of production of redgram and redgram based cropping systems.

| Particulars | Redgram | Redgram+ bajra | Redgram+ greengram | Redgram+ castor | Redgram+ sorghum (fodder) |
|---|---|---|---|---|---|
| Gross income (Rs./ha) | 57400 | 54800 | 62860 | 58058 | 52673 |
| Farm business income(Rs ./ha) | 20621 | 21156 | 37394 | 28466 | 29231 |
| Family labour income(Rs ./ha) | 12448 | 13408 | 29126 | 21929 | 20666 |
| Farm investment income(Rs./ha) | 5605 | 16910 | 27424 | 19602 | 18329 |
| Net income (Rs./ha) | 4475 | 9162 | 25513 | 17753 | 17179 |
| Return per rupee expenditure | 1.19 | 1.20 | 1.85 | 1.44 | 1.48 |
| Unit cost of production (Rs /q) | 6803 | 5836 | 4515 | 4909 | 4344 |

Rs 4909 and Rs 4344 in sole redgram cropping system, redgram + bajra cropping system, redgram + greengram cropping system, redgram + castor cropping system and redgram + sorghum cropping system respectively. It indicates that cost of production was more in redgram sole cropping system which was due to high operational costs and least in redgram + sorghum cropping system because of less operational costs compared to other cropping systems.

From the above discussion it could be concluded that the gross returns, net returns and return per rupee of expenditure were more in redgram + greengram cropping system which was due to high price of both component crops and less total cost of cultivation.

## Conclusions

The cost of cultivation was more in redgram sole cropping system. This is mainly due to increased application of plant protection chemicals and FYM& fertilizers, because of the incidence of more pests and diseases than intercropping systems. Family labour income, farm investment income, gross returns, net returns, and return per rupee of expenditure were more in redgram + greengram cropping system followed by redgram + castor cropping system, redgram + sorghum cropping system, redgram + bajra cropping system and redgram sole crop respectively.

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(Received on 03.11.2015 and revised on 1.02.2016)