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# Comparative Economics of Seed Production vis - a - vis Commercial Production of Cotton in Andhra Pradesh

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## INTRODUCTION

In a developing country like India, to meet the growing food demand of 243 million tonnes estimated for 2006 A.D. and the needs of nearly 10 billions of population, vertical growth in productivity of different crops, exploiting hybrid vigour, seems to be the only possible alternative way. It is estimated that improved seed alone contributes more than 20-25 per cent to the total production. The Indian farmer has now realised the benefit of quality seed in boosting agricultural production and therefore is willing to pay a price for the quality seed available in the market.

Andhra Pradesh is considered as the 'Seed Capital' of the country, producing about 20 lakh quintals of seeds of various crops in one lakh hectares area annually (Rao, 1997). However, the cost of seed production is higher compared to commercial crop production, as it involves some specific cultural operations, such as sowing of male and female parents in separate rows, pollination, roguing, harvesting male and female rows separately, threshing in gunny bags, etc. There are several studies pertaining to cost of cultivation of various crops under commercial production, but only a few studies related to cost of seed production. Hence, the present study is undertaken with the following objectives: (i) To analyse the economics of seed production vis - a - vis commercial production, (ii) To compare the income from seed production with commercial production, and (iii) To specify the variables that are discriminating the seed production from commercial production and identify the various sources of change in gross returns.

## METHODOLOGY

In view of increasing demand for improved cotton hybrid seed and also the recent failure of commercial crop, the cotton crop has been selected purposively for the present study. Though Mahbubnagar district of Andhra Pradesh ranks the highest in area under cotton seed production, Kurnool district, which ranked second, was selected, as it stood first in the overall area (16,750 ha.) offered for seed production in

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different crops in the state. Later, a sample of 30 farmers was selected randomly from the list of registered cotton seed growers of Kurnool district, along with a matching sample of 30 farmers who had taken up commercial cultivation of cotton. Thus, a final sample of 30 each of seed producing and commercial cotton producing farmers was selected randomly for the study.

Primary data on cost of cultivation of both hybrid seed production and commercial production of cotton were collected from the sampled farmers for the year 1998-99, through a pre-tested schedule. Tabular analysis was used to estimate the various costs according to cost concepts and income measures as given below.

Cost concepts:

Cost A1 = All the variable costs excluding family labour cost and including interest on working capital,

Cost B1 = Cost A1 + Interest on value of owned fixed capital (other than land),

Cost B2 = Cost B1 + Rental value of owned land + rent paid for leased-in land,

Cost C1 = Cost B1 + Imputed value of family labour,

Cost C2 = Cost B2 + Imputed value of family labour,

Cost C3 = Cost C2 + 10 per cent of Cost C2 to account for the value of management input of the farmer.

Income measures:

Net income = Gross income - Cost C3,

Family labour income = Gross income - Cost B2,

Farm business income = Gross income - Cost A1 or Cost A2,

Farm investment income = Farm business income - imputed value of family labour,

Net benefit - cost ratio = Net income/Cost C3.

*Discriminant Function Analysis*

Linear discriminant function of the following form was employed to know the relative importance of different variables in discriminating between the two groups of farms of equal size, viz., seed production and commercial production of cotton.

$$Z = \sum_{i=1}^{n} L_i X_i$$

where,

Z = Total discriminant score for seed production and commercial production,

$X_i$ = Variables selected to discriminate the two groups ( i = 1,2, ..., n),

$L_i$ = Linear discriminant coefficients of the variables estimated from the data.

Mahalanobis $D^2$ statistic was used to measure the discriminating distance between the two groups,

$$D^2 = \sum_{i=1}^{n} L_i d_i$$

where,

n = Total number of cases,

$L_i$ = Inverted matrix of the coefficients of the discriminant function,

$d_i$ = Mean difference of the variables,

The significance of $D^2$ was tested by applying the following F test.

$$\frac{(n-1-p)(n1n2)}{(n-2)(n)} D2 \sim F\infty\ (p, n\text{-}p\text{-}1)$$

where,

n1 = number of individuals in the commercial farm group,

n2 = number of individuals in the seed farm group,

n = n1 + n2.

The Z scores for each group may be calculated as:

$$Z1 = \sum_{i=1}^{P} L_i\ X1_i \text{ (for commercial farm),}$$

$$Z2 = \sum_{i=1}^{P} L_i\ X2_i \text{ (for seed farm).}$$

The critical mean discriminant score was obtained as

Z = [ Z1 + Z2]/2,

For each individual Zi value was calculated.

$$Z_i = \sum_{i=1}^{P} L_i\ X_i$$

If the individual Zi value is more than Z, the individual belongs to the commercial farm, otherwise to seed farm.

*Decomposition Model*

The total change in gross returns can be decomposed into a programme component that refers to change in the farming situation, i.e., from general commercial crop production to seed production and input component that refers to changes in the quantities of independent variables. For measuring these two types of changes, 'the decomposition model' as adopted by Bisalaiah (1977), was adopted.

The model involves Cobb-Douglas type of production function, by decomposing the natural logarithm of the ratio of gross returns in seed production to commercial production.

Thus, the per acre production function for cotton commercial production can be written as:

$$\text{Log } Y1_i = \text{Log } b_0 + b_i \sum_{i=1}^{n} \text{Log } X1_i + U1_i \qquad \text{.... (1)}$$

where,

$Y1_i$ = Gross returns in rupees per acre in cotton commercial production.

$X_i$ = Independent variable,

$b_0$ = Scale parameter,

$b_i$ = Input coefficient.

Likewise per acre production function for cotton seed production can be written as:

$$\text{Log } Y2_i = \text{Log } b_0^1 + b_i^1 \sum_{i=1}^{n} \text{Log } X2_i + U2_i \qquad \text{.... (2)}$$

By taking the difference between two production equations, adding some terms, subtracting the same terms and rearranging them, the equation can be written as:

$$\text{Log} \frac{Y_{2i}}{Y_{1i}} = \left(\text{Log} \frac{b_0^{\ 1}}{b_0}\right) + \left(\sum_{i=1}^{n}(b_i^{\ 1} - b_i)\text{Log}X_{1i}\right) + \left(b_i \sum_{i=1}^{n} \text{Log} \frac{X_{2i}}{X_{1i}}\right) + (U_{2i}-U_{1i}) \qquad \text{.... (3)}$$

From the decomposition equation (3), it could be inferred that the first bracketed expression is a measure of percentage change in output due to shift in scale parameter (bo) of the production function; the second bracketed expression gives the sum of the arithmetic changes in output elasticities, each weighed by the logarithm of the volume of that input used, is a measure of change in output due to shifts in slope parameters (output elasticities) of the production function; and the third bracketed expression is the sum of the logarithms of the ratio, for each input of 'new' to 'old' input, each weighed by the output elasticity of the input. Thus, this gives a measure of change in output due to changes in per acre quantities of labour, fertiliser, capital, etc., used, given the output elasticities of these inputs under cotton seed production.

## RESULTS AND DISCUSSION

### *Cost of Production*

The item-wise cost of seed production as well as commercial production of cotton, as presented in Table 1 reveal that human labour occupied the major share (53.86 and 19.03 per cent) of total cost of Rs. 74,412/acre and Rs. 26,461/acre of seed production and commercial production of cotton, respectively. The operational costs of all the items were comparatively higher in seed production (Rs. 68,101/acre) over commercial production (Rs. 16,166/acre). This was due to the additional operations like gap filling, roguing, emasculation, pollination, etc., involved in cotton seed production. Thus, the operational costs took the major share of 91 per cent in seed production, as compared to 61 per cent in commercial production.

TABLE 1. ITEMWISE COMPARISON OF COSTS OF SEED PRODUCTION AND COMMERCIAL PRODUCTION OF COTTON

*(Rs./acre)*

| Sr. No. (1) | Item (2) | Seed production (3) | Commercial production (4) |
|---|---|---|---|
| | Operational costs | | |
| 1. | Human labour | 40,083 (53.86) | 5,035 (19.03) |
| 2. | Machine labour | 5,803 (7.80) | 2,784 (10.52) |
| 3. | Seed | 565 (0.76) | 489 (1.85) |
| 4. | Manures and fertilisers | 9,005 (12.10) | 3,094 (11.70) |
| 5. | Plant protection chemicals | 8,848 (11.90) | 3,474 (13.13) |
| 6. | Irrigation | 197 (0.27) | 260 (0.98) |
| 7. | Miscellaneous expenses | 294 (0.39) | 296 (1.12) |
| 8. | Interest on working capital | 3,306 (4.44) | 734 (2.77) |
| | Sub-total | 68,101 (91.52) | 16,166 (61.10) |
| | Fixed costs | | |
| 9. | Depreciation on implements and farm buildings | - | 1,490 (5.63) |
| 10. | Cess | - | 127 (0.48) |
| 11. | Rent for leased-in land | 6,311 (8.48) | 4,200 (15.87) |
| 12. | Rental value of owned land | - | 3,584 (13.54) |
| 13. | Interest on owned fixed capital (excluding land) | - | 894 (3.38) |
| | Sub-total | 6,311 (8.48) | 10,295 (38.90) |
| | Total cost | 74,412 (100.00) | 26,461 (100.00) |

*Note:* Figures in parentheses indicate per cent to total cost.

Most of the farmers of cotton seed production in the study area were migrants from neighbouring districts and thus they did not own any fixed assets. Hence, the rent for leased-in land was the only item, among the fixed costs, which accounted to Rs. 6,311/acre.

*Cost Concepts and Income Measures*

Cost of cultivation according to various cost concepts, as depicted in Table 2, reveal that all the costs were higher in seed production over commercial production.

TABLE 2. COMPARATIVE STUDY OF COTTON SEED PRODUCTION AND COMMERCIAL PRODUCTION ACCORDING TO COST CONCEPTS AND INCOME MEASURES

*(Rs./acre)*

| Item (1) | Seed production (2) | Commercial production (3) |
|---|---|---|
| Cost concepts | | |
| Cost A1 | 66,778 | 16,452 |
| Cost A2 | 73,089 | 20,652 |
| Cost B1 | 66,778 | 17,346 |
| Cost B2 | 73,089 | 25,130 |
| Cost C1 | 68,101 | 18,677 |
| Cost C2 | 74,412 | 26,461 |
| Cost C3 | 81,853 | 29,107 |
| Income measures | | |
| Yield (qtl./acre) | 3.54 | 11.38 |
| Price (Rs./qtl.) | 25,694 | 1,674 |
| Value of male seed and discards/by-products | 14,724 | - |
| Gross income | 105,682 | 19,055 |
| Net income | 23,829 | -10,052 |
| Family labour income | 32,593 | -6,075 |
| Farm business income | 31,270 | -1,597 |
| Farm investment income | 31,270 | -266 |
| Net cost-benefit ratio | 1.00: 0.29 | 1.00: -0.35 |

However, seed production gives positive returns with the cost-benefit ratio of 0.29:1.00, when compared to commercial production (1.00: -0.35), which is in concurrence with the results obtained by Sobharani (1984). Thus, it could be inferred that though the cost of cultivation was higher in seed production, it fetched higher income to seed growers, owing to the higher price received for the seed produce, depending on the demand and also due to the lower market risk involved in seed production (Singh *et al.*, 1998).

*Discriminating Characteristics Between Seed Farms and Commercial Farms*

The results of discriminant function analysis as studied between two distinct groups, viz., seed farms and commercial farms are presented in Table 3.

$D^2$ value was found to be statistically significant (149.52**) at one per cent level of probability, indicating that the variables considered in the function are useful in distinguishing the two groups of farms in cotton cultivation.

The relative importance of the discriminators as calculated through their per cent contribution to total distance reveal that plant protection with 33.89 per cent followed by child labour (27.22 per cent), gross returns (20.83 per cent), processing cost (10.97 per cent), manures and fertilisers (5.84 per cent), etc., contributed mostly to discriminate between the commercial farms and seed farms of cotton.

Thus, it could be inferred that plant protection chemicals, child labour and gross returns were the three major contributing factors to discriminate between the two groups of farms. This indicates that there were significant differences in the expenditure on plant protection chemicals and child labour and in the gross returns between seed production and commercial farms in cotton.

TABLE 3. PARTICULARS OF DISCRIMINANT VARIABLES IN COTTON

| Item | Mean ('000 Rs.) | | Mean difference $d_i$ ('000 Rs.) | Discriminant coefficient ($L_i$) | ($L_i$) ($d_i$) | Per cent contribution to the total distance |
|---|---|---|---|---|---|---|
| | Group I (commercial production) | Group II (seed production) | | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| X1 - owned labour | 1.3309 | 1.3230 | 0.01 | 0.5897 | 0.0047 | 0.0031 |
| X2 - hired labour | 3.6738 | 1.8240 | 1.85 | 0.7143 | 1.3213 | 0.8837 |
| X3 - child labour | 0.0293 | 35.6760 | -35.65 | -1.1418 | 40.7020 | 27.2207 |
| X4 - seed | 0.4888 | 0.5653 | -0.08 | -6.9737 | 0.5335 | 0.3568 |
| X5 - manure and fertiliser | 3.0952 | 9.1055 | -6.01 | -1.4523 | 8.7285 | 5.8375 |
| X6 - plant protection | 3.4738 | 8.8430 | -5.37 | -9.4291 | 50.6737 | 33.8895 |
| X7 - processing | 0.3233 | 2.0540 | -1.73 | -9.4812 | 16.4088 | 10.9739 |
| X8 - miscellaneous | 0.5558 | 0.4908 | 0.07 | 0.0844 | 0.0055 | 0.0037 |
| X9 - gross returns | 19.0550 | 105.6817 | -86.63 | -0.3596 | 31.1482 | 20.8312 |

$D^2$ = 149.5262**; $T^2$ = 2242.893, F - statistic = 214.8365,
$Z_1$ = -47.1538, $Z_2$ = -196.6800 and Z = - 121.92.

**indicate Significance at 1 per cent level of probability.

*Change in Gross Returns*

By substituting the values of production parameters (Appendix 1) and the geometric mean levels of different inputs (Appendix 2) in the decomposition equation, the details of total change in per acre gross returns of cotton production are given in Table 4.

TABLE 4. DECOMPOSITION ANALYSIS OF TOTAL CHANGE IN PER ACRE GROSS RETURNS BETWEEN SEED PRODUCTION AND COMMERCIAL PRODUCTION OF COTTON

| Item (1) | Per cent change attributable (2) |
|---|---|
| Total change in measured output | 16.40 |
| Source of change | |
| 1. Technical change | 64.50 |
| 2. Change in inputs | |
| Adult human labour | 0.30 |
| Child labour | -23.50 |
| Seed | -0.30 |
| Manure and fertilisers | 1.60 |
| Plant protection chemicals | 1.12 |
| Processing | 6.70 |
| Total due to input change | -14.10 |
| Total due to all sources | 50.40 |

The total change in measured output indicating the per cent difference in per acre gross returns between seed production and commercial production of cotton was 16.40. It was also observed that 64.5 per cent of change in gross returns was purely due to technical change, i.e., seed production and a negative change of –14.10 per cent was due to the change in the levels of inputs use. The negative values for child labour (-23.5) and seed (-0.3) imply that the expenditure on these items will have a negative impact on gross returns.

## CONCLUSIONS AND POLICY IMPLICATIONS

As the net benefit from cotton seed production is encouraging, the area under seed production can be increased to ensure timely supply of quality seed to the farmers. The "native" farmers of the district may be encouraged to grow cotton seed by extensive training programmes, in view of the fact that the study revealed that most of the cotton seed farmers are migrants from the neighbouring districts. The native farmers should also be encouraged to take up seed production by providing the required quantity of breeder/foundation seed along with proper technical guidance in the production of quality seed. The negative contribution of input change to total change in output sounds a note of caution for the efficient utilisation of selected inputs in cotton seed production.

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## APPENDIX 1

PER ACRE PRODUCTION ESTIMATES FOR SEED PRODUCTION AND COMMERCIAL PRODUCTION OF COTTON

| Variable | Elasticity of output | | | |
|---|---|---|---|---|
| | Seed production | | Commercial production | |
| (1) | (2) | (3) | (4) | (5) |
| Constant | b0 | 4.513 | b0[1] | 0.964 |
| Adult human labour | X21 | -0.053 | X11 | 0.003 |
| Child labour | X22 | -0.134 | X12 | -0.026 |
| Seed | X23 | -0.162 | X13 | 0.103 |
| Manures and fertilisers | X24 | 0.127 | X14 | 0.187 |
| Plant protection | X25 | 0.109 | X15 | -0.104 |
| Processing | X26 | 0.244 | X16 | 1.098 |

$R^2$ = 0.282 for seed production and 0.626 for commercial production.

APPENDIX 2

SAMPLE GEOMETRIC MEAN LEVELS OF PER ACRE OUTPUT AND INPUTS IN COTTON

| Item (1) | Seed production (2) | Commercial production (3) |
|---|---|---|
| Output (Y) | 5.016 | 4.258 |
| Adult human labour (H) | 3.471 | 3.705 |
| Child labour (CH) | 4.539 | 0.782 |
| Seed (S) | 2.729 | 2.680 |
| Manures and fertilizers (F) | 3.952 | 3.483 |
| Plant protection (PP) | 3.945 | 3.535 |
| Processing (PR) | 3.287 | 2.498 |