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Decomposition model to compare the productivity difference between contract and non-contract chilli farmers in southern Tamil Nadu

K DIVYA[1], M PRAHADEESHWARAN[2], M MALARKODI[3], R RAVIKUMAR[1] and M VIJAYABHAMA[1]

[1]Department of Basic and Social Sciences, Forest College and Research Institute Mettupalayam 641301 Tamil Nadu, India
[2]Department of Agricultural Economics, [3]Directorate of Agri-Business Development Tamil Nadu Agricultural University, Coimbatore 641003 Tamil Nadu, India
Email for correspondence: divyatnau@gamil.com

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ABSTRACT

A study was conducted to understand the productivity differences between contract (adopters of GAP technologies) and non-contract farmers (non-adopters of GAP technologies). The study covered three major chilli growing districts in southern Tamil Nadu. The average return to contract farmers was Rs 1,20,174.37 and non-contract farmers was Rs 80,561.25 per hectare of chillies. The parameters governing the input-output relations in the case of contract farms were different from those of non-contract farms. The decomposition analysis showed that the per acre return of contract farming was 55.14 per cent higher than that of non-contract cultivation. The GAP technology component alone contributed 10.99 per cent to the total increase in output while the contribution of all other inputs was 44.15 per cent. The major contributor amongst all the inputs to the difference in returns was the cost incurred by the farmers for adopting the GAP technology (27.42%) followed by farmyard manure (19.00%). Irrigation and the chemical fertilizers were found to be positively contributing but at a lower level ie 1.59 and 0.14 per cent respectively. Land preparation and human labour (human days) were found to reduce the gross return.

Keywords: Good agricultural practices (GAP), decomposition model, productivity difference

INTRODUCTION

The demand for processed food has gone up due to an increase in urban population with relatively higher income levels. This has opened up opportunities for various participants in the value chain. High value agriculture (HVA) is composed of agricultural crops and other non-livestock farm-based commodities such as fruits and vegetables and other horticultural commodities which give a higher rate of return to farmers per unit of land, labour and capital as compared to staple crops. It is assumed that when HVA commodities enter well developed value chains, better knowledge and capacities help to increase the value of the product at every link of the chain thereby increasing profitability. This can be achieved only through an integrated approach with the collective efforts of farmers, processors and traders.

Chillies are mostly consumed and exported as chilli powder, dried chillies, pickled chillies and chilli oleoresins. There are many post-harvest operations like drying, cleaning, processing, packaging etc. The study covered three major chilli growing districts in Tamil Nadu namely Thoothukudi, Ramnathapuram and Virudhunagar. Chillies produced from irrigated area had higher quality than rainfed area. Processing firms procured chillies from contract farmers to maintain the required quality standards. This linkage enabled to change the method of farming by adoption of good agricultural practices (GAP). The adoption of GAP had led to increase in production and price. The expected overall benefits of appropriate adoption and monitoring of good agricultural practices enabled improvement in safety and quality of food and other agricultural products, promotion of sustainable agriculture and contribution to meeting national and international environment and social development objectives.

The study was conducted to understand the productivity differences between contract and non-contract farmers. The study may be further useful for all the stakeholders especially the processors and government institutions for framing suitable policy measures.

METHODOLOGY

In southern Tamil Nadu, Ramanathapuram, Thoothukudi and Virudhunagar districts were purposively selected for the study. These districts were selected based on the area under cultivation of Sannam variety of chillies and trading and processing activities. Four blocks from three districts, where both contract and non-contract system of chillies cultivation was existing exclusively, were selected for the study.

Random sampling technique was used to select 160 sample farmers from eight villages located in four blocks and three districts. In each block two villages were selected and from the selected villages 20 contract and 20 non-contract farmers were selected at random. The farmers were contacted individually for collection of data with the help of well-structured and pre-tested interview schedule. The data thus collected were processed using tabular analysis, multiple regression/production function and decomposition analysis.

Sources of productivity difference between contract and non-contract farmers

Farmers under contract system followed GAP. In order to identify the contribution of GAP technology among the various inputs, decomposition analysis was undertaken. It revealed the total productivity difference between contract and non-contract chilli cultivation system.

The output decomposition model developed by Bisaliah (1977) was used for investigating the contribution of various constituent sources to the productivity difference between the contract and independent farmers. For any two production functions, the total change in the productivity could be brought out by shifts in the production parameters that defined the production function itself and by the changes in the input-use levels. Therefore the production function was considered as the convenient econometric model for decomposing the productivity difference.

Functions of the form of Equation (1) were fitted for contract and non-contract farmers separately.

$$\ln Y = \ln b_0 + b_1 \ln S + b_2 \ln F + b_3 \ln C + b_4 \ln P + b_5 \ln H + b_6 \ln B + b_7 \ln M + u_i \quad .....(1)$$

where Y= Gross return (Rs/ha), L= Land preparation (machine time/ha), F= Farmyard manure (tonnes/ha), P= Plant protection chemicals (Rs/ha), H= Human labour (man days/ha), I= Irrigation (number of h/crop duration/ha), T= Technology cost (Rs/ha), b_j= Regression coefficients (j= 0, 1, 2…, k) (k= 7)

The output decomposition model used in this study was:

$$\ln Y_1 = \ln b_{01} + b_{11} \ln S_1 + b_{21} \ln F_1 + b_{31} \ln C_1 + b_{41} \ln P_1 + b_{51} \ln H_1 + b_{61} \ln B_1 + b_{71} \ln M_1 + u_i \quad .....(2)$$

$$\ln Y_2 = \ln b_{02} + b_{12} \ln S_2 + b_{22} \ln F_2 + b_{32} \ln C_2 + b_{42} \ln P_2 + b_{52} \ln H_2 + b_{62} \ln B_2 + b_{72} \ln M_2 + u_i \quad .....(3)$$

$$\ln Y_3 = \ln b_{03} + b_{13} \ln S_3 + b_{23} \ln F_3 + b_{33} \ln C_3 + b_{43} \ln P_3 + b_{53} \ln H_3 + b_{63} \ln B_3 + b_{73} \ln M_3 + u_i \quad .....(4)$$

where Y, S, F, C, P, H, B, M, bj and ui are as denoted in Equation (1). However Equations (2), (3) and (4) represent contract, non-contract and pooled regression functions respectively

$$\ln Y_1 - \ln Y_2 = \ln (Y_1/Y_2) = \{\ln b_{01} - \ln b_{02}\} + \{(b_{11} - b_{12}).\ln S_2 + (b_{21} - b_{22}).\ln F_2 + (b_{31} - b_{32}).\ln C_2 + (b_{41} - b_{42}).\ln P_2 + (b_{51} - b_{52}).\ln H_2 + (b_{61} - b_{62}).\ln B_2 + (b_{71} - b_{72}).\ln M_2\} + \{b_{11}.\ln(S_1/S_2) + b_{21}.\ln(F_1/F_2) + b_{31}.\ln(C_1/C_2) + b_{41}.\ln(P_1/P_2) + b_{51}.\ln(H_1/H_2) + b_{61}.\ln(B_1/B_2) + b_{71}.\ln(M_1/M_2)\} \quad .....(5)$$

In other words

[Output Δ]= [Technology Δ Effect] + [Input use Efficiency Δ Effect] + [Input usage Δ Effect]

The decomposition Equation (5) gives an approximate measure of the percentage change in output in contract farming system in the production process. The first flower bracketed expression on the right hand side of Equation (5) is the measure of percentage change in output due to shift in scale parameter of the production function. The second flower bracketed expression is the difference between output elasticities each weighted by natural logarithms of the volume of that input used under non-contract farmer category, a measure of change in output due to shift in slope parameters (output elasticities) of the production function.

The third flower bracketed expression is the sum of the natural logarithm of the ratio of each input of contract to non-contract farmers each weighted by the output elasticity of that input. This expression is a measure of change in output due to change in per ha quantities of inputs used in the production process.

RESULTS and DISCUSSION

Response functions for analyzing the yield difference of contract and non-contract chilli farms

Value addition at farm level was analysed in terms of increase in returns and higher price for good quality produce. The average return of contract production function analysis was employed to analyse the yield differences between contract and non-contract farming systems. It was also used to estimate the yield responses of contract and non-contract farms to various factors of production.

The average return to contract farmer was Rs 1,20,174.37 per hectare and non-contract farmer was Rs 80,561.25 per hectare of chillies.

The production function with intercept dummy for contract system was a 'good fit' with all the explanatory variables included in the model collectively explaining nearly 55 per cent of the variation in the production (Table 1). The regression coefficient for the intercept dummy variable (0.551) was positive and significant. This implied that the parameters governing the input-output relations in the case of contract farms were different from those of non-contract farms. Thus the results provided the necessary proof for decomposing the total change in per ha output with the adoption of contract farming.

These findings are in conformity with those of Hugar et al (2009) wherein the regression coefficient (0.24) for intercept dummy variable was significant. Similar results were obtained by Bisaliah (1977) for Punjab wheat economy, Kunnal (1978) for sorghum economy in the Hubli Taluka of Dharwad district in Karnataka and Hugar et al (2000) for IPM technology in cotton.

Decomposition of the outturn difference in contract and non-contract farmers

Decomposition analysis was used to estimate the contribution of various sources to the outcome difference between contract and non-contract farmers. Maheswari et al (2008) also identified the sources of productivity difference between the precision and conventional farming by decomposing the productivity change. The outcome difference resulted by adoption of GAP technology between the contract and non-contract productions was decomposed into its constituent sources and results are presented in Table 2.

The decomposition analysis showed that the per acre return of contract farming was 55.14 per cent higher than that of non-contract cultivation. The GAP technology component alone contributed 10.99 per cent to the total increase in output while the contribution of all other inputs was 44.15 per cent. The major contributor amongst all the inputs to the difference in return was the cost incurred by the farmers for adopting

Table 1. Production function estimates of contract and non-contract system of chillies cultivation

Particulars	Contract farming	Non-contract farming	Pooled
Number of observations	80	80	160
Intercept	2.7166 (1.3960)	4.5328 (1.2104)	5.0201 (6.7891)
Land preparation cost (Rs)	-0.0518 (0.9735)	-0.0008 (0.9863)	0.1313 (0.0138)
Farmyard manure (tonnes)	0.3928 (0.0104)**	0.0960 (0.0134)	0.245 (6.1515)
Chemical fertilizers (kg)	0.2362 (0.5645)	0.1317 (0.4931)**	0.0926 (0.5901)
Human labour (man days)	0.0454 (0.4025)	0.0502 (0.4860)	-0.1764 (0.0004)
Irrigation (number of h/crop duration/ac)	0.0713 (1.3276)	0.9988 (5.1174)	0.4129 (3.789)
GAP technology adoption cost (Rs)	0.4653 (0.0189)**	0.0949 (0.02138)**	0.2600 (2.189)
Intercept dummy	-	-	0.5513***
R^2	0.6098	0.8679	0.8057
Adjusted R^2	0.5777	0.8570	0.7981

***Significant at 1% level of significance, **Significant at 5% level of significance

Table 2. Decomposition of productivity in chillies cultivation among contract and non-contract farmers

Particulars	Percentage
Total observed difference in output	55.14
Technology component	10.99
a. Neutral Technology	-181.61
b. Non-neutral Technology	192.60
Contribution of inputs	44.15
Land preparation	-1.80
FYM	19.00
Manures and manuring	0.14
Human labour (man days)	-2.20
Irrigation	1.59
GAP technology cost	27.42
Total estimated difference in output	55.14

the GAP technology (27.42%) followed by farmyard manure (19.00%). Irrigation and the chemical fertilizers were found to be positively contributing but at a lower level ie 1.59 and 0.14 per cent respectively. Land preparation and human labour (man days) were found to reduce the gross return. It could be suggested that the usage of the human labour and land preparation were on higher side leading to inefficiencies.

Maheswari et al (2008) reported that the total productivity difference between the precision and non-precision farming for tomato was 63.86 per cent and for brinjal 28.14 per cent and contribution of technology was higher for tomato (33.71%) and brinjal (20.48%).

Kiresur and Ichangi (2011) indicated that the per ha production of *Bt* cotton was 26.38 per cent higher than that of non-*Bt* cotton. The Bt technology component alone contributed 26.56 per cent to the total change in output.

CONCLUSION

The results of the study showed that per acre return of contract farming was 55.14 per cent higher than that of non-contract cultivation. The GAP technology component alone contributed 10.99 per cent to the total increase in output while the contribution of all other inputs was 44.15 per cent. The major contributor amongst all the inputs to the difference in returns was the cost incurred by the farmers for adopting the GAP technology (27.42%) followed by farmyard manure (19.00%).

REFERENCES

Bisaliah S 1977. Decomposition analysis of output change under new production technology in wheat farming: some implications to returns on investment. Indian Journal of Agricultural Economics **32(3):** 193-201.

Hugar LB, Amrutha CP and Patil BV 2009. Productivity difference between *Bt* and non-*Bt* cotton farms in Karnataka state, India: an econometric evidence. Karnataka Journal Agricultural Sciences **22(2):** 349-352.

Hugar LB, Veerapur MS and Patil BV 2000. Cost and return of cotton cultivation with integrated pest management in Raichur district, Karnataka. Journal of Cotton Research and Development **14(2):** 216-220.

Kiresur VR and Ichangi M 2011. Socio-economic impact of *Bt* cotton: a case study of Karnataka. Agricultural Economics Research Review **24(1):** 67-81.

Kunnal LB 1978.Output factor shares and employment effect of technical change in jowar economy. MSc (Agric) Thesis, University of Agricultural Sciences, Bangalore, Karnataka, India.

Maheswari R, Ashok KR and Prahadeeswaran M 2008. Precision farming technology, adoption decisions and productivity of vegetables in resource-poor environments. Agricultural Economics Research Review **21:** 415-424.