Indian Journal of Ecology (2022) 49(5): 1706-1709
DOI: https://doi.org/10.55362/IJE/2022/3720

Manuscript Number: 3720
NAAS Rating: 5.79

Resource Use and Technical Efficiency in Coriander Production in Jhalawar District of Rajasthan

Uttam Chand and M. Anoop[1*]

Office of the Assistant Director of Horticulture, Department of Horticulture, Rajasthan, Barmer-344 001, India
[1]Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221 005
[*]E-mail: anoopmangalasseri@gmail.com

Abstract: This study examines the efficiency of resource use, technical efficiency and constraints in coriander production in Jhalawar district of Rajasthan. The results indicated that fertilizer, plant protection chemicals and irrigation water resources were being used at sub-optimal level, and increase in use of these resources will provide better return. The mean technical efficiency of farms was 85.40 percent, and more than 66 percent farms were operating at above 80 percent efficiency level. Lack of disease resistant seed varieties and lack of awareness about seed treatment were the major production constraints, whereas lack of proper market information and lack of ingredient estimation facilities for seed spices were the major marketing constraints faced by the farmers. Government interventions are needed for awareness creation, information dissemination, establishment of ingredient estimation facility, facilities for storage, processing and transportation.

Keywords: Coriander, Resources use efficiency, Stochastic frontier analysis, Technical efficiency

India is popularly known as the 'spices bowl' of the world from ancient times. This land of spices is ranked first in the production, consumption, and export of spices in the world. India fulfils around 50-60 per cent of the world's demand for seed spices with an annual export of about 15 per cent of its production (Lal 2018). The vast geographical area and diversified climate of India are favourable for the cultivation of a variety of spices. Rajasthan is the second largest spice-producing state of India with a 10.41 percent share after Madhya Pradesh. Coriander or Dhaniya (*Coriandrum sativum*) is one among the most popular seed spices along with cumin, fenugreek and fennel. It is an annual herbaceous plant of Apiaceae family characterized by the presence of a slender hollow stem. Young coriander leaves are used as an important ingredient of curries, chutneys, and soups. Seeds are used in the making of curry powders and seasonings of bakery products. It also has medicinal properties and is used as a natural diuretic, aphrodisiac, carminative, diabetic, antioxidant, anti-cancer, and cardioprotective. The area and production under coriander cultivation in India is 528970 ha and 700815 tonnes (2019-20). Rajasthan is the third largest producer of coriander after Madhya Pradesh and Gujarat. Major coriander growing districts of Rajasthan are Jhalawar, Baran, Kota, Bundi, and Alwar region. Coriander occupies an area of 60039 ha (5.88 per cent share of total spice area of Rajasthan) with a production of 89341 tonnes (8.44 per cent share of total spice production) in Rajasthan, in 2019-20. Rajasthan is a leading producer of coriander, and a number of farmers are depending on this spice crop for their livelihood. Hence it is important to understand the efficiency level of coriander production in Rajasthan. In this backdrop, this study looks into the efficiency of resource use, technical efficiency and constraints in the production and marketing of coriander in a major producing district of Rajasthan.

MATERIAL AND METHODS

The present study is based on primary data regarding inputs and output, and the constraints in production which were collected from the respondent farmers through personal interview method with a standardized schedule. Multi-stage sampling was used for the selection of the area of the study. Rajasthan was selected being the third largest producer of coriander, and Jhalawar district was selected as it was having highest area under coriander cultivation in the state. Jhalrapatan tehsil was selected for the same reason, and two villages (Samrai & Jhoomki) were selected randomly from Jhalrapatan tehsil. Fifteen farmers were randomly selected from each of these villages, thus making a sample of 30 farmers for the study.

Resource use efficiency: To estimate resource productivity and allocative efficiency, following Suresh and Reddy (2006) and Guleria et al (2022), Cobb-Douglas form of production function was fitted to the data by taking gross income as a dependent variable. Inputs used were the independent variables for regression.

The model used was:

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5}$$

This functional form was estimated using ordinary least square (OLS) method after converting into loglinear form.

$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5$

Where, Y = Gross return per hectare (₹), a = Constant representing intercept of the production function, X_1 = cost incurred in labour use per hectare (₹), X_2 = cost incurred in machine use per hectare (₹), X_3 = cost incurred in fertilizer use per hectare (₹), X_4 = cost incurred in plant protection chemicals used per hectare (₹), X_5 = cost incurred in irrigation per hectare (₹), b_1, b_2, b_3, b_4 and b_5 are the regression co-efficients of the respective resource variables.

Statistical significance of the coefficients was tested with the help of 't' test.

To examine the efficiency of resource use, the ratio of marginal value product (MVP) to the marginal factor cost (MFC) for every significant input was computed. When MVP > MFC, the ratio will be greater than 1. This indicates efficient utilization of that resource, and there is further scope for allocating more units of that particular resource. Conversely, if MVP < MFC, the ratio will come less than 1, indicating over-utilization of that resource.

RUE = MVP/MFC

$MVP = MPP_i \times P_y$

$MPP_i = b_i Y/X_i$

Where, MVP = marginal value product, MFC = marginal factor cost, MPP_i = marginal physical product of the ith input, P_y = price of output, b_i = elasticity coefficient of the independent variable, Y = geometric mean of the output, and X_i = geometric mean of the ith input.

Technical efficiency: Following Jacob and Ambily (2021) and Dev et al. (2021), Stochastic Frontier Analysis (SFA) was used to study technical efficiency in coriander production.

The stochastic model can be represented as: $Y_i = f(X_i, \beta) \exp(V_i - U_i)$

Where, Y_i is Production of ith farm, f (X_i, β) is a function of X_i, of the inputs for the ith farm and β is the vector of unknown parameters, V_i is symmetric component of the error term and U_i is random error.

The model used in the study is:

$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + V_i - U_i$

Where, Y = Gross return per hectare (₹), a = Constant representing intercept of the production function, X_1 = cost incurred in labour use per hectare (₹), X_2 = cost incurred in machine use per hectare (₹), X_3 = cost incurred in fertilizer use per hectare (₹), X_4 = cost incurred in plant protection chemicals used per hectare (₹), X_5 = cost incurred in irrigation per hectare (₹), b_1, b_2, b_3, b_4 and b_5 are parameters to be estimated.

Constraints in production and marketing: Garrett's (1969) ranking technique was used to rank the farmers' responses on constraints in coriander production and marketing. Following formula was used to convert the ranks given by each respondent into percent position. These percent positions were further converted into scores using Garrett's table.

$$\text{Percent position} = \frac{100 \text{ X } (\text{Rij} - 0.5)}{N_i}$$

Where, R_{ij} is the rank given to ith constraint by the jth individual, and N_j is the number of constraints ranked by the jth individual.

RESULTS AND DISCUSSION

Resource use efficiency: The coefficient of multiple determinations (R^2) was 0.7605 which indicate 76.05 per cent variation in gross return was explained by the independent variables included in the model (human labour, machine labour, fertilizers, plant protection measures and irrigation charges (Table 1). The regression coefficients of inputs like fertilizer, plant protection chemicals and Irrigation water were positive and significant. The increase in use of these inputs will increase the gross return. One percent increase of fertilizer, plant protection chemicals and irrigation from the existing mean levels, would increase the return by 0.27 percent, 0.52 percent and 0.22 percent, respectively.

The efficiency of resource use was computed with the help of the ratio of marginal value product (MVP) to their marginal factor cost for the significant resources included in the regression model (Table 2). The input variables such as fertilizer, plant protection chemicals and irrigation water showed their MVP/MFC ratios as greater than unity. This

Table 1. Regression coefficients of variables in coriander in Jhalawar district

Variables	Regression coefficients (bi)	Std. Error
Human labour	0.084	0.195
Machine labour	-0.174	0.178
Fertilizer	0.268*	0.135
Plant protection chemicals	0.518*	0.254
Irrigation	0.218**	0.104
R^2	0.761	

Note: *Significant at 10 per cent level, **Significant at 5 per cent level

Table 2. Resource use efficiency in Coriander production in Jhalawar district

Variables	MVP	MFC	MVP/MFC
Fertilizer	14.14	1	14.14
Plant protection chemicals	36.12	1	36.12
Irrigation	5.61	1	5.61

indicates that these variables are underutilized and additional returns of ₹ 14.14, ₹ 36.12 and ₹ 5.61 will be achieved by spending of every additional rupee on fertilizer, plant protection chemicals and Irrigation water, respectively.

Technical efficiency: Producing at technically inefficient levels leads to reduction in farmers income and profit. Understanding on estimates of technical efficiency can help farmers to understand whether they are producing at technically efficient level or not, subject to the available resources. This will ensure better use of inputs and thus improvement in efficiency in production (Dev et al 2021). High value of the estimated variance parameter of the model shows that differences between observed and maximum value of output was mostly due to farmers practices rather than random utility. Further, the results (Table 3) showed that estimated value of coefficient of irrigation was positive and highly significant. This indicates the potential of irrigation in increasing the crop output.

There was wide variation in technical efficiency among the sample farms- ranging from 66.1 to 98.5 percent (Table 4). The mean technical efficiency was 85.4 percent. This indicates that on an average, the sample farmers tend to realize around 85.4 percent of their technical capabilities. Thus, on an average, there is potential to realize 14.6 percent more of technical efficiency by following efficient crop management practices.

Table 3. MLE Estimates of stochastic frontier production function

Variables	Coefficient	Std. Error
Constant	7.748869	1.655552
Human labour	0.044372	0.204228
Machine labour	-0.1628	0.159555
Fertilizer	0.174697	0.108762
Plant protection chemicals	0.21338	0.339143
Irrigation	0.225264***	0.052939
sigma-squared	0.0402***	0.015268
gamma	0.999***	0.010983
log likelihood function	26.66595	
LR test	1.820197	

Table 4. Distribution of sample farmers under different levels of technical efficiency

Technical efficiency (%)	Number of farms	Percentage to total
60.01-70	2	6.67
70.01-80	7	23.33
80.01-90	10	33.33
> 90	11	36.67
Total	30	100
Mean TE (%)	85.40	

Majority of the farms (36.7 percent) were operating close to the frontier with technical efficiency of more than 90 percent. This was followed by 33.3 percent farms whose efficiency levels ranged between 80.01 to 90 percent and 23.3 percent farmers with efficiency range of 70.01 to 80 percent. The analysis revealed that more than 66 percent of the farms were operating at technical efficiency levels greater than 80 percent.

Constraints in production and marketing: Lack of resistant varieties to major diseases was a prime production constraint. Leaf blight, bacterial blight, powdery mildew and anthracnose were the major diseases of coriander. Varieties resistant to these diseases can help to improve productivity as well as the quality of produce. Lack of awareness about seed treatment was the second most ranked constraint by the respondents and illiteracy is a big issue behind this. Lack of availability of verified, improved seeds, lack of better machineries and lack of awareness about control measures for major diseases, lack of availability of fertilizers, and its high cost, lack of availability of labour, capital, poor texture of soil, issue of weeds and lack of electricity were the other major constraints in production (Table 5).

Table 5. Constraints in production and marketing of coriander crop

Constraints	Mean score	Rank
Production constraints		
Lack of resistant variety to major diseases	67.13	I
Lack of awareness about seed treatment	64.16	II
Lack of improved seed (Govt verified)	60.2	III
Lack of improved machineries for cultivation	59.66	IV
Lack of awareness about control measures for major diseases	55.56	V
Lack of timely availability of fertilizers	55.3	VI
High cost of fertilizers	48.06	VII
Non-availability of timely labour	47.73	VIII
Poor economic condition (Lack of capital)	40.43	IX
Poor texture of soil	40.33	X
Lack of effective weedicides for coriander	37.36	XI
Less availability of electricity for irrigation	35.9	XII
Marketing Constraints		
Lack of proper market information	62.86	I
Lack of ingredient estimations facility in seeds	59.36	II
Lack of declaration of Minimum support prices	57.46	III
Lack of proper storage structures	56.96	IV
Lack of transportation facility	56.5	V
Lack of regulated market	56.1	VI
Lack of processing units	33.83	VII

Among the major constraints in marketing of coriander, lack of proper market information was the major issue faced by farmers in the study area. Farmers mostly depend on the information provided by local trader only. Lack of ingredient estimations facility in seeds was the second important marketing constraint faced by the coriander growers. A proper ingredient estimation facility can provide better pricing for a good quality product. As there are no support measures like MSP, farmers were facing difficulty to get reasonable price for their produce. Lack of proper storage and transportation facilities were other major issues. Because of this, farmers were not able to take benefit of price movements over time and space. The lack of regulated markets and processing facilities also were creating hurdles to farmers in marketing their produce and to fetch better returns.

CONCLUSIONS

A number of variables such as fertilizers, plant protection chemicals and irrigation water were underutilized by the farmers. Further use of these resources can significantly contribute to farm yield and income. Also, from the analysis of technical efficiency, it was found that the major share in deviation of farm income from the maximum was mostly due to farmers practices rather than random factors. Thus, farmers can resolve this and improve the efficiency levels. Most of the farms were found functioning in efficiency levels not much far from the frontier. A number of constraints related to both production and marketing were found creating difficulties to coriander farmers in the area. There is need for awareness creation programmes, mechanisms for dissemination of accurate market information, establishment of ingredient estimation facilities, and government interventions for regulated markets and better storage, processing and transportation facilities.

REFERENCES

Dev K, Sharma R and Samriti 2021. Evaluation of technical efficiency of agricultural growers in mid hills of Himachal Pradesh. *Indian Journal of Ecology* **48**(3): 939-943.

Garrett EH and Woodworth RS 1969. *Statistics in Psychology and Education*, Vakils, Feffer and Simons Pvt. Ltd., Bombay. p329.

Guleria A, Randev AK, Dev K and Singh P 2022. Resource use efficiency of agricultural farms in mid hills of Indian North-Western Himalayas. *Indian Journal of Ecology* **49**(1): 265-271.

Jacob EE and Ambily AS 2021. Exploring the sustainability of dairy farming in Kerala: a stochastic cost frontier approach. In: *Proceedings of the First International Conference of Economics, Business & Entrepreneurship, ICEBE 2020*, 1st October 2020, Tangerang, Indonesia (p. 33). European Alliance for Innovation.

Lal G 2018. Scenario, importance and prospects of seed spices: a review. *Current Investigations in Agriculture and Current Research* **4**(2): 491-498.

Suresh A and Reddy TRK 2006. Resource use efficiency of paddy cultivation in Peechi command area of Thrissur district of Kerala: an economic Analysis. *Agricultural Economics Research Review* **19**(1): 159-171.

Received 03 July, 2022; Accepted 22 September, 2022