International Journal of Environment and Climate Change

Volume 13, Issue 9, Page 3392-3396, 2023; Article no.IJECC.104807
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Study on Resource Use Efficiency under Integrated Farm System (Crop+Dairy) in Sultanpur District of Uttar Pradesh, India

Avinash Mishra [a++*], Mukesh Kumar Maurya [a#] and Ashish Samarpit Noel [a†]

[a] *Department of Agricultural Economics, Naini Agriculture Institute, SHUATS, Prayagraj-211007, India.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2023/v13i92591

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/104807

Original Research Article

Received: 02/06/2023
Accepted: 05/08/2023
Published: 10/08/2023

ABSTRACT

Resource-use efficiency is a prerequisite for effective resource management and profitable agriculture, and it is crucial to achieving this aim. The survey year of 2021–2022 provided the primary and secondary data on which the report was built. According to the study, the production elasticities for the kharif crops of paddy, sugarcane, and urd are 0.85, 0.88, and 0.85, respectively, whereas they are 0.87, 0.86, and 0.87, respectively, for the rabi crops of wheat. According to an examination of the production function of the dairy sector, the production elasticities of Green+ Dry Fodder, Concentrates, Health, and Labor in marginal, small, and medium size grouped farms were 0.88, 0.93, and 0.91, respectively.

[++] *Ph.D. (Research Scholar);*
[#] *Assistant Professor;*
[†] *Professor and Head;*
**Corresponding author: E-mail: avimishrapas@gmail.com;*

Keywords: Cobb-douglas; resource use efficiency; integrated farming system.

1. INTRODUCTION

Integrated farming system research (IFSR) was developed in response to the need for researchers to appreciate the requirements and constraints in the growth of resource-poor small holdings. The IFSR is a unique approach system, according to some. The major emphasis is on the interdependencies of the components of home management. It takes into account how aspects of the farm interact with socioeconomic, biological, and physical problems. IFSR intends to address specific problems encountered by landless laborers and farmers with limited resources in order to boost production in marginal areas with unfavourable environmental conditions.

Despite India's tremendous economic expansion, the growth rate of the agricultural sector has been extremely slow recently. The Economic Survey of India, 2008 reports that between 1990 and 2007, the growth rate of food grain output slowed to 1.2%, which was less than the 1.9% population growth. Our country's population is expected to reach 1370 million by 2030 and 1600 million by 2050. We must produce 289 and 349 MT of food grains throughout the corresponding times to satisfy the demand. According to the country's current situation, area under cultivation may continue to decrease, and by 2030, more than 20% of the current cultivable area would be used for non-agricultural purposes. The difficulty is exacerbated in India by the falling average farm size and financial constraints that prevent larger agricultural investment because 80 percent of farmer families belong from small or middle class group. Productivity improvement could be a crucial answer for ensuring nutrition and food security for a large population. This entails the use of scientific agronomic methods and technologies to increase the productive potential of conventional agricultural systems [1,2,3].

Farming system research is a comprehensive approach to problems faced by small and marginal farms [4]. The integrated farming system is a strategy for resource management that attempts to generate agricultural goods in an inexpensive and sustainable way to meet a range of farm household demands while protecting the resource base and maintaining excellent environmental quality. IFS promotes resource management and makes use of readily available resources in the local area to address sustainable use of land, water, and biota on the farm. It also covers nutritional security, food security, economic security, and security of livelihood.

2. METHODOLOGY

2.1 Sampling Design

Multi-stage sampling technique was utilized to choose the district, block, villages, and farmers.

2.2 Study Area

The majority of the rural population of Uttar Pradesh's 75 districts works in agriculture, with dairy farming serving as their primary industry after agricultural production. Sultanpur was purposefully chosen for the research since it is one of the areas where dairy farming is mostly conducted as an addition to the agriculture system. Two blocks, Kurebhar and Dhanpatganj, were purposefully chosen based on having the most land under this farming technique out of the 14 total blocks in Sultanpur district. The list of blocks was organized in increasing order according to the area under cultivation in the area.

2.3 Data Collection

Using a pre-tested interview plan, the primary information on the farmers was acquired through personal interviews. The necessary secondary information was gathered using a range of sources, including books, diaries, reports, and the files of the district and block headquarters, including research papers, articles, and district statistics reports.

2.4 Analytical Tool

2.4.1 Production function analysis

Cobb-Douglas production function was used to examine the effectiveness of resource usage in an integrated farming system. The Cobb Douglas production function has the following mathematical form:

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

Where,

Y= Gross income in Rs/farm
X_1= Area under different crops in ha
X_2= Number of dairy animals
X_3= Human labour in man days per farm

X_4= Fertilizers in Kg/farm
a = Intercept and
b1, b2, b3and b4 are regression coefficients

For the analysis of production function in respect to Cobb- Douglas Statistical Package for Social Sciences (SPSS) software was used.

3. RESULTS AND DISCUSSION

In order to assess the effectiveness of the primary resources used in the production of the Kharif and Rabi crops viz., Field + Seeds (X_1), Labour(X_2), irrigation(X_3) and fertilizer (X_4) the production function analysis was conducted. The cobb Douglas production function was investigated as the best fit, and the resulting findings are compiled in this section.

3.1 Elasticity of Production

Table 1 demonstrates that the coefficient of multiple determinant (R2) on the marginal size group of the kharif crop in paddy is 0.85, sugarcane is 0.86, and urd is 0.90, while in the rabi crop wheat is 0.87, Mustard is 0.86, and Gram is 0.86, respectively, and indicating that all the explanatory variable viz., Field + Seeds (X1), Labor (X2), irrigation (X3), and fertilizer (X4).

In a manner similar to this, the coefficient of multiple determinants (R2) on the small size group of the kharif crop in paddy is 0.87, sugarcane is 0.89, and urd is 0.88, while in the rabi crop wheat is 0.88, Mustard is 0.86, and Gram is 0.87, indicating that all the explanatory variables, such as Field + Seeds (X1), Labour (X2), irrigation (X3), and fertilizer (X4) together.

The coefficient of multiple determinants (R2) in the medium size group of the kharif crop in paddy is 0.85, sugarcane is 0.88, and urd is 0.85, while in the rabi crop in wheat is 0.87, Mustard is 0.86, and Gram is 0.87, indicating that all the explanatory variables, such as field + seeds (X1), labor (X2), irrigation (X3), and fertilizer (X4) together contributed in the kharif crop.

3.2 Significant of factor of production

Table 1 showed that the elasticity of output for the kharif crop on marginal farms was substantial at 5% for paddy urd and sugarcane. While the mustard and gram crops in X1 and X3 were significant in the rabi crop at 5% each, the wheat and mustard crops in X2 and X4 were significant at 1% each. Similar to large farms, the elasticity of output in small farms was substantial at 5% in paddy and sugarcane with regard to X4 and X1. While the X1 crop in rabi was significant at 5% in wheat, the X2 and X4 crops in wheat and the X1 crop in mustard are significant at 1%.

While in medium farm, the elasticity of production in kharif crop with respect to X_1 were significant at 5 percent in sugarcane. But in rabi crop in X_1 and X_2 were significant at 5 percent in wheat and mustard while in X_1 of gram are significant at 1 percent.

3.3 Return to Scale

The return to scale for marginal farmers in the rabi crop, which comprised wheat, mustard, and gram, was 0.91, 0.91, and 0.90, respectively, while the kharif crop, which included rice, sugarcane, and urd, was judged to be 0.92, 0.96, and 0.85 respectively. It is inferred that if all factors were increased by 1% at once, the return on each agricultural condition would increase by less than 1%. Similar to this, paddy's Return to Scale for small farmers in the kharif crop study was 0.89, sugarcane's was 0.91, and urd's was 0.86. In the study of the rabi crop, 0.90 for wheat, 0.87 for mustard, and 0.89 for gram were likewise discovered to be sub-one. It is implied that raising every element by one percent at once would result in an increase in return on each agricultural situation of less than one percent.

Return to scale for medium farmers in kharif crops was determined to be 0.85 for rice, 0.88 for sugarcane, and 0.85 for urd, respectively. In rabi crops, 0.87 for wheat, 0.86 for mustard, and 0.87 for gram were determined to be less than unity. It is inferred that increasing all factor by one percent simultaneously result in increase of the return by less than 1 percent on each farm situation.

3.4 Elasticity of Production

The production function analysis was carried out to determine the efficiency of various resources (Green+ Dry Fodder, Concentrates, Health and labour) used in the Dairy farming. Cobb-Douglas production function was found best fit to the data, and applied for the analysis.

Table 1. Resource Use Efficiency of different households under IFS for kharif and Rabi Crops

Particulars	Kharif			Rabi		
Production Elasticities (X_1 to X_4)	**Paddy**	**Sugarcane**	**Urd**	**Wheat**	**Mustard**	**Gram**
Marginal Farmers						
X_1	0.07**	0.05	0.18	0.02	0.22	0.26**
	(0.12)	(0.04)	(0.25)	(0.30)	(0.43)	(0.30)
X_2	0.20	0.44	0.21**	0.04	0.15*	0.18*
	(0.35)	(0.25)	(0.23)	(0.04)	(0.42)	(0.10)
X_3	0.25	0.23**	0.29	0.22	0.29**	0.24
	(0.44)	(0.10)	(0.09)	(0.19)	(0.34)	(0.07)
X_4	0.39	0.62	0.15	0.62*	0.23	0.22
	(0.62)	(0.32)	(0.04)	(0.31)	(0.30)	(0.18)
Return to Scale	0.92	0.96	0.85	0.91	0.91	0.90
R^2	0.85	0.86	0.90	0.87	0.86	0.86
Small Farmers						
X_1	0.25	0.19**	0.26	0.01**	0.15*	0.08
	(0.27)	(0.55)	(0.37)	(0.11)	(0.64)	(0.14)
X_2	0.28	0.24*	0.26	0.41*	0.39	0.23
	(0.21)	(0.19)	(0.23)	(0.14)	(0.71)	(0.16)
X_3	0.12	0.06	0.19	0.03	0.23	0.17
	(0.04)	(0.46)	(0.33)	(0.05)	(0.42)	(0.09)
X_4	0.23**	0.46	0.14*	0.46*	0.08	0.39*
	(0.33)	(0.27)	(0.54)	(0.17)	(0.15)	(0.14)
Return to Scale	0.89	0.91	0.86	0.90	0.87	0.89
R^2	0.87	0.89	0.88	0.88	0.86	0.87
Medium Farmers (Semi Medium + Medium)						
X_1	0.16	0.43**	0.31	0.26**	0.44	0.16*
	(0.26)	(0.10)	(0.16)	(0.45)	(0.39)	(0.54)
X_2	0.31	0.10*	0.35	0.10	0.37**	0.18
	(0.25)	(0.77)	(0.40)	(0.29)	(0.70)	(0.46)
X_3	0.32	0.28	0.09*	0.22	0.03	0.31
	(0.24)	(0.13)	(0.27)	(0.33)	(0.59)	(0.39)
X_4	0.04*	0.01	0.07	0.27	0.01	0.21
	(0.19)	(0.01)	(0.11)	(0.30)	(0.13)	(0.31)
Return to Scale	0.85	0.88	0.85	0.87	0.86	0.87
R^2	0.91	0.94	0.93	0.95	0.94	0.90

**Significant at 1% level of probability*
***Significant at 5 % level of probability*

Table 2 .Resource use efficiency of dairy farming under IFS

Farm Groups	Independent Variables				Return to Scale (On the basis of Milk production)	R^2
	Green+ Dry Fodder (X_1)	Concentrates (X_2)	Health Care (X_3)	Labour (X_4)		
Marginal	0.35	0.27*	0.38	-0.10	0.90	0.88
	(0.18)	(0.17)	(0.22)	(-0.08)		
Small	0.44	0.33**	0.46**	-0.08	1.18	0.93
	(0.21)	(0.13)	(0.16)	(-0.03)		
Medium (Semi Medium + Medium)	0.32	0.39**	0.45*	-0.09	1.04	0.91
	(0.20)	(0.11)	(0.15)	(-0.79)		

*** Significant at 5% significant level*
**Significant at 1% significant leve*

Table 2 provides the predicted values for production elasticity, standard error, the coefficient of multiple determinations (R2), and returns to scale for dairy farming by various size groups of farms. The Table makes clear that the co-efficient of multiple determinations (R2) for farms in the marginal, small, and medium size groups were, respectively, 0.88, 0.93, and 0.91. It is evident from the above co-efficient of multiple determination of the marginal, small, and medium size group of farms that all four independent input variables—Green+ Dry Fodder, Concentrates, Health, and Labor—contributed 88.00 percent, 93.00 percent, and 91.00 percent to these farms.

Out of four independent variables Green+ Dry Fodder, Concentrates, Health and labour, two variables i.e. Concentrates and Health were found statistically significant at 1% level of probability in case of marginal and medium size group of farms respectively. In case of small size group of farms Concentrates and Health while in medium only health had significant relationship at 5% level of probability and rest variable were not associated significantly with the yield.

The marginal, small, and medium-sized agricultural groups' returns to scale were 0.90, 1.18, and 1.04, respectively. Small and medium farms found returns to scale to be more than unity whereas marginal farm types found returns to scale to be less than unity. It implies that the scale effects of dairy farming are decreasing for small and medium farms while growing for marginal farms [5-8].

4. CONCLUSION

According to the production function analysis, for a medium-sized group, the production elasticities for the kharif crop of paddy, sugarcane, and urd are 0.85, 0.88, and 0.85, respectively, while for the rabi crop of wheat, they are 0.87, Mustard, 0.86, and Gram, 0.87, respectively. The production elasticities of Green+ Dry Fodder, Concentrates, Health, and Labor in marginal, small, and medium size groups farms were 0.88, 0.93, and 0.91, respectively, according to the analysis of the production function of the dairy industry.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anuraj Singh, Sangramsing P Bainade, Cheenu Kashyap, Vivek Kumar. Integrated farming system. The Pharma Innovation Journal. 2022;SP-11(5):1488-1496
2. Sharma S, Padbhushan R, Kumar U. Integrated nutrient management in rice–wheat cropping system: An evidence on sustainability in the Indian subcontinent through meta-analysis. Agronomy. 2019; 9(2):71.
3. Soni RP, Katoch M, Ladohia R. Integrated farming systems- A review. IOSR Journal of Agriculture and Veterinary Science. 2014;7(10):36-42.
4. Behera UK, France J. Integrated farming systems and the livelihood security of small and marginal farmers in India and other developing countries. Advances in agronomy. 2016;138:235-82.
5. Phuge SC, Deorukhakar AC, Meshram AV, Thorat VA, Dhekale JS, Wadkar SS. Resource use efficiency in Farming Systems in North Konkan coastal zone region of Maharashtra, International Journal of Current Microbiology and Applied Sciences. 2020;11:128-136.
6. Rashtrarakshak Satihal DG, Patil SS, Reddy BS. Resource use efficiency and cost of cultivation under Integrated Farming System in Hyderabad Karnataka region, Trends in Biosciences. 2016; 9(4):236-240.
7. Singh H, Meena GL, Sharma L, Jangid MK, Bhushan B, Kumar M. Resource use efficiency in Integrated Farming Systems of Banswara district of Rajasthan, Journal of Animal Research. 2018;8(4):01-06.
8. Singh SP, Gangwar B, Singh MP. Economics of Sugarcane- based farming system in Western Uttar Pradesh, Agricultural Economics Research Review. 2008;21(1):109-117.
Available:https://www.google.com/search?q=+2018+Indian+Council+of+Agricultural+Research&sxsrf=APwXEdfi9qPZ-5MbshDynhvQI3uOhQ22-g%3A1680625741315&ei=b

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/104807