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Garlic: Study on resource use efficiency in Etawah district of Uttar Pradesh

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Abstract
The study was conducted in Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.). The enquiry pertained to the agricultural year 2021-22. District and block namely, Etawah & Takha and Basher were purposively selected for the study due to higher concentration of garlic area. List of the respondents from selected blocks were prepared along with acreage under garlic cultivation, 120 respondents (Farmers) proportionally from each category of farms and classified into three categories i.e. marginal (below 1 ha), small (1-2 ha) and medium (2-4 ha & above). Under marginal farms the elasticity of production with respect to human labor, manure & fertilizers and irrigation were statistically significant whereas, under small farms elasticity of production with respect to irrigation and manure and fertilizer were significant and under medium farms seed was found statistically significant. It means these inputs have sufficient scope to more use for production. In case of garlic returns, to scale on marginal, small and medium size group of sample farms characterized by decreasing returns to scale. Out of total variation in dependent variable explained by human labor, seed, manure and fertilizers and irrigation under entire size of sample farms for both crops varied from minimum of 90.83 percent to maximum of 91.11 percent.

Keywords: Respondents, blocks, MVP, resource use efficiency, R^2

Introduction
After onions, garlic (*Allium satium* L.) is the second-most significant bulb crop in the Amaryllidaceae family. The subsurface development component known as bulbs is where the economic yield is found. The garlic bulb is a complex or multiple bulb made up of bulbs or bulblets that are commonly known as cloves (Patidar *et al.*, 2018) [8]. Garlic is one of the most popular spices in the whole world. It is extensively grown in Central Asia and Eastern Region (Meena, 2013) [7]. This food is high in carbohydrates (0.57g), protein (0.57 g), phosphorus (13.77 mg), potassium (36.09 mg), calcium (16.29 mg), magnesium (2.25 mg), and all of the other nutrients (2.98g). Ascorbic acid is present in green garlic in a significant amount (1%). It is a significant source of human nutrition and offers significant health benefits, playing a crucial role in the immune system for the modern day (Diriba and Shiferaw, 2016) [3]. India is the world's greatest producer of garlic and grows it in mild to cold climates. When cooked, clove's unique pungent, spicy flavour greatly softens and sweetens. When used medicinally, it strengthens the immune system, lowers blood pressure, lowers cholesterol, enhances cognitive function, and more. In Indian medicine (Ayurvedic, Unani, and Siddha), it is used as a carminative and stomach stimulant to help digestion and absorption of meals. It provides for domestic necessities as well as being a substantial source of foreign exchange. (Yewatkar, 2019) [10]. Madhya Pradesh recorded the highest production of garlic across India in financial year 2022, amounting to over two million metric tons. The Indian states of Rajasthan, Uttar Pradesh, and Gujarat followed. The country produced over 3.1 million metric tons of the garlic in 2021(According to Statista). Uttar Pradesh produces 34.31 thousand hectares and 227.34 thousand metric tonnes of garlic annually, with productivity rate of 6625 kg/ha. India would need to grow 30 lac tonnes of garlic with a better nutritional content than other bulb crops (raw 1 clove) by the year 2050 in order to feed its expanding population and satisfy export and processing demands (Kumud *et al.*, 2019) [6].
Keeping the importance of study on "Garlic: Economic study on resource use efficiency in Etawah District of Uttar Pradesh was conducted with specific objectives:
1. To study the resource use efficiency of study area.

2. To study the marginal value productivity (MVP) of the study area.

Material and Methods

1. Sampling Techniques

The multistage stratified, purposive cum random sampling procedure was used for the selection of district, block, village and respondents.

a. Selection of District

The study was purposively undertaken in Etawah district in order to avoid operational inconvenience of the investigator.

b. Selection of Block

At first, a list of all 8 blocks of Etawah district of Uttar Pradesh along with acreage of garlic cultivation were prepared and arranged in descending order. The block namely Takha and Basher having highest area in garlic was selected purposively for the study.

c. Selection of Farmers

A separate list of garlic growers of selected blocks were prepared along with their size of holding and stratified into three categories i.e.

1. Marginal – (Below 1 ha)
2. Small – (1 to 2 ha)
3. Medium – (2 to 4 ha)

From this list, samples of 120 respondents were drawn following the proportionate random sampling technique categories.

2. Methods of Enquiry

The primary data were collected by survey method through personal interview with use of pre-structured schedule, while secondary data were collected from blocks head quarter and district offices etc.

3. Period of Enquiry: The data were pertained to the agricultural year 2021-2022.

4. Methods and Techniques of Analysis

Regression Analysis

Production function analysis was carried out to examine the productivity and efficiency of different resources of the sample farms. Multiple regression analysis was done to examine the cost-benefit relationship and productivity of farms. Different types of production functions were explored, out of them only Cobb-Douglas production function was found best fit for analysis. (Yadav *et al.*,2013) [9]

The mathematical form of Cobb- Douglas production function is given below:

$Y = ax1^{b1}\, x2^{b2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots X\, e^{\mu}$

Where;

Y = Dependent variable (output values in Rs. / Ha.)
X_i = i^{th} independent variable (input values in Rs. /ha.)
X_1 =Seed (Rs. /ha.)
X_2= Machinary(Rs/ha.)
X_3=Human Labour(Rs/ha.)
X_4= Manure and fertilizer (Rs/ha.)
X_5= Plant protection
X_6= Irrigation
a = Constant
b_i = Production elasticity with respect to X_i
e = Error term or disturbance term
μ = Random variables

The value of the constant (a) and coefficient (bi) in respect of the independent variables in the function have been estimated by using the method of least squares.

Estimation of Marginal value product

The marginal value product of input was estimated by taking partial derivatives of returns with respect to the input concerned, at the geometric mean level of inputs (Ahmad *et al.*,2011) [1].

Where,

$$(MVP)b_i = \frac{b_i \bar{y}}{x_i}$$

bi = Production elasticity with respect to Xi
$\bar{y}$ = Geometric mean of y (output values in Rs./ha.)
Xi= Geometric mean of Xi
(MVP) = Marginal value product of i^{th} impact

Results & Discussion

The production function analysis was carried out to determine the efficiency of prime included resources *viz*. human labour, manure and fertilizer, machinery charge, seed, and irrigation as explanatory variable use in production of paddy. The Cobb-Douglas production function as best fit was explored and respective results are summarized in this section.

The value of elasticity of production, standard error, coefficient of multiple determination and returns to scale of garlic production by different size group of farms have been worked out and presented in Table 2.

Table 1 depicted that coefficient of multiple determinations (R^2) on marginal, small and medium size group of farms accounted for 0.905, 0.879 and 0.852, respectively and indicating that all the explanatory variable *viz.*, seed, machinery charges, human labour, manure and fertilizers, plant protection and irrigation together contributed 90.50, 87.90 and 85.20 percent, respectively.

It is observed from Table 6 that on marginal farms, the elasticity of production with respect to human labour and irrigation were statistically significant at 1 percent, while machinery was statistically significant 5 percent level of significance. In case of small farms elasticity of production with respect to human and irrigation were statistically significant at 5 percent and manure & fertilizer were statistically significant at 1 percent level of significance, respectively and in respect to medium farms irrigation was found statistically significant at 5 percent while manure & fertilizer were statistically significant 1 percent level of significance. Rest factors of production included in production process were found statistically non-significant. It can be inferred that are no further scope for application of these input.

Returns to scale

Returns to scale pertained to marginal, small and medium farms were analyzed i.e. 0.929, 0.882 and 0.833, respectively,

which was found to be less than unity. It is therefore, inferred that increasing all factors by one percent simultaneously results increase of the returns by less than 1 percent on each farm situation.

Table 1: Elasticity coefficients of the production function for garlic

Size groups	Elasticity of output						Sum of elasticity	R^2
	Seed cost (x_1)	Machinery charges (x_2)	Human Labour (x_3)	Manure & fertilizer (x_4)	Plant protection (x_5)	Irrigation (x_6)		
Marginal	0.164	0.235**	0.197	0.054	0.049*	0.227	0.929	0.905
Small	0.032	0.368**	0.271	0.079	0.021*	0.108	0.882	0.879
Medium	0.240	0.040*	0.186*	0.144	0.172	0.048	0.833	0.852

**1%level of significance and *5%level of significance.

Table 2: MVP of different sector in the garlic production

Marginal value product					
x_1	x_2	x_3	x_4	x_5	x_6
1.915	12.931	8.882	0.489	11.334	26.008
0.412	14.654	1.947	4.897	3.906	10.917
2.182	1.812	7.441	8.523	19.041	8.580

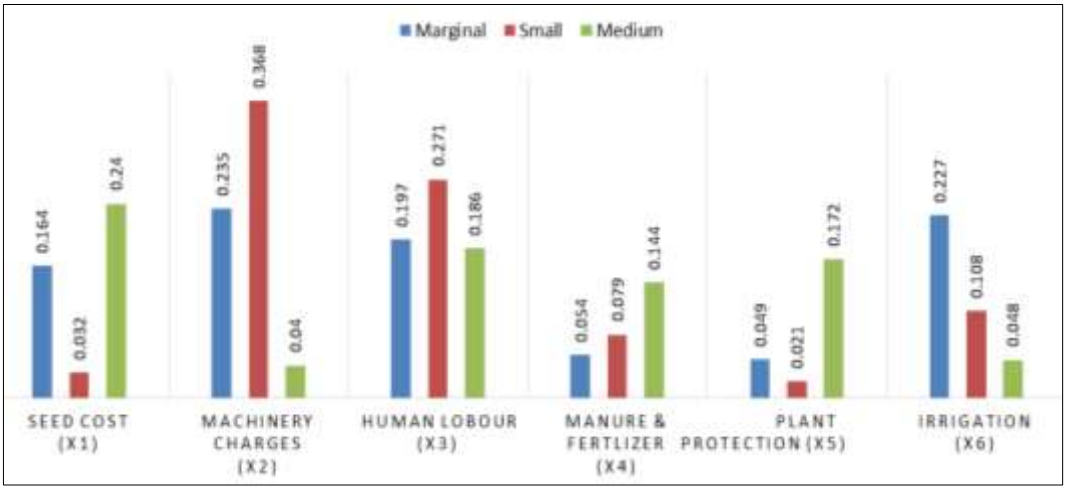

Fig 1: Resource use efficiency of garlic on marginal farms in the study area

Marginal value productivity

It is evident from Table 2 that marginal value productivities are positive and more than unity in case of manures and fertilizers and irrigation on marginal, small and medium farms and in case of human labour it was positive on marginal and small farms only and more than unity which indicates scope for increasing the expenditure on this input variable. In case of human labour on medium farms it was found less than unity which indicated excess investment on this variable hence, there are need to decrease it, for increasing profitability of farms.

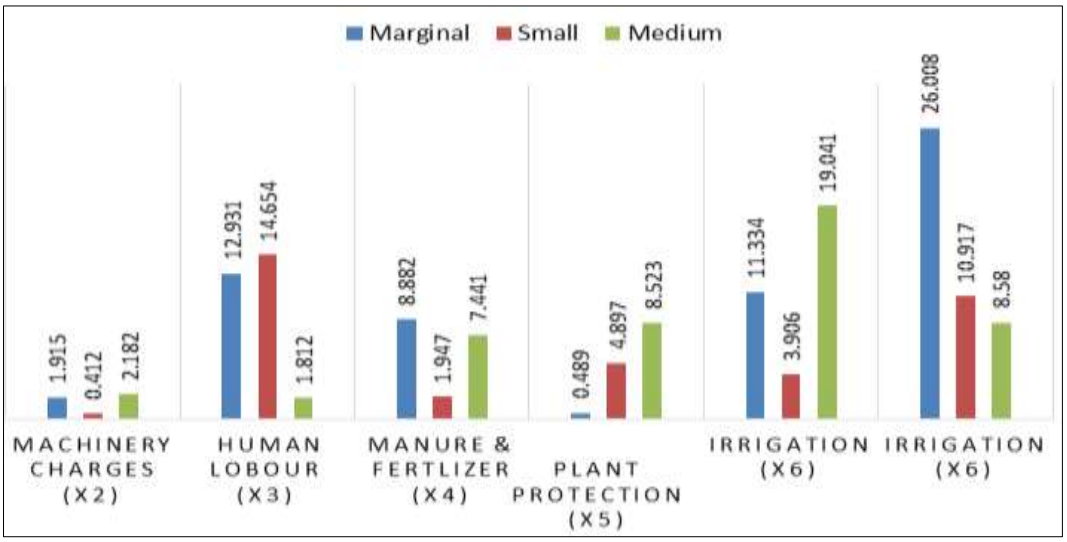

Fig 2: Marginal Value of Productivity

Conclusion

Under marginal farms the elasticity of production with respect to human labor, manure & fertilizers and irrigation were statistically significant whereas, under small farms elasticity of production with respect to irrigation and manure and fertilizer were significant and under medium farms seed was found statistically significant. It means these inputs have sufficient scope to more use for production. Rest factors of production included in production process were found statistically non-significant that means no further scope for application of these inputs. In case of garlic returns, to scale on marginal, small and medium size group of sample farms characterized by decreasing returns to scale. Out of total variation in dependent variable explained by human labor, seed, manure and fertilizers and irrigation under entire size of sample farms for both crops varied from minimum of 90.83 percent to maximum of 91.11 percent.

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