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RESEARCH PAPER

Economics and pesticide use efficiency in vegetable crops in district Kanpur, Uttar Pradesh

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Abstract : The study was under taken with 60 vegetable growers in Kalyanpur block of district Kanpur during 2007-08 on three major vegetables *viz*., tomato ,brinjal and chilli. The highest plant protection cost Rs. 1994 per hectare was measured for chilli constituting 6.3 per cent of total variable cost. The plant protection cost of tomato was Rs.1911.37 per hectare with a tune of 8.6 per cent variable cost, while lowest cost of plant protection was measured Rs. 1578/ha in case of brinjal constituted with 10.8 per cent of total variable cost. The pesticide use efficiency analysis for tomato revealed that one per cent increase in value of plant protection reduced the yield by 0.11 per cent reflected the over use of pesticide while production elasticity of labour (0.18) and fertilizer (0.14) indicating further scope of enhancing the labour and fertilizer for better yield of tomato crop. The pesticide use efficiency of brinjal indicating positive response and resulted 0.20 per cent increase in yield of brinjal by increasing one per cent more dose of the pesticide. The production elasticity of fertilizer (0.30) and labour (0.29) also resulted positive response and further scope in brinjal crop. The pesticide use efficiency for chilli crop (- .03) showed a negative response for plant protection and restrict the further use of plant protection chemicals. The production elasticity for labour (0.25) and fertilizer (0.43) indicated under use of nutrients and man power. Hence, there is still scope for increasing man power and fertilizers to improve the yield of chilli crop in the study area.

Key Words : Economics, Pesticide use efficiency, Production elasticity, Marginal value product

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INTRODUCTION

India is the second largest vegetable producer next to china accounting about 108.5 million tonnes production with 17.2 million hectares of area . India is contributing 13.4 per cent of the total world vegetable production and share 60.59 per cent of total horticultural production in India (Ananymous, 2010). Importance of vegetables has gained more momentum recently due to presence of phyto-chemical compounds which works as anti oxidants against several diseases and pests. In India as an average 33 per cent crop loss occurs due to pests and diseases (Puri and Sharma , 1999). In addition 1000 crore worth of agricultural export are rejected due to presence of high pesticide residues. India is highest consumer of pesticides among south Asian countries. Among India , Uttar Pradesh is the second largest consumer of pesticides (6855 metric tonnes) next to Punjab. A study by Chandra Sekaran *et al.* (1997) confirmed that 89 per cent of vegetables studied were contaminated with residues of pesticides last sprayed and about 14 per cent of these had residues above their respective maximum limit level. To address the concern about health and environmental effect, plant protection gradually shifted towards development of alternative methods of pest control like integrated pest management .

MATERIAL AND METHODS

The district Kanpur Nagar was selected for the study as it is one of the major vegetable growing district in Uttar Pradesh. Based on cultivation area of tomato, brinjal and chillis, Kalyanpur block was selected for study. From this block four villages namely, Sambhalpur, Jhakara, Rautepur and Loharkheda were selected randomly. Out of these selected villages, a total of 60 respondents, from each village 15 respondents actively engaged in vegetable production were selected randomly

The primary data were collected by personal interview method in well prepared pretested schedules in advance. The secondary data were collected from district statistical office, and different district level offices, various journals and records. The study was related to the cropping year 2007-08. To analyse the efficiency of pesticide use in selected vegetable crops Cobb-Douglas form of production function was fitted . The function was follows.

Y = aPPCb1NPKb2Lb3eu

where, a= intercept , Y = Yield in tonne /ha, PPC = Plant protection chemicals in Rs. /ha

NPK = Fertilizers nutrients in kg/ha, L = Human labour man days/ha

eu = Error term

The marginal value product (MVP) of each input was worked out at its geometric mean level.

MVPi = bi Y/X PY

where, MVP = Marginal value product of input

bi = Production elasticity co-efficient, Y = Geometric mean of output

X = Geometric mean of input, PY = Price per unit of output

To analyze the efficiency of input use, the marginal value product (MVP) of each input was compared with its marginal input cost (MIC).If input is used efficiently the ratio between MVP and MIC is one. A ratio more than one and less than one indicate under utilization and over utilization of the inputs, respectively.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Cost of plant protection:

The Table 1 reveals that the plant protection cost / ha was highest for chillies with Rs. 1994.00 forming 6.30 per cent of total variable cost. Next to chillies the plant protection cost was high for tomato crop with Rs. 1911.37 / ha followed by brinjal Rs. 1578.00/ ha and forming 8.60 and 10.08 per cent of total variable cost of cultivation, respectively.

Analysis of pesticide use efficiency:

Pesticide use efficiency in tomato:

It could be observed from Table 2 that the multiple co-efficient of determination R^2 was 0.75 indicating that the explanatory variable included in the analysis could explain about 75 per cent of variation in the yield of tomato crop. The elasticity co-efficient of plant protection chemicals was statistically negatively significant at one per cent level was found influencing the yield of tomato. The production elasticity for plant protection chemicals was -0.11 implying that one per cent increase in the value of chemicals would reduce the yield by 0.11 per cent. The production elasticity of labour was 0.18 implying that one per cent increase in man days from existing geometric mean level would increase the yield of tomato by 0.18 per cent. The production elasticity of fertilizer was 0.14 indicating that one per cent increase in the value of fertilizer would increase the yield by 0.14 per cent. The ratio between MVP and MIC revealed that the additional expenditure on plant protection chemicals by Rs. 0.32 would result in a loss of Rs. 10.54 indicating the need for reducing expenditure on plant protection chemicals. The ratio was found to be Rs. 1.69 for fertilizers (NPK), which indicated under utilization of fertilizers. The ratio was found to be Rs. 0.59 for labour indicated that still scope of labour for better tomato yield. Hence, there is scope for improving tomato yield by increasing the application of fertilizer (NPK) and labour and reducing the application of plant protection chemicals (Kumar and Arora, 1999).

Table 1 : Cost of plant protection

Sr. No.	Crop	Chemical cost (Rs.)	Application cost (Rs.)	Total cost (Rs.)	Per cent to total cost of cultivation
1.	Tomato	1311.37	600.00	1911.37	8.60
2.	Brinjal	1178.00	400.00	1578.00	10.08
3.	Chillies	1594.00	400.00	1994.00	6.30

Table 2 : Production function estimates for tomato

Variables	Co-efficients	Standard errors	P- value	MVP	MIC	MVP/MIC
Constant	7.48***	0.90	0.00			
Plant protection chemicals	-0.11*	0.06	0.08	-3.39	0.32	-10.54
Fertilizers	0.14***	0.05	0.01	10.95	6.5	1.69
Human labour	0.18**	0.08	0.02	44.45	75	0.59
R^2	0.78					
F	27.12					

*, ** and *** indicate significance of value at P=0.10, 0.01, and 0.05, respectively

Table 3 : Production function elasticity for brinjal

Variables	Co-efficients	Standard errors	P- value	MVP	MIC	MVP/MIC
Constant	4.14***	0.86	9.72			
Plant protection chemicals	0.20*	0.11	0.08	8.41	0.32	26.30
Fertilizers	0.30***	0.10	0.01	14.51	6.5	2.23
Human labour	0.29**	0.09	0.01	63.97	75	0.85
R^2	0.80					
F	26.14					

*, ** and *** indicate significance of value at P=0.10, 0.01, and 0.05, respectively

Table 4 : Production function estimate for chilli

Variables	Co-efficients	Standard errors	P- value	MVP	MIC	MVP/MIC
Constant	5.26**	2.59	0.05			
Plant protection chemicals	-0.03***	0.02	0.01	-1.61	0.32	-5.05
Fertilizers	0.43**	0.20	0.04	20.18	6.5	3.10
Human labour	0.25**	0.37	0.05	37.75	75	0.50
R^2	0.62					
F	4.90					

*** and ** indicate significance of values at P=0.01 and 0.05, respectively

Pesticide use efficiency in brinjal :

It is observed from Table 3 that the multiple co-efficient of determination R^2 was 0.90 indicating that the explanatory variables included in the analysis could explain about 90 per cent variation in the yield of brinjal crop. The production elasticity for plant protection chemicals was 0.20 implying that one per cent increase in the value of chemicals would increase the yield by 0.20 per cent. The production elasticity of human labour was 0.29 implying that the one per cent increase in man days from existing geometric mean level would increase the yield of brinjal crop by 0.29 per cent. The production elasticity for fertilizers was 0.30 indicating that the one per cent increase in the quantity of fertilizer would increase the yield by 0.30 per cent. The ratio between MVP and MIC revealed that the additional expenditure on plant protection chemicals by 0.32 would result in profit of Rs. 26.30. The ratio was found to be Rs. 2.23 for fertilizers (NPK) , which indicated under utilization of fertilizers. The ratio was found to be Rs.0.85 for labour , which indicated under utilization of labours. Hence , there is scope for improving the brinjal yield by increasing the application of fertilizer (NPK) , labour and plant protection chemicals.

Pesticide use efficiency in chilli :

Table 4 reveals that the multiple co- efficient of determination $R^2$was 0.59 indicating that explanatory variables included in the analysis could explain about 59 per cent variation in the yield of chilli crop. The production elasticity of plant protection chemical was-0.03 implying one per cent increase in the value of chemical would reduce the yield by 0.03 per cent. The production elasticity of human labour was 0.25 implying that one per cent increase in man days the existing geometric mean level would increase the yield of chilli by0.25 per cent. The production elasticity of fertilizers was 0.43 indicating that one per cent increase in fertilizer would increase the yield by 0.43 per cent. The ratio between MVP and MIC revealed that the additional expenditure on plant protection chemicals Rs. 0.32 would result in a loss of Rs. 5.05 indicating the need for reducing expenditure on plant protection chemicals. The ratio found to be Rs.3.10 for fertilizers (NPK), which indicated under utilization of fertilizers. The ratio was found to be Rs.0.50 for labour, which indicated under utilization of labour. Hence. There is scope for improving the chilli yield by increasing the application of fertilizer (NPK), labour and reducing the application of plant protection chemicals. Similar results were observed by Bagi and Huang (1983).

Conclusion and suggestion:

The study revealed that the highest plant protection cost /ha was incurred in chilli crop followed by tomato and brinjal. The pesticide use efficiency analysis revealed that further increase in the doses of plant protection chemicals for chillies and tomato crop, reduce the yield as well as resulting net loss in productivity and profit of the vegetable growers, analysis suggested for improving the yield of tomato and chilli by increasing application of fertilizers (NPK) and man power only rather further use of pesticides . In case of brinjal crop it was observed that the factors like fertilizer, labour and even plant protection chemicals were underutilized. The increase in level of fertilizer, labour and even plant protection chemicals would enhance the yield and return from brinjal crop. The judicious use of plant protection

chemicals, labour and fertilizers would go a long way for higher productivity and return from vegetable crops in the study area.

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