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Original Research Article

Analyses of the Profitability of IPM and Non-IPM Practices in Pigeon Pea

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A B S T R A C T

India is the world's largest producer and consumer of pulses including pigeon pea. Pigeon pea is susceptible to a large number of diseases and insect pests which cause heavy losses. To combat these entire pest farmers are practicing various IPM and non-IPM practices. The present study mainly deals with the different between these to practice with respect to profitability and output. The share of fixed cost in total cost of cultivation was 11.31 per cent (Rs. 4627) and 10.79 per cent (Rs. 4627) in case of IPM and non-IPM farmers, respectively. Among the variable costs, the expenditure incurred on human labour was highest share (24.46%) followed by, PPC (16.04%) cost incurred on IPM components, Similarly in case of non-IPM farmers the expenditure incurred on human labour was also highest (25.96%) followed by PPC (25.42%). The average output of pigeon pea was slightly higher (9.97 q/ha) in case of IPM farmers as compared to non-IPM farmers (9.55 q/ha). The variability of dependent variable was found to be 0.93 and 0.86 that means 93 per cent and 86 per cent is explained by the independent variables included in the model in case of IPM and non-IPM farmers, respectively. Due to adoption of IPM technology was Rs. 6227 and the net gain obtained from the IPM package of pigeon pea was Rs. 3230.

Keywords

Pigeon pea, IPM practice, non-IPM practice and Profitability

Introduction

India ranks 10th in the world pesticides consumption and its total consumption was 45,386 tonnes per annum (Anon. 2012). In India, 400 chemical factories are manufacturing 55 different basic pesticides. Totally 164 pesticides have been registered for use in the country. Pesticide use in India is increasing at a rate of 2 to 5 per cent annually and it is about 3 per cent of total pesticides used in the world. About 90,000 metric tonnes of technical grade pesticides are currently produced and more than 67 per cent is used in agriculture sector alone. India is presently the largest manufacturer of basic pesticides among the South Asian and African countries with an exception of Japan. The Indian pesticides market is the 12th largest in the world (Anon. 2012).

About 70 per cent of pesticides are being used in developing countries like India and remaining 30 per cent in developed countries. More than 1000 agro-chemicals are being manufactured and used for agriculture as well as for public health purposes. Out of these pesticides used, 80.5 per cent are insecticides, 11 per cent are fungicides and 7 per cent are herbicides. Karnataka stands 7th position in total quantity of consumption (1225

tonnes/annum), whereas consumption value of pesticides in Vijayapura district is Rs. 400 million (Anon, 2012).

During nineties in Northern Karnataka, application of almost all broad spectrum insecticides failed to reduce the extensive damage of pests (70 to 90%) and the losses incurred were to the tune of Rs. 400 crores (Lingappa and Yelshetty, 1994). Similar situation with incidence of pests ranging between 90 to 100 per cent was observed during 1997-98 (Yelshetty and Siddegowda, 1998).

India is the world's largest producer and consumer of pulses including pigeon pea. About 90 per cent of the global pigeon pea area (4.9 m.ha.) is in India contributing to 93 per cent of the global production (Anon, 2013).

The major pigeon pea growing states of India are Maharashtra, Uttar Pradesh, Madhya Pradesh, Karnataka, Gujarat, Andhra Pradesh, Tamil Nadu and Bihar.

India with its area of 3.75 million hectares and production of 3.1 million tonnes ranks 9th in the world productivity (Anon, 2013). The area and production of pigeon pea in Karnataka is 6.81 lakh ha and 6.27 lakh tonnes, respectively (Anon, 2013).

Pigeon pea is susceptible to a large number of diseases and insect pests which cause heavy losses. Fletcher (1920) listed a total of 35 insects like *Helicoverpa armigera*, *Etiellazinckenella*, *Euchryspos cnejus*, *Odontotermes distans*, *Marucatestulalis* and *Gryllus bimaculatus*. Lal *et al.,* (1985) reported nearly 200 species of insects on pigeon pea, among these, 34 as serious pests for other crops as well. Of late, insects which have become serious includes Podbug, *Calvigrallagibbosa*, *C.scutellarius*, various species of leaf webbers, especially *Cydiacritica*, *Maruca vitrata* and glaerucid beetle. Polyphagous pests like cutworms *(Agrotis ipsilon* and *Ochropleura flammatra)* and hairy caterpillars *(Amsacta moorei*, *A. albistriga* and *Spilosoma obliqua)* have also become serious (Arora and Dhaliwal, 1996). This study is an enadeavour to provide the knowledge about the profitability of IPM and non-IPM practice in pigeaon pea.

Materials and Methods

The present study attempted to evaluate the economics of pesticide use in pigeon pea. Pigeon pea is predominantly grown in Vijayapura district. The area under pigeon pea in Vijayapura district is 1,83,550 hectare (2014). The Pesticide use studies in this area is lacking hence, Vijayapura in Karnataka state is purposively selected for the study. Vijayapura district is located in Northern part of Karnataka and is situated between15^{0} 20$^{'}$ to 17^{0} 28$^{'}$ North latitude and 74^{0} 54$^{'}$ to 76^{0} 28$^{'}$ East longitude. It consists of five taluks viz., Vijayapura, Sindagi, Indi, Muddebihal and Basavana Bagewadi.

The present study was mainly based on the primary data obtained from sample farmers through personal interview method. Multistage sampling procedure was adopted to get a necessary information from sample respondents. Six pigeon pea growing farmers out of which three are IPM and other three are non-IPM were randomly chosen from each village for getting the required information on pigeon pea cultivation from five taluks where 4 villages considered from each taluks. Thus, the total sample size is 120. The sample farmers were interviewed personally using a pre-tested and structured schedules specifically designed for the study. Following analytical tools are used in the present study;

Production function analysis

The Cobb-Douglas (CD) production function was estimated to study the resource use efficiency and influence of inputs on pigeon pea yield in Vijayapura district.

The production function of the following type was specified in the present study.

$a_1\ a_2\ a_3\ a_4\ a_5\ a_6$
$Y = A\ X_1\ X_2\ X_3\ X_4\ X_5\ X_6\ e_u$

Where,

Y= Gross income from pigeon pea (Rs. ha^{-1})

X_1= Expenditure on Seeds (Rs. ha^{-1})

X_2= Expenditure on Farm yard Manure (FYM) (Rs. ha^{-1})

X_3= expenditure on Fertilizers

X_4 = Expenditure on human labour (Rs. ha^{-1})

X_5 = Expenditure on bullock labour (Rs. ha^{-1})

X_6= Quantity of Pesticides used (L ha^{-1})

A= Constant

A_i = Production elasticities

u = Radom error

Partial Budgeting Technique

In order to compare the costs and returns of IPM and non-IPM partial budgeting technique was employed.

This will reflect difference in quantitative aspects of IPM and non-IPM model.

Results and Discussion

The details of cost incurred and returns realized in pigeon pea cultivation by IPM and non-IPM farmers during the crop year 2013-14 is presented in Table 1. It could be seen from the table that, per hectare total cost of cultivation was Rs. 40,907 in case of IPM farmers and Rs. 42,846 in case of non-IPM farmers. In both the cases, variable costs accounts for Rs. 36,280 and Rs. 38,218 with a share of 88.69 per cent and 89.19 per cent of the total cost of cultivation in the case of IPM and non-IPM farmers, respectively. Among the variable costs, the expenditure incurred on human labour was highest share (24.46%) followed by, PPC (16.04%), chemical fertilizers (15.57%), machine labour (14.89%), cost incurred on IPM components (7.33%), bullock labour (3.66%), interest on working capital (3.48%), seeds (1.96%) and FYM (1.29%). Similarly in case of non-IPM farmers the expenditure incurred on human labour was also highest (25.96%) followed by PPC (25.42%), machine labour (13.52%), fertilizers (14.06%), bullock labour (3.80%), interest on working capital (3.59%), seeds (1.57%) and FYM (1.23%). The share of fixed cost in total cost of cultivation was 11.31 per cent (Rs. 4627) and 10.79 per cent (Rs. 4627) in case of IPM and non-IPM farmers, respectively. Among these fixed costs, rental value of land was having maximum share being Rs. 2975 in both the cases. The other minor fixed cost includes depreciation (Rs. 1125), interest on fixed capital (Rs. 420), irrigation charges (Rs. 100) and land revenue (Rs. 7.5). It could also be seen from the table that, the per hectare gross returns realized by IPM farmers were high (Rs. 50,225) compared to non-IPM farmers (Rs. 48,330). The net returns per hectare obtained by IPM farmers were high (Rs. 9317) than that of non-IPM farmers (Rs. 5484).

The following pattern was used in partial budget analysis.

Sl. No.	Debit	Credit
a.	Increasing in cost due to IPM	Decreasing in cost due to IPM
b.	Decrease in returns	Increasing in returns
c.	Total Debit	Total credit
d.	Net gain	

Table.1 Cost and returns structure of pigeon pea cultivation

(Rs./ha)

Sl. No.	Particulars	IPM (n=60)	Per cent	Non-IPM (n=60)	Per cent
A.	**Variable costs**				
1.	Human labour	10007	24.46	11123	25.96
2.	Bullock labour	1497	3.66	1629	3.80
3.	Machine labour	6092	14.89	5797	13.52
4.	Seeds	800	1.96	675	1.57
5.	Farm yard manure	527	1.29	530	1.2
6.	Fertilizers	6370	15.57	6027	14.06
7.	PPC	6562	16.04	10895	25.42
8.	Cost incurred on IPM components excluding PPC	2997	7.33	0	0.00
9.	Interest on working capital (@ 12%)	1425	3.48	1542	3.59
	Total variable cost (A)	**36280**	**88.69**	**38218**	**89.19**
B.	**Fixed costs**				
1.	Irrigation charge	100	0.24	100	0.23
2.	Land revenue	7.5	0.02	7.5	0.01
3.	Rental value of land	2975	7.27	2975	6.94
4.	Depreciation	1125	2.75	1125	2.62
5.	Interest on fixed capital (@ 10%)	420	1.03	420	0.98
	Total fixed costs (B)	**4627**	**11.31**	**4627**	**10.79**
C.	**Total cost of cultivation (A+B)**	**40907**	**100**	**42846**	**100**
D.	**Returns**				
1.	Total Returns	50225		48330	
2.	Net returns	9317		5484	
3.	B:C Ratio	1.23		1.13	
4.	T test	2.06			

Table.2 Resource use efficiency in the production of pigeon pea by IPM and non-IPM farmers

Sl. No.	Particulars	Parameter	IPM-farmers (n=60)		Non-IPM farmers (n=60)	
			Regression Coefficients	MVP:MFC Ratios	Regression Coefficients	MVP: MFC Ratios
1.	Intercept	A	2.03 (0.634)	-	2.49 (0.781)	-
2.	Seed	X_1	-0.003 (0.074)	-0.20	0.18*** (0.093)	13.26
3.	FYM	X_2	-0.01** (0.005)	-13.27	0.0006 (0.006)	1.13
4.	Fertilizers	X_3	-0.12* (0.031)	-1.23	-0.12*** (0.006)	-1.03
5.	Human labour	X_4	0.99* (0.185)	4.98	0.204 (0.073)	0.92
6.	Bullock labour	X_5	0.13* 90.0360	5.41	0.0008 (0.147)	0.03
7.	PPC	X_6	-0.01 (0.107)	-0.10	0.67* (0.007)	2.95
8.	R^2		0.93		0.86	
9.	Returns to scale (bi)		0.96		0.93	

*= significant at 1% probability level
**= significant at 5% probability level
***= significant at 10% probability level
Note: Figures in parentheses are standard errors.

Table.3 Partial budgeting analysis of benefits associated with IPM package of pigeon pea

(Rs./ha)

Sl. No.	Debit (Rs.)		Credit(Rs.)	
a.	Added cost due to IPM	Rs.2997	Reduced cost due to IPM	Rs.4332
b.	Reduced returns	Rs. 0	Added returns	Rs.1895
c.	Total Debit = a + b	Rs.2997	Total credit = a+ b	Rs. 6227
1.	Net gain = total debit – total credit =			Rs.3230

The average output of pigeon pea was slightly higher (9.97 q/ha) in case of IPM farmers as compared to non-IPM farmers (9.55 q/ha). There was noticeable difference in the total cost of cultivation and increased net returns realized by the IPM farmers as compared to non-IPM farmers. The B: C ratio was also high in case of IPM farmers (1.23) when compared to non-IPM farmers (1.13). The profitability of IPM practicing farmers of pigeon pea is higher as compared to the non-IPM farmers. Hence the null hypothesis is accepted. The statistical t-test is conducted to know the statistical difference between IPM and non-IPM practices. The test indicated that there was a significant difference between two cultivation practices.

The information on the family type of sample farmers indicated that, higher proportion of nuclear family type was observed in case of IPM farmers (51.67%) as compared to non-IPM farmers (35%). While, joint family type was observed more in case of non-IPM farmers (65%) than that of IPM farmers (48.33%).

Resource use efficiency in pigeon pea production among IPM and non-IPM farmers

The Cobb-Douglass production function was estimated to study the resource use efficiency and influence of inputs on pigeon pea yield and the results of the analysis are presented in Table 2.

Perusal of the table revealed that, the co-efficient of multiple determination (R^2) was found to be 0.93 and 0.86 that means 93 per cent and 86 per cent of the variation in the dependent variable is explained by the independent variables included in the model in case of IPM and non-IPM farmers, respectively.

In case of IPM farmers, the regression co-efficient for human labour (0.99) and bullock labour (0.13) were found to be positive and significant at one per cent probability level. Whereas, the regression co-efficient for seed (-0.003), FYM (-0.01), fertilizers (-0.12) and PPC (-0.01) were found negatively non-significant except for FYM and fertilizers.

Similarly, in case of non-IPM farmers the regression co-efficient for PPC (0.67) was positively significant at one per cent probability level. The regression co-efficient for seed (0.18), FYM (0.0006), human labour (0.204) and bullock labour (0.0008) were also positive but found non-significant except for seed which was significant at ten per cent level of significance. Whereas, the regression co-efficient for fertilizer (-0.12) was negative and found significant at ten per cent probability level.

In case of both IPM and non-IPM farmers the sum of regression co-efficient was less than unity, which indicated decreasing returns to scale. This unveiled that if quantity of all the inputs were increased by one per cent, the yield of pigeon pea would increase by 0.96 per cent and 0.93 per cent in case of IPM and non-IPM farmers, respectively.

It could also be seen from the table that, the MVP: MFC ratio was found negative in case of seed (-0.20), FYM (-13.27), fertilizers (-1.23) and PPC (-0.10) in case of IPM farmers which indicated the over-utilization of these resources in the pigeon pea cultivation. Whereas, the ratio for human (4.98) and bullock labours (5.41) were found positive and indicated that there is still scope to increase these resources in the pigeon pea cultivation.

In case of non-IPM farmers, the MVP: MFC ratio was negative for fertilizer (-1.03) and for human labour (0.92) and bullock labour (0.03) was found less than unity which indicated that, these three resources were over-utilized. But, the ratio for seed (13.26), FYM (1.13) and PPC (2.95) was found more than unity which indicated that these resources were underutilized.

Partial budget analysis of benefits associated with IPM package of pigeon pea

In order to know the profitability of IPM, partial budgeting analysis was carried out and the results are presented in the Table 3. The results revealed that, the added cost incurred by the IPM farmers for its adoption

was Rs. 2997 whereas, the IPM adopters gets the benefit of Rs. 4332 as a reduced costs, added returns of Rs. 1895 due to adoption of IPM. Thus, the total credit due to adoption of IPM technology was Rs. 6227 and the net gain obtained from the IPM package of pigeon pea was Rs. 3230.

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References

Anonymous, 2012, www. Indiastat. com/Agriculture.

Anonymous, 2013, www. Indiastat. com/ Agriculture.

Arora, R. and Dhaliwal, G. S., 1996, *Principle of Insect Pest Management*, Common Wealth Publishers, New Delhi (India), pp 83-89.

Fletcher, T. B., 1920, Annotated list of Indian crop pests. In: *Report of the Proceedings of the Third Entomological Meeting*, 3–15 February 1919, Pusa. Superintendent Government Printing, Calcutta, 1: 33–314

Lal, S. S., Yadava, C. P. and Chandra, S., 1985, Suppression of pod fly damage through varietal selection. *International Pigeonpea Newslett.* (ICRISAT), 5: 42-43.

Lingappa, S. and Yelshetty, S., 1994, Togarikai samagra keeta nirvahanae. *Bull Agric. Res*, Gulbarga, Univ. Agri. Sci., Dharwad, Karnataka (India), p. 21.

Yelshetty, S. and Siddegowda, D. K., 1998, Progress of Pulses Entomological Research at Gulbarga. Perspectives in Entomological Research for Sustainable Agriculture in North Karnataka. Univ. Agric. Sci., Dharwad, Karnataka (India) p. 33.