Int.J.Curr.Microbiol.App.Sci (2019) Special Issue-9: 183-193

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-9 pp. 183-193**
Journal homepage: http://www.ijcmas.com

Original Research Article

An Economic Analysis of Paddy Production in Raichur District, Karnataka, India

Mali Patil Vijay Kumar[1]* and Nahar Singh[2]

Department of Agricultural Economics & Agribusiness Management
Allahabad School of Agriculture
Sam Higginbottom Institute of Agriculture Technology & Sciences
Allahabad - 211007 (U.P.) India
**Corresponding author*

A B S T R A C T

India is the world's second largest producer and consumer of cereals including paddy. Paddy is susceptible to a large number of diseases and insect pests which cause heavy losses. The present study as analyzed the cost, returns and input-output ratio in paddy production in Raichur district, Karnataka. The share of variable cost (Cost A1) in total cost of cultivation was 62.25 per cent, 64.23 per cent and 65.53 per cent in case of small, medium and large farmers respectively. The output of paddy was slightly higher (74.87 q/ha) in case of medium respondents as compare to small (74.40 q/ha) and large (74.79 q/ha) respondents. The total cost incurred on pesticides by large respondents was high and the rate of return from pesticide use for large respondents was low compare to small and medium respondents. The variability of dependent variable was found to be 0.92, 0.88 and 0.89 that means 92 per cent, 88 per cent and 89 per cent is explained by the independent variables included in the model in case of small, medium and large farmers respectively. In case of Marginal value product (MVP) and Marginal factor cost (MFC) the ratio of pesticide is positive in medium farmers (0.49) and other groups were negative i.e for small (-1.05) and large (-0.01) farmers.

Keywords

Paddy, Cost, Returns and input-output ratio

Introduction

India has the largest area under the rice accounting for 28.5 per cent of the global rice and India produce 22% of world production. Rice is India's pre-eminent crop, and it is the staple food of the people of the eastern and southern parts of the country. In India, the major paddy growing states are Uttar Pradesh, West Bengal, Orrisa, Chattisgarh, Andra pradesh and Karnataka, In Production wise West Bengal, Andra pradesh, Uttar Pradesh and Karnataka (Anon., 2013). Karnataka is one of the major paddy growing states in India. It was grown on an area of 13.40 lakh ha with an annual production of 40.53 lakh tonnes and the average yield of paddy is around 3103 kg/ha during 2013-14 (*DES Bangalore-2013-14*). The major paddy growing districts in Karnataka are, Raichur, Ballari, Haveri, Uttar Kannada, Dharwad, Koppal, Mysore, Hassan, and Chitradurga. Paddy in the state is grown under different agro-climatic (upland, low land and rain fed) conditions. In Raichur district comprising area 1, 78,356 ha, production 5,72,963 tones and yield was 3,377 kg/ha (DES Bangalore-2013-14).

The crop is damaged by more than 100 species of insect pests of which about dozen are of significance. The state loses 30 per

cent yield every year on this account. However, out of all inputs, pesticides play key role in increasing agriculture production by controlling agriculture pests and diseases. It has been observed that about on third of reliable global output is estimated to be lost due to insect pests, disease and weeds. In India, the value of crop lost due to pest was estimated at Rs.6, 000 crores in 1983 (Atwal, 1986), which reported to have further increased to Rs.29, 000 crores in early 1990's (Dhaliwal and Arora, 1996). The agrochemical policy group, apex body of 200 crop protection companies has said agriculture produce lost in 2007 due to pest was estimated at Rs.1.40 lakh crores (Kumarswamy, 2008).

Materials and Methods

The present study attempted to analyze the economics of cost, returns and input-output ratio in use of pesticides in Paddy. Paddy is predominantly grown in Raichur district. The area under Paddy in Raichur district is 1, 78,356 hectare (2014). The Pesticide use in study area is more hence, Raichur in Karnataka state is purposively selected for the study. The soil of district is Medium Black, Deep Black, Mixed Red and Black cotton soils suitable for agriculture and horticulture crops. The climate of the district is very hot and dry. The district consists of five talukas viz., Sindhanur, Manvi, Raichur, Lingasugur and Devdurga, in that two talukas were selected viz., Sindhanur and Manvi talukas. From each selected village, small, marginal and big farmers were randomly selected for the study. Thus the total sample constitutes 125 paddy farmers from nine villages of two talukas in Raichur district.

Tabular analysis

The data was summarized in the form of appropriate tables. The technique of tabular presentation was used to assess the cost, returns, input-output and profits from paddy crop cultivation in the study area. The percentages and averages were computed and compared to draw meaningful inference.

Production function analysis

The Cobb-Douglas (CD) production function was used to study the resource use efficiency and influence of inputs on paddy yield in Raichur district. The production function of the following type was specified in the present study.

a_1 a_2 a_3 a_4
$Y = A\ X_1\ X_2\ X_3\ X_4\ e^u$
Where,
Y= Gross income from paddy (Rs.\ha)
X_1= Expenditure on Seeds (Rs.\ha)
X_2 = Expenditure on Fertilizers and Manures (Rs.\ha)
X_3 = Expenditure on Pesticides used (Rs.\ha)
X_4 = Expenditure on labour (Rs.\ha)
A= constant
a_i= production elasticities
e^u = random error.

Since one of the objective of the study was to optimum quantity of pesticide use, PPC variable was measured in physical value while others are measured in monetary values. The above function was converted into the linear form through logarithmic transformation of all variables and is written as

$\text{Log } Y = \log A + a_1 \log X_1 + a_2 \log X_2 + a_3 \log X_3 + a_4 \log X_4 + \log u.$

The marginal value products for each inputs were calculated at the geometric mean levels of the respective resources by using formula,

$$\text{Marginal value product of } X_i = ai\ \frac{\overline{Y}}{\overline{X}}$$

Where,

Y = geometric mean of gross income
X_i = geometric mean of i^{th} resource
a_i = production elasticity of i^{th} resource

The marginal value product was compared with the marginal factor cost to arrive at optimal use of the resources. To determine the optimum quantity of pesticide use, under the assumption of profit maximization behavior, the following relationship was estimated. The marginal physical product (MPP) of pesticides was equated to the price ratio of the pesticide and paddy.

$MPP=(dy\backslash dx) = P_p\backslash P_y$
i.e. $a_3 (Y\backslash X) = P_p\backslash P_y$
$X^* = (b_3. Y. P_y)\backslash P_p$

Where,
X^* = optimum quantity of pesticides
a_3 = production elasticity of pesticides
MPP = marginal physical product of pesticides
P_p = unit price of pesticides (Rs\lit. a.i)
P_y = farm gate price of the paddy (Rs\kg)

The rate of returns from pesticide use in the paddy was computed by using formula as suggested Nguyen and Tran Thi, 2003. The rate of return was estimated as the ratio of (Returns – total cost other than pesticides)/ total pesticide cost.

Results and Discussion

Cost and returns from paddy cultivation

The cost incurred and returns realized from paddy cultivation and their total cost and returns were calculated and presented in Table 1. Among the three categories of respondents the total cost incurred by the large respondents were high (Rs. 1, 09,345.37/ha) as compared to small (Rs.1, 80,007.72/ha) and medium respondents (Rs. 1, 09,202.69/ha). The share of variable cost was 63.06 per cent and that of fixed cost was 36.94 per cent. Labour expense was the major component of variable cost while rental value of land was major the fixed cost.

It was noticed that the expenditure on pesticide was highest (Rs. 7,393.28/ha) for large respondents as compared to small and medium respondents. The per hectare average pesticide expenditure was Rs. 6,930.47 and the pesticide expenditure increased with the increase in farm size. The study conducted by Raghuvanshi *et al.,* (1999) on wheat also revealed similar results.

The pesticide shared 6.11 per cent of the total cost of cultivation in paddy. Tripathi (1999) noticed that the gross income received by larger farmers was more compared to others in cabbage cultivation in Tehri district of Uttar Pradesh. He noticed that the pesticide expenditure was 6.43 per cent of the total cost. Subba Rao *et al.,* (1987) indicated that in the cotton growing region of Guntur districts of Andhra Pradesh, the pesticide expenditure was 20 per cent to 25 per cent of the total cost.

Birthal *et al.,* (2000) reported that farmers spent 29 per cent of total cost on pesticides in cotton crop. Engindeniz (2006) reported that the cost of pesticide and pesticide application were 11.72 per cent of total variable cost in cucumber. Thus, these studies indicated the share of pesticides in the total cost of cultivation was in the range of 6 per cent to 29 per cent.

The gross returns obtained per hectare by large respondents were high (Rs.1,32,637.75/ha) as compared to small and medium respondents (Rs. 1, 31,990.00/ha and Rs. 1, 32,463.25/ha respectively) presented in Table 2. The cost and returns structure did not very substantially across different categories of respondents. Different

categories of respondents were practicing almost similar cultivation methods and thus could be the reason for this.

The net returns per hectare obtained by small respondents were high (Rs. 23,982.28/ha) as compared to that of medium and large respondents (Rs. 23,260.56/ha and Rs. 23,292.38/ha respectively). It indicated that the net return realized was higher for small respondents as they spent slightly less on bullock labour compared to medium and large respondents.

Cost and returns with reference to pesticide use

The cost incurred and returns realized from pesticide use were calculated and presented in Table 3. Among the three categories of respondents the total cost incurred on pesticides by large respondents was the high cost (Rs.7,393.28/ha) as compared to small (Rs.6,715.07/ha) and medium respondents (Rs.6,855.55/ha). On an average the expenditure on pesticides for all famers worked out to Rs. 6,987.97 per hectare.

The rate of return from pesticide use was computed by using formula as suggested by the Nguyen and Tran Thi (2003). Table 3 revealed that the rate of return from pesticide use for large respondents was low compared to other respondents. This was because of the excessive and uneconomical pesticide use by these respondents as compared to small and medium respondents. The large respondents because of easy access to funds and in the anxiety to get better yields appeared to spend slightly more on PPC. The rate of return from pesticide use was the highest for small respondents (4.57).

Resource use efficiency in paddy

The Cobb- Douglass production function was estimated to analyze relationship between resource and productivity of paddy using survey data from sample respondents. The gross income in rupees realized from paddy output was taken as dependent variable while expenditure made on seed (Rs), fertilizers and manures (Rs), laboures (Rs) and pesticide (Rs) were taken as independent variables. The estimated of the production functions are presented in Table 4. The inputs included in model explained 92 per cent (small respondents), 88 per cent (medium respondents), 89 per cent (large respondents) and 86 per cent (all respondents) of variation in paddy output as revealed by the coefficient of multiple determinations (R^2). The summation of regression coefficients indicated decreasing returns to scale *i.e.* for each incremental use of all inputs simultaneously respondents would get less than one unit of output for all categories of respondents.

The elasticity co-efficient of all respondents for pesticides and labour was 0.085 and 0.142 at the all respondents. This indicated that one per cent increase in expenditure on labour and pesticides would result in increasing the gross income by 0.142 and 0.085 per cent respectively. It was observed that the net income of sample respondents would increase with increased use of labour. The pesticides is considered as yield increasing input, by controlling insect pests the possibility of reducing the yield loss would increase and the gross income of the respondents would also increase.

The elasticity coefficients of all respondents for fertilizers (-0.092) and seeds (0.019) were negative suggesting that one per cent increase in expenditure on fertilizers and positive in seeds would result in decrease of gross income by 0.092 and increasing 0.019 per cent respectively. In study area respondents are in the habit of applying excess fertilizers. This would result in growth of plant as fleshy and greenly. This in turn attracts more insect

and pests and leads to crop loss and finally reduces gross income.

The above results were in concurrence with the results obtained in the cotton respondents of Guntur district of Andhra Pradesh in a study by Eswaraprasad *et al.,* (1988) and Pandurangudu (1988) for the pesticides, fertilizer and manures and labour. The study conducted by Nagaraj *et al.,* (1994) in Tungabhadra command area also revealed similar result with respect to PPCs in cotton. However, Prabhu (1985) criticized the production function approach for estimating the marginal productivity and optimum quantity of pesticides use since the plant protection chemicals could not be compared with the yield increasing inputs such as fertilizers and manures which appeared to be lacuna of production function approach.

Marginal value product to marginal factor cost

The production elasticity coefficients were used for the estimation of marginal value products of the resources. The Cobb-Douglas function coefficients and geometric mean level of inputs and outputs were used to estimate the marginal value products. The knowledge of the marginal returns of resources is useful because it indicates economic optimal level of resources to be used. The producers by comparing marginal value products with the marginal factor costs can decide optimal use of resources. Maximum efficiency of resources occurs when the ratio of marginal value product to marginal factor cost is one.

It was evident from Table 5 that the ratio of marginal value product and marginal factor cost were positive and more than unity for labour (2.85) small holdings (underutilized) and another three resources were negative i.e for seeds (-9.54), fertilizer (-5.84) and pesticides (-1.05) all categories of respondents indicating that the resource was over utilized and there is no/less scope for getting higher returns by increasing the use of the resource.

In case of medium respondents fertilizer, pesticides and labour less utilized hence there is a more scope for utilized but vice versa in case of larger respondents all inputs i.e variable inputs like seeds (-5.16), fertilizers(-8.23), pesticides (-0.01), labour(-0.05) therefore utilization of resources over utilized there was no scope for using these factors.

The ratio for fertilizer was negative implying that respondents could maximize their profit by using lesser quantities of fertilizers. In fact they are using more than recommended dose (874.5 kg/ha), where the recommended dose of fertilizers was 320 kg per hectare.

The above results were in conformity with results obtained by Eswarprasad *et al.,* (1988) and Pandurangadu (1988) for the fertilizers. Similar results were noticed for labour also. The marginal value productivity of labour was negative and the elasticity of production was less than zero. Thus the labour use was uneconomical in the study area.

In conclusion, the PPC cost appeared to increase with increase in size of holdings. Though the rate of return on pesticides was more than five in all the cases, it should not be based on inferred that the respondents should spent more on PPCs. The decision to spend on PPC must be economic threshold of pests infestation.

The respondents need be educated with respect to various issues of pesticides. The analysis of production elasticities indicate the extent of change in output for every per unit increase or decrease in the use of resources.

Table.1 Cost of paddy cultivation in different farm groups

Sl.No	Particulars	Unit	Small		Medium		Large		ALL	
			Phy. Units	Value (Rs)	Phy. Units	Value (Rs)	Phy. Units	Value (Rs)	Phy. Units	Value (Rs)
1	Hired labour	Man days	81.41	20739.20 19.20	90.45	23042.14 21.10	90.14	22963.165 21.00	86.61	22064.53 20.29
2	Bullock labour	Pair days	1.13	282.81 0.26	1.38	343.75 0.31	1.64	409.38 0.37	1.34	334.66 0.31
3	Machine Labour	Hr	21.24	13020.00 12.05	21.26	13025 11.93	21.3	13103.13 11.98	21.26	13042.30 11.99
4	Cost of seed	Kgs	62.38	1783.93 1.65	62.5	1787.5 1.64	62.5	1787.5 1.63	62.45	1786.01 1.64
5	FYM	Tones	4.27	1707.50 1.58	4	1600 1.47	3.58	1432.5 1.31	4.01	1603.18 1.47
6	Fertilizer		570.00	17965.63	570.00	17965.63	570.00	17965.63	570.00	17965.63
i	N	Kg	292.5	7812.50 7.23	292.5	7812.50 7.15	292.5	7812.50 7.14	292.50	7812.50 7.18
Ii	P	Kg	215.00	7562.50 7.00	215.00	7562.50 6.93	215.00	7562.50 6.92	215.00	7562.50 6.95
iii	K	Kg	37.50	1087.50 1.01	37.50	1087.50 1.00	37.50	1087.50 0.99	37.50	1087.50 1.00
iv	Zn	Kg	25.00	1503.13 1.39	25.00	1503.13 1.38	25.00	1503.13 1.37	25.00	1503.13 1.38
7	PPC's		7.88	6715.08	8.04	6855.55	8.67	7393.28	8.13	6930.47
I	Dust	Kg	2.56	1982.56 1.84	2.55	1972.88 1.81	2.76	2132.46 1.95	2.61	2016.48 1.85
ii	Liquid	Lit	5.32	4732.52 4.38	5.49	4882.67 4.47	5.91	5260.82 4.81	5.52	4913.99 4.52

8	**Irrigation charges**			237.00 0.22		237.00 0.22		237.00 0.22		237.00 0.22
9	**Int on working capital**			4074.15 3.77		4131.86 3.78		4074.65 3.73		4093.67 3.76
10	**Depi charges**			650.00 0.60		1087.50 1.00		2225 2.03		1187.60 1.09
11	**Land Revenue and Tax**			62.00 0.06		62.00 0.06		62.00 0.06		62.00 0.06
Cost A1 (item no. 1 to 11)				67237.30 62.25		70137.93 64.23		71653.24 65.53		69307.07 63.74
12	**Rent paid for leased land**			32343.75		32343.75		32343.75		32343.75
Cost A2 (item no. 1 to 12)				99581.05		102481.68		103996.99		101650.82
13	**Int on Fixed capital**			2975.02 2.75		3014.39 2.76		3116.77 2.85		3023.40 2.78
14	**Rental value of own land**			32343.75 29.95		32343.75 29.62		32343.75 29.58		32343.75 29.74
Cost B (Cost A1+13+14)				102556.07 94.95		105496.08 96.61		107113.76 97.96		104674.22 96.26
15	**Family labour**	**Man days**	21.40	5451.65 5.05	14.55	3706.61 3.39	8.76	2231.61 2.04	15.96	4066.74 3.74
Cost C (Cost B+15) / Total cost				108007.72 100.00		109202.69 100.00		109345.37 100.00		108740.97 100.00

Note: Figures in parenthesis are percentages to the total cost

Table.2 Per hectare wise major of cost concept, yield and farm profitability of paddy in different size farm groups

Sl.No	Particulars	Small	Medium	Large	ALL
1	**Yield of Paddy in quintal**				
I	**Main product in quintal**	74.40	74.87	74.79	74.65
Ii	**By product in quintal**	73.00	66.25	72.50	70.61
2	**Price per quintal**				
I	**Price per quintal of main product**	1725.00	1725.00	1725.00	1725.00
Ii	**Price per quintal of by product**	50.00	50.00	50.00	50.00
3	**Gross Return of Paddy**				
I	**Value of Main product in Rs**	128340.00	129150.75	129012.75	128779.25
Ii	**Value of By product in Rs**	3650.00	3312.50	3625.00	3530.40
Iii	**Gross income in Rs** (Income of main products + by products	131990.00	132463.25	132637.75	132309.65
4	**Measure of cost concepts (value in Rs)**				
I	**Cost A_1**	67237.30	70137.93	71653.24	69307.066
Ii	**Cost A_2**	99581.05	102481.68	103996.99	101650.82
Iii	**Cost B**	102556.07	105496.08	107113.76	104674.22
Iv	**Cost C**	108007.72	109202.69	109345.37	108740.97
6	**Measure of farm profitability (value in Rs)**				
I	**Gross Income**	131990.00	132463.25	132637.75	132309.65
Ii	**Farm Business Income** (Gross income - Cost A_2)	32408.95	29981.57	28640.76	30658.84
Iii	**Net Income** (Gross income - Cost C)	23982.28	23260.56	23292.38	23568.69
Iv	**Farm Investment Income** (Net income + Rental value of own Land + Interest on fixed capital)	59301.05	58618.70	58752.90	58935.84
V	**Family Labour Income** (Gross income - Cost B)	29433.93	26967.17	25523.99	27635.44
Vi	**Cost Benefit Ratio** (Gross Income / Cost C)	1.222	1.213	1.213	1.217

Table.3 Cost and returns with reference to pesticide use

Respondents	Cost (Rs)	Rate of Return (Rs)
Small (n=52)	**6715.07**	**4.57**
Medium (n=42)	**6855.55**	**4.39**
Large (n=31)	**7393.28**	**4.15**
All (n=125)	**6930.47**	**4.37**

Note: Rate of return to pesticides = (Return - all costs other than pesticides)/total pesticide cost (Nguyen and Tran Thi, 2003)

Table.4 Resource use efficiency for paddy production

Sl. No.	Explanatory variable	Small (n=52)	Medium (n=42)	Large (n=31)	All (n=125)
	Intercept	13.095* (17.240)	0.594 (5.463)	20.889** (2.564)	9.876** (1.488)
1	Expenditure on Seeds (Rs)	-0.129* (0.119)	-0.217** (0.118)	-0.069* (0.064)	0.019 (0.060)
2	Expenditure on Fertilizers (Rs)	-0.794 (2.037)	1.013** (0.581)	-1.111** (0.300)	-0.092 (0.153)
3	Expenditure on Pesticide (Rs)	-0.053* (0.055)	0.025 (0.112)	-0.001 (0.043)	0.085** (0.013)
4	Expenditure on Labour (Rs)	0.564** (0.243)	-0.103* (0.118)	-0.010 (0.059)	0.142** (0.035)
	R^2	0.92	0.88	0.89	0.86
	Adjusted R^2	0.88	0.84	0.84	0.80
	'F' value	75.69	53.48	20.77	104.34
	∑bi	-0.270	1.096	-1.107	0.084

Note: Figures in parentheses are standard errors
*denotes significance at 5%
** denotes significance at 1%

Table.5 Ratio of marginal value product to the marginal factor cost in paddy production

Sl. No.	Resources	Respondents			
		Small	Medium	Large	All
		MPV/MFC	MPV/MFC	MPV/MFC	MPV/MFC
1	Seeds (Rs)	-9.54	-16.13	-5.16	1.37
2	Fertilizer	-5.84	7.50	-8.23	-1.03
3	Pesticides (Rs)	-1.05	0.49	-0.01	0.16
4	Labour (Rs)	2.85	0.50	-0.05	0.71

The scope for re-organization of the resources was also indicated by the production elasticities.

In case of all respondents the ratio of marginal value product to the marginal factor cost was more than one for seeds. This implied that further increased use of this resource would bring higher returns. The scope for enhancing profit by increased use of seeds was evident from the analysis. The ratio was found to be less than one for plant protection chemicals, labour and fertilizers revealing that these resources were used more than optimally. The respondents in the study area were found to use PPC more than optimality level. This supported the hypothesis that the respondents in the study area using the pesticides indiscriminately which needs immediate attention by technocrats to avoid possible wastage of resources and reduce the environmental damage by excessive pesticide use.

References

Agri Business Export Knowledge Center, UAS Dharwad, 2012-2013.

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

Anonymous, 2014, www Indiastat.com/Agriculture.

Atwal, S. S., 1986, Future of pesticides in plant protection in G. S. Venkataraman (Ed) 1986, plant protection in the year 2000 AD. Indian National Sci. Acad., New Delhi.

Birthal Pratap S., Sharma, D. P. and Santhkumar, 2000, Economics of integrated pest management: evidence and issues. Indian J. Agric. Econ., 55: 10-15.

Commodity Profile for Rice – December 2014.

Dhaliwal, G. S. and Arora, R., 1996, Principle of insect pest management. Common Wealth Publishers, New Delhi.

Directorate of Economics and statistics (DES) Bangalore.

District Statistical Office (DSO) Raichur.

Engindeniz, S. and Engindeniz, D. Y., 2006, Economic analysis of pesticide use on greenhouse cucumber growing: a case study for Turkey. J. Plant Diseases Protect., 113 (5): 193-198.

Eswaraprasad, Y., Srirama Murthy, C., Satynarayana, G., Chennorayadut, K. V. and Llitha Achoth, 1988, An econometric analysis of cotton production in Guntur district of Andra Pradesh. Margin, 21 (1): 79-86.

Kumarasamy, S., 2008, Crop loss due to pest attack pegged at Rs.1.40 lakh crores. 33 (4):73-74.

Nagaraju, T., Khan, H. S. S. and Vijaykumar, H. S., 1994, Resource use efficiency in hybrid cotton in different locations in the Tungabadra command area. Agric. Econ. Rev., 7 (1): 56-62.

Nguyen Huu Dung and Tran Thi Thanh

Dung, 2003, The economic and health consequences of pesticide use in paddy production In the Mekong, Vietnam, http://203.116.43.77/ publications/research1/ACF124.html.

Pandurangadu, K., 1988, Economics of pesticide use in major commercial crops of Guntur district of Andhra Pradesh. M. Sc. (Agri). Thesis, ANGARU. Hyderabad.

Prabhu, S. K., 1985, the treatment of pesticides production function frame work: A skeptical note. Indian J. Agric. Econ., 38: 585-590.

Subbarao, D. V., Chowdry, K. R and Venkata Reddy, C. G., 1987, Degradation of agro-ecosystem- An explainatory study on cotton farming. Indian J. Agric. Econ., 42 (3): 410-411.

Tripathi, R. S., 1999, Economics of cabbage production in high- hills of Uttar Pradesh. Indian J. Hort., 56 (4): 343-347,