J Krishi Vigyan 2017, 6(1) : 1-9 DOI : 10.5958/2349-4433.2017.00039.3

Adoption Level of Recommended Agricultural Practices by Punjab Farmers

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ABSTRACT

Punjab is predominately an agrarian state and largest contributor of food grains to the central pool. In current scenario, though we have achieved great success in agricultural production and productivity and became not only self reliant but rather surplus producer of many agricultural commodities, but at the same time, we are facing a sort of crisis on many fronts. The rising cost of cultivation, stagnating yields, dwindling underground water reserves, pest resistance, resurgence of new weeds etc. are some of the concerns. To counter balance these issues farmers in the state were resorting to higher doses of nutrients, pesticides, irrigations etc. than the recommended levels. Then there are certain practices regarding residue disposal, seed treatment, soil testing etc. which also have a bearing on sustainability of state agriculture. It was found that though having good farming experience and education level, farmers of the state were not sticking to the recommended practices and resource use levels. Some constraints were cited by the sampled farmers regarding this aspect. These included higher doses of fertilizers and number of irrigations to enhance the productivity, spurious quality of pesticides leading to higher doses, stubble burning due to lack of viable alternative and low awareness about recommendation of soil testing etc. So it was found that farmers equipped with education and expertise in farming were by and large aware about the issues concerning agricultural development, but the constraints emerging mainly due to on-going mono-culture in agricultural production were posing a threat to sustainable growth in the state.

Key Words: Adoption, Agricultural practices, Irrigation, Paddy, Pesticides, Variety, Wheat

INTRODUCTION

In developing nations like India, agriculture still holds the key to reducing poverty and increasing the security of livelihoods. Human resource is one of most important inputs for development of agricultural and allied sectors. Agriculture being the backbone of Indian economy, the human resource needs to undertake various activities related to agricultural development which is critical to attain country's goals towards rural development, employment generation and host of related fields leading to sustainable growth. Indian agricultural sector has shown spectacular achievement from deficit to surplus since the inception of 'Green Revolution'. However, over the years, the scenario has changed. The growth in agriculture sector has slowed down and the job opportunities have declined in wake of mechanization leading to increased unemployment. To deal with these issues, the importance of training cannot be underestimated. The skills to improve productivity, increase adaptability to deal with change and crisis, and facilitate the diversification of livelihoods to manage risks are at a premium in rural areas (Collette and Gale, 2009). Providing these skills effectively is one of the key challenges of rural development.

Punjab agriculture has made tremendous achievement, due to its human resource who could harness the rapid developments in science and technology. No one can undermine the enthusiasm of the state's zesty farming community in adoption of new technologies. The growth achieved by the

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state agriculture in sustaining food security of the nation and various activities related to agricultural development can be attributed to the concerted efforts of available skilled human force.

Some concerns have emerged in the state agriculture in the last two decades or so, in terms of depleting natural resources in wake of intensive agriculture like stagnating yields, rising costs and shrinking profit margins, high indebtedness of farmers leading to suicides. So, there is urgent need to sustain the livelihood of rural masses especially the marginal and small famers of the state.

Human activities have always had significant impact on the environment. It is a paradoxical situation that the very development achieved by man in different fields that led to his welfare, now poses threat to present and future generations (Nagarajan and Nagarajan, 2000). With the market forces at the helm of affairs, the demand for natural resources and environmental services to support resource intensive development has grown infinitely (Sengupta, 2001). This issue has gained importance in the present context as many natural resources, which were once regarded as free goods, have now become scarce resources on one hand and on the other; there is immediate need to prevent depletion/degradation of these resources to make the sustainable growth feasible. Therefore, the present study was undertaken to study the awareness as well as adoption level of recommended agricultural practices by Punjab farmers.

MATERIALS AND METHODS

The study is based on primary data collected from farm households of randomly selected 10 blocks from three agri-economic zones viz. sub–mountainous zone (Zone I), central plain zone (zone II) and south western zone (zone III) of the state. At second stage of sampling, two villages from each selected block and 25 farm households from each village were selected. Based on size of the operational holding, farmers were classified into three categories i.e. small, medium and large. Thus, the ultimate sample consisted of 495 farm households in proportion to the size holding structure existing in that particular village. The data were collected about inputs use pattern including fertilizers, pesticides, irrigations, soil testing practice, seed treatment etc. from selected sample of farm households across the state through especially structured and pre-tested questionnaire using personal interview method. Awareness along with adoption was sought regarding various agricultural practices as well as the constraints faced by farmers in following the recommended practices. Statistical techniques like percentage, average etc. were worked out for the variables.

RESULTS AND DISCUSSION

Educational status

Education plays an important role in determining the socio-economic status and level of awareness of the respondents. As far as this knowledge parameter was concerned, majority of the farmers i.e. 51.21 per cent in the study were found to be matriculates and 17.37 per cent were illiterate (Table1), where as 14.17 per cent farmers have studied beyond matriculation but were under graduates followed by 10.12 per cent who have acquired education up to primary level. Further, 7.08 percent were graduates and above. Statistical analysis has shown that large farmers were more educated may be due to their sound financial status. Education and size of holding were found to be directly related to each other. Sampled farmers of zone III were found to be significantly less educated than farmers of zone II and zone I, respectively.

Farming Experience

It was found that average experience of the sampled farmers in state was 27.47 yr. in agriculture production (Table 2). In zone I, 65 per cent of the farmers were having farming experience of more than 25 yr. followed by 58 per cent in zone II and 50 per cent in zone III in the state. The measure of variability showed that variation was more in zone III. Medium farmers were found to be more

Table1. Educational status of sampled farmers (zone wise and category wise). (Number)

Zone	I				II				III				State	
Category	Small	Medium	Large	Total (%)	Small	Medium	Large	Total (%)	Small	Medium	Large	Total (%)	Total Punjab	%age
Illiterate	3	1	1	10.87	24	12	12	16.11	11	12	10	21.85	86	17.37
Upto Primary	5	0	0	10.87	17	8	8	11.07	4	4	4	7.95	50	10.10
>5" upto Matric	17	8	5	65.22	61	32	38	43.96	42	22	29	61.59	254	51.31
>10" and under graduation	2	0	2	8.69	22	18	17	19.13	4	0	5	5.96	70	14.14
Graduation and above	0	0	2	4.35	8	6	15	9.73	2	1	1	2.65	35	7.08
Total	27	9	10	100	132	76	90	100	63	39	49	100	495	100

experienced than others as they were also older in age as compared to small and large farm categories.

Table 2. Average farming experience of the respondent's zone wise and category wise

(Year)

Zone	Category	Average	S.D	C.V
I	Small	30.66	15.96	52.07
	Medium	30.33	15.83	52.20
	Large	28.00	18.04	64.43
II	Small	26.76	15.93	59.53
	Medium	28.78	15.18	52.73
	Large	29.41	16.79	52.11
III	Small	23.41	14.39	61.49
	Medium	29.20	13.47	46.14
	Large	24.22	13.13	54.21
	I	30.02	16.06	53.52
State	II	28.08	16.00	56.99
	III	25.17	13.88	55.15

Important resources and practices followed

Soil type

It is the basic requirement for most of human or natural activities and is also the major resource available on earth as a bounty. Primary activities like agriculture depend only on the availability and suitability of land. Land of Punjab is mainly formed of the alluvium deposited by rivers of Indus system. It varies widely across the state. The agricultural production depends on the soil texture and composition of the soil of that particular region.

In Punjab, paddy is grown over wide range of soil with pH varying from 5.0 to 9.5 and texturally varying from sandy loam to clay loams. Silty to clayey loam soils with low permeability, free of sodicity and water logging are considered best for paddy cultivation. Majority of the soils are deficient in nitrogen, 52 per cent medium to high, in available phosphorus and 90 per cent medium to high in available potassium. Micronutrients such as iron, zinc, sulphur and manganese are becoming critical due to intensive cultivation.

Soil testing

The profitable combination of rice-wheat crops has led to higher doses of inputs like chemical fertilizers and pesticides. Excessive use of these chemicals, mechanical operations, lesser use of farm compost as well as non-cycling of crop residues in the soil has created deficiencies of nutrients in the soil. Shukla *et al* (2014) has reported that in Punjab, 16.6, 6.2, 3.6 and 15.2 per cent soil samples were found deficient in zinc, ferrous, copper and manganese, respectively. Similarly, Singh *et al* (2016) reported that organic carbon (OC) status of majority of soil samples analysed ranged between low to medium in district Kapurthala which falls under zone II. The Punjab soils were already having low organic carbon content, which has further declined. Thus soil testing becomes important to supervise the indiscriminate application of chemical fertilizers and pesticides. The data (Table 3) showed that from the total sampled farmers across the zones, only 23 per cent farmers got their soil tested at some point of time. Zone I showed highest proportion (33%) followed by zone II (22%) and zone III (22%), farmers responded in positive for undertaking soil testing. Category-wise, it was found that 30 per cent of the medium farmers, 27 per cent of large farmers and 17 per cent of small farmers have reported to get the soil tested.

Table 3. Soil testing undertaken by farmers' zone wise and category wise

(Number)

Zone	Small	Medium	Large	State
I	7 (25.92)	4 (44.44)	4 (40.00)	15 (32.60)
II	19 (14.39)	24 (31.57)	24 (26.66)	67 (22.48)
III	12 (19.04)	9 (23.07)	12 (24.48)	33 (21.85)
State	38 (17.11)	37 (29.83)	40 (26.84)	115 (23.23)

Figures in parenthesis indicate the percentage to total

Seed treatment

It is a recommended practice to undertake seed treatment with application of fungicides and insecticides to control the seed born diseases of the crop. Out of total sampled farmers (Table 4), about 96 per cent reported following this practice. In zone I, 98 per cent of the farmers, 96 per cent in zone II and 94 per cent in zone III were found to be following this practice. It was found that the cost of the practice was not much, but prevention of suspected diseases can go a long way with this treatment. Category wise, 92 per cent of the small farmers had undertaken the seed treatment, where as about 98 per cent of the medium and large farmers have gone with it while sowing the crops. The small farmers were found to be less concerned about this practice as compared to medium and large farmers probably due to the expenses involved in the activity.

Table 4. Seed treatment undertaken by sampled farmers zone wise and category wise (Number)

Zone	Small	Medium	Large	Total
I	26 (96.29)	9 (100)	10 (100)	45 (97.82)
II	125 (94.69)	73 (96.05)	89 (98.88)	287 (96.3)
III	56 (88.88)	39 (100)	48 (97.95)	143 (94.7)
State	207 (92.34)	121 (97.58)	147 (98.65)	475 (95.95)

Figures in parenthesis indicate the percentage to total

Fertilizer Use

Intensive cultivation in the wake of increased cropping intensity in state agriculture puts stress on soil fertility. The natural capacity of the soil to produce gets depleted with nutrients being extracted from it. The soil has to be replenished continuously to maintain its fertility level. With decline in practices like keeping fallow land, diversified crop rotations, less availability of organic matter, the dependence has increased on chemical fertilizers in the growth of state agriculture. To overcome the nutrient deficiencies caused by intensive agriculture, the use of chemical fertilizers has increased in the state over time. Per hectare use of NPK was 762 thousand tons in 1980-1981 which has increased to 2270 thousand tons in 2015-2016. Judicious application of fertilizers fulfils the nutrient requirement of the crops but overuse of it could result in degradation of soil, water and crop quality. Punjab has emerged as highest user of fertilizers per hectare of cropped area in the country. This not only adds to the cost

of cultivation thus squeezing the profit margins, but also creates stress on environment.

The farmers were enquired about the doses of fertilizers used for the crops. In zone I, 77 percent each of small and medium farmers and 70 per cent of large farmers were found to be using recommended doses of fertilizers (Table 5). In all 76 per cent of the total sampled farms were using recommended levels of fertilizers. In zone II, 22.7 per cent of small farms, 9.21 per cent of medium farms and about 8 per cent of large farms were using the fertilizers as per the recommended levels. So, only 14.76 per cent of the sampled farms were adding the fertilizers as per package of practices in this zone. In zone III i.e. cotton belt of the state, 40 per cent of small farmers, about 8 per cent of medium farms and 16 per cent of large farmers were applying fertilizers doses as per recommended levels. So, in this zone 33 per cent of sampled households were using recommended doses of fertilizers. For the state as a whole, 34 per cent of small farms, 13.7 per cent of medium farms and 14.8 per cent of large farms were found to be using recommended fertilizers levels and overall 23 per cent of the farms in state were at this level.

Thus, it was evident that farmers in sub-mountainous zone (zone I) were using fertilizers according to recommendation, followed by zone III and lastly by zone II. Zone II is the central plain zone, where farmers were using higher fertilizers than the recommended package of practices. Manan *et al* (2016) reported that in Kapurthala, 63 per cent of farmers were adding higher quantity of phosphatic fertilizer (DAP) than the recommended dose in growing spring maize. Further, Manan *et al* (2015) also reported that adoption of cultivation practices such as application of urea fertilizer at the time of sowing and recommended dose of di-ammonium phosphate fertilizer by the farmers was 19.0 and 38.4 per cent, respectively in wheat crop.

It was also noticed that category-wise, small farmers were using fertilizers more optimally than medium and large farmers in the state. The scenario was found to be same in all the zones. The reason could be the financial constraint of the small farmers which is limiting them to the recommended doses of fertilizers for crop cultivation.

Table 5. Use of recommended fertilizers zone wise and category wise (Number)

Zone	Small	Medium	Large	Total
I	21 (77.7)	7 (77.7)	7 (70.0)	35 (76.08)
II	30(22.7)	7 (9.21)	7 (7.8)	44 (14.76)
II	25 (39.7)	3 (7.7)	8 (16.3)	36 (33.29)
Total	76 (34.23)	17 (13.70)	22 (14.76)	115(23.23)

Figures in parenthesis indicate the percentage to total.

Table 6. Varieties of Paddy and other Kharif crops grown by sampled farmers zone wise and category wise. (Number)

Zone	Particulars	Paddy				Other kharif crops			
		Small	Medium	Large	Total	Small	Medium	Large	Total
I	Recommended	0 (0)	0 (0)	1 (10)	1 (2.17)	0 (0)	0 (0)	0 (0)	0 (0)
	Non-Recommended	7 (25.93)	5 (55.56)	4 (40.0)	16 (34.78)	26 (96.3)	9 (100)	10 (100)	45 (97.83)
II	Recommended	16 (12.12)	23 (30.26)	14 (15.56)	53 (17.78)	5 (3.78)	6 (7.89)	22 (24.44)	33 (11.07)
	Non-Recommended	97 (73.48)	66 (86.84)	69 (76.67)	232 (77.85)	13 (9.84)	3 (3.94)	11 (12.22)	27 (9.06)
III	Recommended	18 (28.57)	9 (23.08)	27 (69.23)	54 (35.76)	9 (14.29)	6 (15.38)	17 (34.69)	32 (21.19)
	Non-Recommended	15 (23.81)	17 (43.59)	19 (48.72)	51 (33.77)	27 (42.86)	20 (51.28)	29 (59.18)	76 (50.33)

Figures in parenthesis indicate the percentage to total.

Table 7. Varieties grown of wheat crop by sampled farmers zone wise and category wise.

(Number)

Zone	Particulars	Small	Medium	Large	Total
I	Recommended	27 (100)	9 (100)	10 (100)	46 (100)
	Non-Recommended	4 (14.81)	2 (22.22)	2 (20.00)	8 (17.39)
II	Recommended	94 (71.21)	51 (67.10)	38 (42.22)	18 (61.40)
	Non-Recommended	40 (30.30)	23 (30.26)	29 (30.22)	92 (30.87)
III	Recommended	28 (44.44)	32 (82.05)	50 (33.11)	110(72.85)
	Non-Recommended	37 (58.73)	22 (56.41)	25 (51.02)	84 (55.63)

Figures in parenthesis indicate the percentage to total

Varieties Sown by sampled farmers

Different varieties of crops vary not only in nutrient requirements and yield levels but also have difference in resistance to pests, diseases etc. Varieties are recommended by the research institutions according to technical feasibility in a particular area/region but some times farmers do not stick to these varieties due to their own constraints like failure to sow it on time, inadequate yield in particular zone, more pest/disease attacks etc. therefore, they also grow unrecommended varieties. It was found that in zone II, 78 per cent farmers growing non-recommended varieties of the paddy followed by zone I (35%) and zone III (34%). Considering other kharif crops, 98 per cent of zone I farmers were growing non-recommended varieties of maize such as hishell and DKC 7074 followed by 50 per cent in zone III of cotton hybrids such as RCH 650, SP 7007 and SP 7010.

Data in Table 7 revealed that in wheat crop, 56 per cent of the farmers were growing non-recommended varieties such as HD 2733 in zone III followed by zone II (31 %) and zone I (17 %), on contrary to it, data also showed 61-100 per cent adoption of recommended wheat varieties indicating overlapping responses from the farmers following both types of wheat varieties (recommended and non-recommended) on some area.

Pesticides usage in Punjab agriculture

The high yielding varieties under the plant protection umbrella with higher energy subsidies in fertilizers and irrigation has aggravated the pest problems. This has led to increased use of pesticides to get higher yields but this practice has caused the imbalance in natural control in crops like cotton, which have become vulnerable to minor disturbances in a biotic factors leading to frequent losses. This resulted in emergence of new pest problems and development of resistance to pesticides (Dhaliwal *et al,* 2000). On the other hand, farmers use higher levels of non-recommended pesticides as they find difficulties in adaptation to cultural practices, non-availability of resistant varieties with good yield potential, lack of quality control in available pesticides as well as lack of efficient bio-control measures.

Table 8. Use of recommended doses of pesticides zone wise and category wise.

(Number)

Zone	Small	Medium	Large	Total
I	25 (92.6)	8 (88.9)	6 (60.6)	39 (84.78)
II	40 (30.3)	9 (11.8)	5 (5.5)	54 (18.12)
II	41 (65.08)	14 (18.4)	21 (42.8)	76 (50.33)
Total	10 (47.74)	31 (25.0)	32 (21.47)	169 (34.14)

Figures in parenthesis indicate the percentage to total.

In the survey, sampled farmers (85 %) in zone I responded that they do not indulge in indiscriminate use of agro-chemicals. However, in zone II, only 18 per cent were found to be sticking to recommended doses and rest was using higher levels of agro-chemicals. In zone III 50 per cent of

the respondents reported that they use the pesticides as per the recommended application. Majority of small farmers were using recommended doses and least proportion of large farmers were adhering to norms (Table 8). For the state as a whole, about 48 per cent of small farms, 25 per cent of medium farms and 21 per cent of large farms were found to be following the practice of recommended doses of pesticides. In all, 34 per cent of the total sampled farmers were quoted as sticking to the practice.

Application of irrigations

This aspect is directly related to environment as Punjab Agriculture is mainly dependent on utilisation of underground water reserves for irrigation with shrinking canal irrigation network and erratic pattern of rainfall. More is the number of irrigations applied, more is the indirect cost to the state in the form of power subsidy as well as water. The analysis of this aspect showed that more than 99 per cent of the sampled farmers in the state were following the recommended number of irrigations for wheat crop, however, the case was not same for paddy as is evident from the following table.

There was significant difference in water usage of three categories of farmers and directly related to size of the holding i.e. small farmers were using water more economically as compared to medium and large farmers. There was significant difference in number of irrigations applied to the wheat crop across the zones. It was found to be more in zone I followed by zone III and zone II. Significant difference was observed in number of irrigations during *kharif* season as well in three zones of the state. It was higher in zone II due to the fact that paddy was the main kharif crop in this zone followed by zone III and zone I where the area under paddy cultivation was least.

Residue Disposal

With 28 lakh hectares under wheat and paddy cultivation in the state, a total of 47.2 million ton of straw is generated every year. This included 25 lakh tonnes of wheat straw and 22 lakh ton of paddy straw. Out of this 95 per cent of paddy straw and 25 per cent of wheat straw is burnt each year (GOP, 2014). The mechanized harvesting of these crops has further added to the quantity of residue. At the time of manual harvesting, the straw was chopped into small pieces and ploughed back into the soil to improve its content. Though, a ban was imposed on stubble burning by the state government way back in 2005, but the practice is still going on due to non- implementation of the ban. The problem has been highlighted by the United States National Aeronautics and Space Administration (NASA) and Supreme Court of India has also taken a serious note of it, but of no avail.

Table 9. Irrigations applied by sampled farmers, zone wise and category wise

(Number)

Zone	Paddy (Higher)				Wheat (Recommended)			
	Small	Medium	Large	Total	Small	Medium	Large	Total
I	7 (25.92)	5 (55.56)	4 (40.0)	16 (34.78)	27 (100)	9 (100)	10 (100)	46 (100)
II	126 (95.45)	76 (100)	90 (100)	292 (97.98)	130 (98.48)	76 (100)	90 (100)	296 (99.33)
III	42 (66.66)	26 (66.67)	33 (67.35)	101 (66.88)	63 (100)	39 (100)	49 (100)	151 (100)
State	175 (78.82)	107 (86.29)	127 (85.23)	409 (82.62)	220 (99.1)	124 (100)	149 (100)	493 (99.6)

Figures in parenthesis indicate the percentage to total.

Table 10. Sampled farmers not resorting to residue burning zone wise and category wise

(Number)

Zone	Small	Medium	Large	Total
I	26 (56.52)	8 (17.39)	10 (21.73)	44 (95.65)
II	88 (29.53)	43 (14.42)	42 (91.30)	173 (58.05)
III	52 (34.43)	30 (19.86)	33 (21.85)	115 (77.48)
Punjab	168 (75.67)	81 (65.32)	85 (57.05)	334 (67.47)

It was found that 96 per cent of sampled farmers of zone I were not indulged in the practice of stubble burning, where as in zone II, this proportion was minimum i.e. 58 per cent, while 77 per cent of the respondents denied this practice in zone III. Overall for the state, 67 per cent sampled farmers in the study were found to be not resorting to residue burning, with maximum number of small farmers and minimum number of large farmers thereof.

Constraints of farmers pertaining to recommended level of resource use and agricultural practices

It was found that though having good farming experience and educational level, farmers of the state were not sticking to the recommended practices. Lack of knowledge regarding the soil testing aspect as well as lack of the facility to undertake it near the village emerged as the reasons for not following this practice by the respondents.

Paddy emerging as major *kharif* crop in all the agro climatic zones of the state and it being the water intensive crop has led to the grim ground water situation in the state. Erratic rainfall pattern, fear of loss in yield with less number of irrigations has caused the higher application of irrigations in paddy. The situation was found to be as per recommendations in case of wheat crop. The prominent reason cited for higher levels of fertilizer application was to enhance the crop yields followed by maintenance of soil fertility and to cope with deficit rainfall/ water availability. Lack of knowledge did not emerge as a reason for over fertilization in the state. Only 2 per cent of the farmers showed ignorance about proper knowledge regarding fertilizer doses.

The spurious quality of pesticides emerged as the main reason for higher usage of pesticide by the sampled farmers, followed by increased incidence of pest/disease attacks on the crops in recent times. The recommended doses were found to be ineffective by them. Regarding cultivation of non-recommended varieties mainly in paddy crop, constraints cited by the farmers were inadequate yield of recommended variety in a particular zone, more pest/disease attacks, delay in sowing etc. But by and large, sampled farmers were sowing the crops on recommended times and there was not much variation across the zones.

Residue disposal especially the paddy stubble has emerged as a major problem for the farming community as well as the society as a whole. Lack of state assistance and technical support, high cost of machinery to manage the residue, shortage of time for the next crop and lack of any viable alternative leads to stubble fires. All the sampled farmers were found to be against the burning of crop residue, but due to the above cited reasons the practice was going on.

CONCLUSION

The study revealed that majority of farmers equipped with knowledge parameters of education and good farming experience were by and large well aware about the issues posing threat to sustainable growth of agriculture in the state, but were tied due to constraints emerging mainly on account of mono-culture being followed in the cropping pattern of the state. Different suggestions were put forward by the respondents to tackle these concerns, involving government action whether co-operative or coercive.

Policy intervention and good price remuneration with assured market for alternative crops is the only key. Though each state government has its own agricultural policy, it is largely the Central government funds and policies which define a state's focus. The need of the hour is to diversify to other crops, especially pulses and horticulture.

Alternatives to wheat and rice have to be either at par or above in terms of price and profits.

REFERENCES

Collett K and Gale C (2009). *Training for Rural Development: Agricultural and Enterprise Skills for Women Smallholders*. Eds. Sara Clay Produced by: City & Guilds Centre for Skills Development, London.

Dhaliwal G S, Arora R, Dhawan A K and Singh B (2000). Intensive Agriculture and Pest Problems: A Case Study of Punjab. *Indian J Eco* 27(2): 109-130.

GOP (2014). State of Environment, Punjab, Punjab State Council for Science & Technology, Government of Punjab, Chandigarh.

Nagarajan R and Nagarajan S (2000*). Environmental Problems of Developing Countries, Environment and Economic Development*. Ed. N Rajalakshmi, Manak Publications Pvt. Ltd: 100-120.

Sengupta R (2001). *Ecology and Economics, An Approach to Sustainable Development.* Oxford University Press, New Delhi.

Shukla A K, Tiwari P K and Prakash C (2014). Micronutrients deficiencies vis-à-vis food and nutritional security of India. *Indian J Fert* **10**(12): 94-112.

Singh G, Sharma M, Manan J and Singh G (2016). Assessment of soil fertility status under different cropping sequences in district Kapurthala. *J Krishi Vigyan* **5**(1): 1-9.

Manan J, Sharma M, Singh G and Singh G (2016).Effect of Application of various inputs by the farmers and the yield of spring Maize hybrids. *J Krishi Vigyan* **4** (2): 22-27.

Manan J, Sharma M, Singh G and Singh G (2015). Package of practices followed by farmers and its effect on Wheat yield in district Kapurthala. *J Krishi Vigyan* **4**(1): 67-71.

Received on 11/05/2017 Accepted on 10/06/2017