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Cost and returns of plant protection in paddy under different nitrogen scenario in Tungabhadra project command

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Abstract: Nitrogenous fertilizers are the most important contributing factor for the improvement of crop yields, since last one and half decade. Though farmers are advised by the extension workers to use recommended dose of nitrogenous fertilizers, it is not adopted because of the physical outcome of fertilizer application. The excessive use of nitrogenous fertilizers has resulted in higher plant protection chemicals and has further resulted in increase in pest incidence, but also high cost structure in the production process. In order to examine different dimensions of economic aspects of selected inputs, a study was carried out in Tungabhadra project (TBP) area of Karnataka during the year 2010-11 for which multistage random sampling design was employed for a sample size of 90 farmers. The study revealed that the extent of application of insecticides increased from 5413ml/g a.i/ha to 7338ml/g a.i/ha, fungicides application from 805 ml/g a.i/ha to 1283ml/g a.i/ha and weedicides from 4853ml/g a.i/ha to 7625 ml/g a.i/ha from nitrogen level 1 (upto 50% RD of nitrogen) to nitrogen level 3(>100% RD of nitrogen), respectively. Thus, the total cost incurred towards plant protection chemicals ranged from ₹ 15886/ha to ₹ 24442/ ha from nitrogen level 1 to 3, respectively in paddy cultivation. Thus, emphasis must be given for adoption of Integrated Pest Management (IPM) and Integrated Nutrient Management (INM), which needs promotion through different extension strategies to minimize the losses.

Key words: Command area, Nitrogen, Paddy, Plant protection chemicals

Introduction

Paddy (*Oryza sativa* L.) is one of the important cereal crops of India with largest area in the world (45.50 million ha), with a total production of 96.43 million tonnes during 2007-08 and it stood next only to China in the world with respect to production. In India, Karnataka is one among the paddy growing states and is grown in an area of 1.3 million ha with an annual production of 3.52 million tonnes during 2010 (Anon., 2010). Paddy is one of the most important cereal crop grown in the Tungabhadra project (TBP) command area of Karnataka, which covers 3.6 lakh hectare in *kharif* and 2.52 lakh hectare in *rabi*/summer. Nitrogenous fertilizers are the most important contributing factor for the improvement of crop yields since last one and half decade. Though farmers are advised by the extension workers to use recommended dose of nitrogenous fertilizers, but it is not adopted because of the physical outcome of fertilizer application. The excessive use of nitrogenous fertilizers has resulted in higher plant protection chemicals and has further resulted in increase in pest incidence and also high cost structure in the production process.

Therefore, an attempt is made in the present study to analyse the extent, costs and returns due to overuse of nitrogenous fertilizers and plant protection chemicals in paddy in TBP area of Karnataka. The specific objectives of the study were to analyze the pattern of plant protection and nutrients in paddy cultivation and to find out costs and returns of different plant protection practices under selected nutrient management scenario.

Material and methods

The study was confined to Tungabhadra Project (TBP) area of Karnataka state. The Tungabhadra project area consists of three districts *viz.,* Raichur, Koppal and Bellary. To get a representative sample, multistage random sampling design was used. In the first stage, three talukas were selected from each district based on the highest area under paddy in Tungabhadra project command area namely Sindhanur (Raichur district), Gangavathi (Koppal district) and Siruguppa (Bellary district). In the second stage, three villages from each choosen taluka were selected randomly (table 1). In the third stage, ten farmers from each of the selected villages were choosen at random. Thus, the total sample size comprised of 90 farmers. The primary data was collected from sample farmers using pre-tested questionnaire prepared for the purpose. The primary data on paddy cultivation pertained to the agricultural year 2011-12. The classification of farmers based on the extent of nitrogen used in relation to recommended level in paddy cultivation in TBP area was as given below:

Nitrogen level-1 Sample farmers using upto 50% higher than the recommended dose of nitrogen.

Nitrogen level-2: Sample farmers using more than 50% and upto 100% other than the recommended dose of nitrogen.

Nitrogen level-3: Sample farmers using more than 100% higher than recommended dose of nitrogen.

Recommended dose of nitrogen: 150 kg/ha (Anon., 2009).

Tabular analytical techniques with the help of percentages, averages and ratios were used to compute costs and returns.

Results and discussion

A perusal of tables 1 to 5, clearly indicated that the extent of application of plant protection chemicals and their management considerably increased with increase in the nitrogen use in paddy cultivation under TBP. The application of more and more nitrogen to paddy might have resulted in vigorous, fleshy, greenly vegetative growth due to which plants became succulent leading to increase in incidence of pests and diseases.

Table 1. General characteristics of sample farmers in the study area

Sl. No.	Particulars	Unit	Nitrogen level 1	Nitrogen level 2	Nitrogen level 3	overall
1.	Age of the farmer	Years	39.00	47.00	43.00	44.33
2.	Experience in farming	Years	21.58	33.00	46.00	33.52
3.	Family members in farm work	N0.	3.00	4.00	3.00	3.60
4.	Size of the family					
a)	Male	N0.	2.10	4.00	3.00	2.70
b)	Female	N0.	2.30	3.00	4.00	3.10
c)	Children	N0.	3.00	6.00	4.00	4.00
d)	Total	N0.	7.40	13.00	11.00	09.80
5.	Education level					
a)	Illiterate	Per cent	42.40	53.10	57.50	51.00
b)	Primary	Per cent	36.60	38.40	40.90	38.63
c)	High school	Per cent	14.40	5.00	1.00	6.80
d)	College and above	Per cent	6.60	3.50	0.60	3.56
e)	Total	Per cent	100	100	100	100
6.	Size of the farm	Acre	7.23	10.96	13.71	10.63

Table 2. Frequency and nature of application of pesticides in paddy under different nitrogen scenario

Sl. No.	Particulars	Numbers		
		Nitrogen level 1	Nitrogen level 2	Nitrogen level 3
1.	Number of application of insecticides	2.00	3.00	4.00
2.	Number of application of fungicides	1.00	2.00	3.00
3.	Number of application of weedicides	1.00	1.00	1.00
4.	Combination of insecticides + fungicides	3.00	4.00	5.00
5.	Number of application of granular insecticides	1.00	1.00	1.00

Thus, the farmers who had applied higher than the recommended dose of did used higher levels of pesticides leading to increase in cost of cultivation. Further, the profused vegetative growth might not have resulted in proportionate increase in production. Hence, the farmers who have used more and more of nitrogen, not only increased their cost of cultivation, but also obtained higher net returns due to higher yield (79.79q/ha in nitrogen level 2 and 83.37q/ha in nitrogen level 3) obtained. The result are in line with those of Eswaraprasad *et al.* (1988), Pandurangudu and Raju (1988) and Birthal *et al.* (2000).

The plant protection chemicals applied was 26.77 per cent and 53.58 per cent higher in nitrogen levels 2 and 3 than that of nitrogen level 1, which were almost more by 50 and 100 per cent of the recommended level of nitrogen. This clearly indicated that farmers in TBP area have a high investment capacity towards plant protection chemicals and risk aversion to crop loss due to pests. The insecticides and fungicides were the most frequently used pesticides which accounted for bulk share in total pesticides used. This was also because of high infestation of insect pests like stem borer, brown plant hopper and leaf roller. Similar observations were made in the study by Singh *et al.* (2007).

The pattern of use of both insecticides and fungicides was also found to be similar. Table 3 indicated that majority of farmers were applying more than 50 per cent of the recommended dose of insecticides and fungicides in case of nitrogen level 3 compared to nitrogen level 1. As a result majority of the farmers were applying more than 50 per cent of the recommended dose of insecticides and fungicides. Therefore, there is an urgent need for providing proper awareness and education to TBP farmers about excessive use of nitrogen and pesticide and their implications on cost, income etc. Santa Kumar and Dhandapani (2000) and Nyugen and Tran Thi (2003) reported similar findings.

The cost of plant protection chemicals under different nitrogen scenario in paddy cultivation is presented in Table 4. The cost incurred towards insecticides, fungicides and weedicides (in liquid/powder/granular form) has shown increasing trend with increase in nitrogen levels. The cost on insecticides including liquid and granular form has increased by 26.56% in nitrogen level 2 and 57.31% in nitrogen level 3 than in nitrogen level 1. Similarly, the cost on fungicides (both liquid and powder form) increased by 26.83 % and 54.03% in nitrogen level 2 and 3, respectively than in nitrogen level 1. Thus, the total cost incurred towards plant protection chemicals ranged from ₹ 15,886/ha to ₹ 24,442/ha from nitrogen level 1 to 3, respectively.

Further, it was observed that the frequency of application of plant protection chemicals was increasing with increase in nitrogen levels (table 2). This could be one of the reasons that brown plant hopper and stem borer emerged as serious insect pests in TBP area and sheath blight, leaf reddening and rice blast as serious diseases. This resulted in pests to develop resistance against existing pesticides and emerged as resurgence pests. Such an over dosage of chemicals might have caused the destruction of many of the beneficial insects, which leads to the emergence of more virulent pests. Similar findings were reported by Venkataramani (1992). Thus, there was over use of resources especially nitrogen and plant protection chemicals in paddy production and therefore the extension agencies have to popularize the Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) practices among the farmers of paddy cultivation. Further, emphasis needs to be given on practicing organic farming, use of biofertilizers and

Table 3. Extent of plant protection measures used in paddy under different nitrogen scenario (Active Ingredient/ha)

Plant protection chemicals	Unit	Nitrogen level 1	Nitrogen level 2	Nitrogen level 3
Insecticides				
a) Liquid form	ml	2538	3135	3563
b) Granular form	g	2875	3425	3775
Sub total		5413	6560 (21.18)	7338 (35.56)
Fungicides				
a) Liquid form	ml	75	115	145
b) Powder form	g	730	963	1138
Sub total		805	1078 (33.91)	1283(59.37)
Weedicides				
a) Liquid form	ml	2103	2275	2675
b) Powder form	g	2750	3875	4950
Sub total		4853	6150 (26.72)	7625 (57.11)
Total				
a) Liquid form	ml	4716	5525	6383
b) Powder form	g	3480	4838	6088
c) Granular form	g	2875	3425	3775

Figures in parentheses indicate percentage change over nitrogen level 1

Table 4. Cost of plant protection measures in paddy under different nitrogen scenario (₹/hectare)

Plant protection chemicals	Nitrogen level 1	Nitrogen level 2	Nitrogen level 3
Insecticides			
a) Liquid form	4295	5513	7025
b) Granular form	1035	1233	1360
Sub total	5330	6746 (26.56)	8385 (57.31)
Fungicides			
a) Liquid form	625	723	938
b) Powder form	1388	1830	2163
Sub total	2013	2553 (26.83)	3101 (54.03)
Weedicides			
a) Liquid form	4790	5678	6538
b) Powder form	3753	5163	6418
Sub total	8543	10841 (26.89)	12956 (51.65)
Total	15886	20140 (26.77)	24442 (53.85)

Figures in parenthesis indicate percentage change over nitrogen level 1

Table 5. Cost and return structure from plant protection measures in different nitrogen scenario in paddy cultivation (Per hectare)

Particulars	Nitrogen level 1	Nitrogen level 2	Nitrogen level 3	Overall
Yield (q)	70.12	79.95(14.01)	83.37(18.89)	76.22
Average price of paddy (₹)	1075	1075	1075	1075
Gross returns (₹)	75385	85948(14.01)	89628(18.89)	81943
Cost of plant protection chemicals	15886	20140(26.77)	24442(53.85)	20156
Cost of nitrogen	1443	1903(31.87)	2723(88.73)	2023
Total cost of cultivation	48105	52185(8.48)	52615(9.37)	50968
Net returns	27280	33763(23.76)	37013(35.67)	30973
B.C ratio	1.56	1.64	1.70	1.60

Figures in parenthesis indicate percentage change over nitrogen level 1

bioagents in paddy production to minimise the usage of plant protection chemicals.

The study revealed that the extent of application of insecticides increased from 5413 to 7338 ml or g a.i/ha, fungicides application from 805 to 1283ml or g a.i/ha and weedicides from 4853 to 7625 ml/g a.i/ha from nitrogen level 1 (upto 50% higher than RD of nitrogen) to nitrogen level 3(>100% higher than RD of nitrogen), respectively. The total cost incurred towards plant protection chemicals ranged from ₹ 15,886/ha to ₹ 24,442/ha from nitrogen level 1 to 3, respectively in paddy cultivation. Thus, emphasis must be given for adoption of Integrated Pest Management (IPM) and Integrated Nutrient Management (INM), which needs promotion through different extension strategies to minimize the losses.

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