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ANALYSIS OF FRONTLINE DEMONSTRATION CONDUCTED ON SOIL TEST BASED FERTILIZER APPLICATION IN RICE

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ABSTRACT
Frontline demonstration on soil test based fertilizer application in rice was conducted during *kharif* season from 2014 to 2016 in farmers' fields of Kurnool district of Andhra Pradesh to assess the impact of soil test based fertilizer application in rice on yield, economics and to analyse the performance of this in farmers' fields. Study revealed that application of nitrogen, phosphorus and potassium based on soil test values resulted in an average yield increase of 3.5 per cent over the farmers practice. Application of nitrogen, phosphorus and potassium nutrients based on soil test values recorded Rs. 11,306 ha^{-1} higher average net returns over farmers practice. Soil test based fertilizer application recorded an average B:C ratio of 2.72 against farmers practice of 2.30 and average technology index of 2.17 per cent. The higher grain yield (62.89q. ha^{-1}), net returns (Rs, 80,369 ha-1), B:C ratio (2.72) and lower technology index (2.17 per cent) indicates the feasibility of soil test based nutrient application in the rice crop of the Kurnool district.

INTRODUCTION

Rice fulfills 43 per cent of calories requirement of more than 70 per cent of the Indian population. To meet the demands of increasing population and to maintain self-sufficiency, the present production level of 102 million tons needs to be increased up to 125 million tons by the year 2020 (Sridevi *et al.*,2011). This signifies the contribution of rice in meeting food requirements of the hungry mouth of the country. But crop yield stagnation as well as no further increment in crop yield is emerging challenge for researchers and extension personnel (Kanhaiya Lal Regar and Singh (2014). One of the reasons for lower productivity of rice is imbalanced application of nitrogen, phosphorus and potassium nutrients (Reddy and Ahmed, 2000; Meshram *et al.* 2015).

The command area of Kurnool – Cuddapah canal and Thungabhadra Low level Canal is the most potential belt for paddy cultivation in Kurnool district of Andhra Pradesh. Paddy is being cultivated nearly in 89,000ha during *kharif* under all the sources of irrigation. In order to get higher yields farmers resorted to excessive use of chemical fertilizers, top dressing of complex fertilizers which badly affects both soil and crop. Application of fertilizers mainly nitrogen, phosphorus and potassium without knowing the soil test values leads to nutrient toxicity, deficiency leading to lower yields, higher production costs and ultimately low net returns. To enhance farm profitability under different soil-climate conditions, application of fertilizer doses based on the soil test values is the most appropriate method (Ramanaiah *et al.*, 2012). Keeping this in view, present study was under taken with an objective to demonstrate the cost effectiveness of fertilizers and yield enhancement with application of nitrogen, phosphorus and potassium fertilizers based on soil test values in rice.

MATERIALS AND METHODS

The demonstrations were conducted during *kharif* season from 2014 to 2016. The necessary steps for selection of site and layout of demonstrations etc. were followed as suggested by Choudhary (1999). Farmers who are practicing indiscriminate and excess application of fertilizers were selected from ten different villages in seven mandals *viz.,* Nandikotkur, Jupadu Bangalow, Kallur, C.Belgal, Panyam, Bandatmaklur and Gudur of Kurnool district in Andhra Pradesh. Initial soil fertility of the selected plots were analyzed in soil testing lab at Regional Agricultural Research Station, Nandyal after collecting the soil samples from the 0-15cm depth. Samples were analyzed for organic carbon by Walkey and Black method (1934), available nitrogen by alkaline potassium permanganate method as proposed by Subbaiah and Asija (1956), available phosphorus by Olsen's method (Olsen *et al.,* 1954) and available potassium by ammonium acetate method as described by Jackson (1973). Soil type is deep black soil, on an average all the samples analysed were low in nitrogen content, high in phosphorus and medium in potassium content. Based on soil test values 320kg of nitrogen, 53kg of phosphorus and 80kg of potassium were applied as per the recommendations of James R. Brown *et al.* (2004). In farmers practice they were applied 310kg of nitrogen, 150kg of phosphorus and 75kg of potassium and 19.5kg of sulphur. For each demonstration we have selected a plot of 0.8ha and then divided into two equal parts of each 0.4ha. Sub plots

were allotted with T_1 (plots receiving N, P, K fertilizers based on soil test values) and T_2 (Plots receiving fertilizers as per farmers practice). Rice variety BPT-5204 was sown during July, transplanted during 2nd to 3rd week of August and harvested during 1st to 2nd week of December in all the years. During this period regular visits by District Agricultural Advisory and Transfer of Technology Centre (DAATTC) Scientists to FLD plots were made to supervise important farm operations. The extension activities like group meetings and field days were also organized at the demonstration sites as to provide opportunities for other farmers of that area to interact and to seek benefits from these demonstrations. The data were collected both from the demonstrations as well as check plots. The input and output prices of the commodities prevailed during the study were taken into an account for calculating the net returns and benefit - cost ratio. The extension gap, technology gap and technology index (Samui *et al*., 2000) were calculated using the following equation:

Technology gap = Potential yield - demonstration yield.

Extension gap = Demonstration yield - farmers practice yield.

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

RESULTS AND DISCUSSION

To prove the importance of application of nitrogen, phosphorus and potassium based on soil test values 10 demonstrations were carried out during *kharif* season from 2014 to 2016. Perusal of the data presented in the table 1 indicated that the higher average grain yield (62.89 q.ha^{-1}) of rice was recorded with soil test based application of fertilizers (63.31, 55.94 and 69.42 q.ha^{-1} during 2014, 2015 and 2016, respectively) than farmers practice (63.04, 54.42 and 64.75 q. ha^{-1} during 2014, 2015 and 2016, respectively). These higher yields might be due to balanced application of nitrogen, phosphorus and potassium in the demonstrations. In farmers practice due to application of excess phosphorus by top dressing of complex fertilizers and application of sulphur through sulphur containing complex fertilizers resulted in excessive buildup of phosphorus and sulphide injury in deep black soils of Kurnool District. The higher net returns of Rs. 71,704 ha^{-1} , Rs. 71,724 ha^{-1} and Rs. 97,678 ha^{-1} were recorded during *kharif* 2014, *kharif* 2015 and *kharif* 2016, respectively with soil test based application as against to Rs. 64,918 ha^{-1}, Rs. 60,715 ha^{-1} and Rs.81,556 ha^{-1} during *kharif* 2014, *kharif* 2015 and *kharif* 2016, respectively in the farmers practice. The higher net returns in soil test based N,P,K fertilizer application might be due to higher yields and reduced cost on fertilizers due to application of straight fertilizers for top dressing as against the farmers practice. The benefit - cost ratio of rice cultivation with soil test based fertilizer application was 2.70, 2.57 and 2.90 during *kharif* 2014, *kharif* 2015 and *kharif* 2016, respectively compared to 2.34, 2.13 and 2.42 under farmers practice. This might be due to higher returns and reduced cost of cultivation in soil test based fertilizer application as compared to farmers practice. Anand Kumar *et al*. (2015)

Extension gap of 0.27, 1.52 and 4.67 q ha^{-1} was observed during *kharif* 2014, *kharif* 2015 and *kharif* 2016, respectively (Table 2). Extension gap emphasized the need to bring awareness among the farmers for adoption of soil test based fertilizer application and to harvest the trend of wide extension gap. Results also indicated technology gap between the soil test based fertilizer application and farmers practice in tune of 1.64, 1.28 and 1.23 q ha^{-1} during *kharif* 2014, *kharif* 2015 and *kharif* 2016, respectively. The technology gap observed might be attributed to difference in soil type and cultivation practices and may be overcome by adoption of soil test based fertilizer application along with best management practices.

The technology index indicates the feasibility of the evolved technology at the farmers' fields. Lower the values of technology index more is the feasibility of the technology demonstrated (Chauhan 2011). The technology index in the present study was 2.53, 2.24 and 1.74 per cent during *kharif* 2014, *kharif* 2015 and *kharif* 2016, respectively showing the efficacy of good performance of soil test based fertilizer application. The reduction in the technology index from 2.53 to 1.74 per cent during *kharif* 2014, *kharif* 2015 and *kharif* 2016, respectively exhibiting the feasibility of the soil test based fertilizer application.

Table 1: Yield and economics of rice in Frontline Demonstration on Soil test based fertilizer application in rice

	Grain yield(q ha^{-1})		Cost of cultivation (Rs./ha)		Net Returns (Rs./ha)		B:C Ratio	
	STBF	F.P	STBF	F.P	STBF	F.P	STBF	F.P
2014-15	63.31	63.04	42262	48562	71704	64918	2.70	2.34
2015-16	55.94	54.42	45750	53567	71724	60715	2.57	2.13
2016-17	69.42	64.75	51650	57750	97678	81556	2.90	2.42
Average	62.89	60.74	46554	53293	80369	69063	2.72	2.30

Table 2: Technology gap, Extension gap and Technology index in Frontline Demonstration on Soil test based fertilizer application in rice

	Technology gap(q ha^{-1})	Extension gap(q ha-1)	Technology index(%)
2014-15	1.64	0.27	2.53
2015-16	1.28	1.52	2.24
2016-17	1.23	4.67	1.74
Average	1.38	2.15	2.17

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