ORIGINAL RESEARCH ARTICLE OPEN ACCESS

Influence of Soil Test Based Application of Phosphorus Fertilizers on Yields of Paddy: A Case Study in Khammam District of Andhra Pradesh

A.D.V.S.L.P. Anand Kumar*[1], M. Srinivasa Rao[2] and M. Satyanarayana[3]

[1]District Agricultural Advisory and Transfer of Technology Centre (DAATTC), Kakinada,
[2]DAATTC, Sanga Reddy,

[3]Krishi Vigyan Kendra, Ghantasala, Andhra Pradesh

*Corresponding author: anandkumarento@gmail.com

Received: 27th January, 2015; Accepted: 28th April, 2015

Abstract

In order to create awareness among the farming community on use of phosphatic fertilizers based on soil test values, 17 On farm demonstrations were conducted during *rabi*, 2011-12 on soils having high status of available Phosphorus in Khammam District of Andhra Pradesh. Application of recommended doses of fertilizers based on soil test values recorded similar grain yields in paddy as that of farmers practice and there was a net savings in the cost of P fertilizers applied per hectare to an extent of Rs.1448/-.

Key Words: Soil test, fertilizer, phosphorus, paddy, yield

Introduction

Ensuring food security for escalating population necessitates the production of additional food grains from the same land without losing the production potential of the soil. This, in turn requires balanced nutrition to the food crops for enhancing and sustaining food production as well as soil productivity with minimum environmental degradation. This can be achieved through soil test based fertilizer application.

Fertilizer is one of the costliest inputs in agriculture and the use of right amount of fertilizer is fundamental for farm profitability and environmental protection (Kimetu *et al*., 2004). To enhance farm profitability under different soil-climate conditions, it is necessary to have information on optimum doses for fertilizer use. Traditionally, to determine the optimum fertilizer doses, the most appropriate method is to apply fertilizer on the basis of soil test and crop response studies. During 1956-57 the semi-quantitative soil test calibrations were evolved and advocated for the use. Subsequently in India the quantitative refinements in the fertilizer recommendations based on the soil and plant analysis were made (1967-68) through the All India Coordinated Research Project for Investigation on Soil test crop response correlation (STCRC).

Soil testing is a tool that aids in taking scientifically sound management decisions about fertilizer requirement after assessing the nutrient status in soils. But with continuous and higher application of complex and other phosphatic fertilizers, larger areas of cultivated lands of Andhra Pradesh are being reported to contain higher available P in soils resulting in adverse effects on the availability of other nutrients particularly micronutrients (e.g. Zn) besides increasing the cost of cultivation in different crops. One of the reasons for lower production of rice is imbalanced fertilization of N, P and K nutrients (Reddy and Ahmed, 2000). The most comprehensive approach of fertilizer application by incorporating soil test values, nutrient requirement of the crop, contribution of nutrients from soil, manures, fertilizers and fixing yield-targets is possible only through Soil Test Crop Response (STCR) approach.

Out of 4,00,070 soil samples analyzed during 2010-11 by state soil testing laboratories, 1,22,471 samples constituting 31% were found to register high Phosphorus levels in soils. The research reports of Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad indicate that with applicability of targeted yield equations for soils having high Phosphorus, there is a possibility of saving of Phosphorus fertilizers to an extent of 25 to 75 per cent from currently used phosphorus fertilizer doses in selected crops on such high Phosphorus soils.

In the light of above, Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad implemented Bhoochetana project during *rabi,* 2010-11 under RKVY Scheme through its extension institutes like Krishi Vigyan Kendras (KVK) and District Agricultural Advisory and Transfer of Technology Centres (DAATTC) in 10 selected Districts of A.P. Keeping this in view, the present

investigation was carried out to study the effect of soil test based phosphatic fertilizer application on crop yield and cost of production.

Materials and Methods

Seventeen On Farm Demonstrations on soil test based application of Phosphatic fertilizers were conducted during *rabi*, 2011-12 under bhoochetana project in five Mandals of Khammam District with the objective to demonstrate to farming community and to popularize the use of soil test based phosphorus fertilizers in crops for reducing the input cost and sustain the soil health.

The services of the soil testing laboratory, Khammam, Khammam District were utilized for selection of farmers having soils with high levels of available phosphorus (Olsens *et al*., 1954) in the present study (Table1).

Each demonstration consisted of two treatments namely farmer practice (T_1) *i. e* unbalanced use of N, P and K fertilizers and soil test based P recommendation (*i. e* Higher the available phosphorus in soils, 30 per cent reduction in the recommended dose of the nutrient Phosphorus for a particular crop) along with farmers practice with regard to N and K (T_2) and each treatment was imposed in 0.40 ha with same variety (MTU-1010).

The recommended dose of N, P and K per hectare for *rabi* paddy in Central Telangana Zone of A.P. is 120, 60 and 40 kg, respectively. Full dose of P along with 1/3rd N and half dose of K were applied during last puddling in both treatments (T_1 & T_2). The remaining 1/3rd N along with half dose of K were applied at panicle initiation stage in both the treatments. Similar plant protection measures were adopted throughout the crop growth period in both the treatments. Grain yield data per acre was recorded, per hectare yield was computed and subjected to paired t' test.

Results and Discussion

Grain yields were estimated based on crop cutting experiments conducted at the time of harvest and arrived at average figures for grain yield (kg/hectare), cost of fertilizers applied (Rs/hectare) in T_1 and T_2. Economics were also worked out for T_1 and T_2 (Table 2).

Grain yields (kg/ha) obtained in T_1 and T_2 were 6115 and 6150, respectively. According to the data recorded for grain yield, no significant difference (t-calculated < t-tab) was observed in farmers practice and soil test based application of phosphatic fertilizers (Table 3). Cost of P fertilizers applied (Rs. /ha) in T_1 and T_2 were Rs.3435 and 1947/-respectively. This indicates that there is a significant difference in the cost of P fertilizers applied in T_1 and T_2 to the extent of Rs.1488/- per hectare (t-calculated > t-tab). Hence, the present study supports the earlier research reports of Prasada Rao and Bhupal Raj (2001) and Reddy and Ahmed (2000) stating that there is a possibility of saving of phosphatic fertilizers to the extent of 25 to 75 per cent on soils having high status of available P. This suggests that the use of excess P fertilizers does not result in significant marginal increase in the yield besides increasing the cost of cultivation and adverse effects on other nutrients.

Hence present study indicates that application of recommended doses of fertilizers based on soil test values recorded similar grain yields in paddy as that of farmers practice and there was a net savings in the cost of P fertilizers applied per hectare to the extent of Rs.1448/-.

References

Kimetu, M., Mugendi, D.N., Palm, C.A., Mutuo, P.K., Gachengo, C.N., Nandwa, S. and Kungu, B. 2004. African network on soil biology and fertility (http://www.ciat.cgiar.org). pp. 207- 224.

Olsen, S. R., Cole C.V., Watanabe F.S. and Dean L.A., 1954. Estimation of available phosphorous in soils by extraction with sodium bicarbonate. USDA Circular. 1. p. 939.

Prasada Rao, A. and Bhupal Raj. 2001. A text book on Guidelines for soil based technologies to optimize land productivity in Andhra Pradesh.

Reddy, K.C. and Ahmed, S.R. 2000. Soil test based fertilizer recommendation for maize grown in inceptisols of Jagtiyal in Andra Pradesh. *Journal of Indian Society of Soil Science* 48:84-89.

Table 1. Particulars of Farmers along with soil test results of P under Bhoochetana during *rabi* 2011-12

S.No	Village & Mandal	Farmers Name	Crop	Soil test value of P_2O_5 (kg/ ha)	Nutrient recommendation of P (kg/ha)
1	Kothuru (V) Kusumanchi (M)	Lodiga Ramaiah	Paddy	65.9 (H)	42.5
2	Kothuru (V) Kusumanchi (M)	Lodiga Venkata Ramana	Paddy	65.99 (H)	42.5
3	Kothuru (V) Kusumanchi (M)	Banoth Ramu	Paddy	87.12 (H	42.5
4	Paleru (V)Kusumanchi (M)	Nukala Rangareddy	Paddy	63.75 (H)	42.5
5	Paleru (V)Kusumanchi (M)	Bajjuri Venkata Reddy	Paddy	70.12 (H)	42.5
6	Singareddy Palem (V) Nelakondapalli (M)	Pagidikathula Ramu	Paddy	71.22 (H)	42.5
7	ThirumalaPuram (V) Nelakondapalli (M)	Banoth Balaji	Paddy	139.7 (H)	42.5
8	Guvalagudem (V) Nelakondapalli (M)	B. Venkateswarulu	Paddy	76.5(H)	42.5
9	Ammagudem (V) Nelakondapalli (M)	AdapalaVenkata Ramana	Paddy	74.4(H)	42.5
10	Medepalli (V) Mudigonda (M)	S. Pramila	Paddy	51.0 (M)	60.0
11	Kamalapuram (V)Mudigonda (M)	D. Ranga Reddy	Paddy	51.0 (M)	60.0
12	Bhanapuram (V) Mudigonda (M)	Y. Upendar	Paddy	115.0 (H)	42.5
13	Kakarlapalli (V) Sathupalli (M)	B. Rambabu	Paddy	49.0 (M)	60.0
14	Ayyagaripeta (V) Sathupalli (M)	N. Prasada Rao	Paddy	49.0 (M)	60.0
15	Rejarla (V) Sathupalli (M)	K. Himakar Reddy	Paddy	157.25(H)	42.5
16	Yerraboinapalli (V) Kalluru (M)	A. Ramarao	Paddy	79.0 (H)	42.5
17	Yerraboinapalli (V) Kalluru (M)	P. Venkata Krishna Rao	Paddy	91.12 (H)	42.5

Table 2. Economics of treatments (mean)

Particulars (per hectare)	T_1 (Farmers practice)	T_2 (soil test based P recommendation)
Cost of cultivation	35625/-	31500/-
Yield	6115	6150
Gross Returns(Rs.)	67875/-	68265/-
Net Returns(Rs.)	32250/-	33878/-
BC Ratio	1.90:1	2.17:1

Table 3. Particulars on cost of "P"fertililzers applied and Yield obtained under Bhoochetana during *rabi* 2011 - 12

S. No	Farmers Name	Quantity of P applied in T_1 (Farmers practice) (Kg/ha)	Quantity of P applied in T_2 (soil test based P recommendation) (Kg/ha)	Cost of P fertilizers applied in T_1 (Rs/ha)	Cost of P fertilizers applied in T_2 (Rs/ha)	Net savings in the Cost of P fertilizers applied in T_2 (Rs/ha)	Grain Yield in T_1(Farmers practice) (Kg/ha)	Grain Yield in T_2 (soil test based P recommendation) (Kg/ha)
1	Lodiga Ramaiah	55	42.5	3000	2670	330	5873	5971
2	Lodiga Venkata Ramana	55	42.5	3000	2670	330	5888	5995
3	Banoth Ramu	60	42.5	4300	1738	2562	6000	6100
4	Nukala Rangareddy	55	42.5	3000	1165	1835	7280	7405
5	Bajjuri Venkata Reddy	86.25	42.5	3525	1738	1787	6975	7042
6	Pagidikathula Ramu	47.5	42.5	3050	1165	1885	7320	7375
7	Banoth Balaji	60	42.5	2195	1738	457	7560	7500
8	B. Venkateswarulu	57.5	42.5	2350	1738	612	4660	4610
9	Adapala Venkata Ramana	82.5	42.5	4200	1738	2462	5813	5895
10	S. Pramila	82.5	60	4200	2445	1755	6648	6560
11	D. Ranga Reddy	57.5	60	3275	2445	830	6760	6728
12	Y. Upendar	82.5	42.5	4200	1738	2462	4820	4875
13	B. Rambabu	88.75	60	4350	2445	1905	4700	4675
14	N. Prasada Rao	68.75	60	3800	2445	1355	6440	6478
15	K. Himakar Reddy	82.5	42.5	4200	1738	2462	5200	5158
16	A. Ramarao	46.25	42.5	3750	1738	2012	6100	6188
17	P. Venkata Krishna Rao	58.75	42.5	2000	1738	262	5925	6000
			Mean	3435	1947	1488	6115.41	6150.29

Average (D): 1488.41 average (D^2): 2883173
t(test value):2.11 (table value):2.12 (n=17,significant at 5% level)

Average (D): 35.71 average (D^2): 5846.18
t (test value): 7.29 (table value):2 (n=17, non significant at 5% level)