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Research Article

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Assessment of targeted yield of the wheat through INM based on soil test crop performance (STCR)

■ MANOJ KUMAR SINGH, JITENDRA SINGH AND PAWAN SIROTHIA

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MEMBERS OF RESEARCH FORUM:

Corresponding author :
MANOJ KUMAR SINGH, Holy Cross Krishi Vigyan Kendra, HAZARIBAG (JHARKHAND) INDIA
Email: manojlohrapur@gmail.com

Co-authors :
JITENDRA SINGH, Krishi Vigyan Kendra, INDORE (M.P.) INDIA

PAWAN SIROTHIA, M.G.C.G. Vishvavidyalay Chitrakoot, SATNA (M.P.) INDIA

Summary

India recorded impressive achievement in agriculture since the onset of green revolution which enabled the country to overcome wide spread hunger, achieve self-sufficiency in food and bring economic transformation. The situation, however started turning adverse, with slow down in the growth rate of output due to decline in soil fertility. This situation can only improve with the help of integrated nutrient management (INM) based on soil test crop response (STCR) nutrient application in the soil, according to the soil formula so that we can get targeted yield of the crop and sustain the soil fertility. Holy Cross Krishi Vigyan Kendra has conducted experiments to assess the STCR to achieve target yield of wheat. On Farm Trials (OFT) were conducted on the farmers fields in 10 different locations. The soil is sandy loam in midland situation the soil reaction was acidic and low or medium in organic matter. The soil samples for soil fertility status were analyzed at initial and final stage of the crop with other agronomic parameters. The source of the technology was Jawaharlal Krishi Vishwavidyalay, Jabalpur (M.P). During *Rabi* season of 2011 – 12 and 2012-13 studies were conducted to find out the doses of fertilizer to obtain targeted yield economically. Three technical options adopted for the experimentation were: Farmers practice – 35 q/ha, fertilizers dose were 80 kg, nitrogen, 60 kg phosphorus and 20 kg potash). Technical option 1- targeted yield 40 q/ha, fertilizers dose by STCR based were 90:55:69 and Technical option 2 – targeted yield 42 q/ha, fertilizer dose by STCR based were 107:63:75. The technical option 1 was the best to adopt as per the assessment and refinement.

Key words : Nutrient management, Soil test crop performance (STCR), Yield, Wheat

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Introduction

Hazaribag district is one of most potential zones for cultivation of major crop wheat which is being cultivated on about 9950.0 ha. To get more and more yield farmers use chemical fertilizers indiscriminately. However, to take decision to use balanced fertilizer requires knowledge of the expected crop yield response to nutrient application (Dobermann *et al.*, 2003). Use of fertilizers by the farmers in the field without information of soil fertility status and nutrient requirement of the crop cause adverse effects on soil and crop leading to both nutrients toxicity and deficiency either by use of excess quantity or under dosing (Ray *et al.*, 2000). Soil test based application of plant nutrients help to realize higher response and benefit

cost ratio as nutrients are used in proportion to the magnitude of the deficiency of a particular nutrient. The correction of the nutrient imbalance in soil helps to harness the synergic effects of balanced fertilization (Rao and Srivastava, 2000) In macro situation level specific fertilizers recommendation is possible taking into account soils of varying fertility resource conditions of farmers and levels of targeted yield for similar soil classes and environment (Ahmed *et al.,* 2002). Field specific balanced estimation of the supply of N,P and K by modeling the expected yield response is a function of nutrient interaction (Ramamurthy *et al.,* 2009).

Resource and Research Methods

The on farm testing trials were conducted in villages Banadag and Pundoul of Hazaribag district in Jharkhand, India, during 2011-12 and 2012-13. The trials were conducted in sandy loam soil, topography low land and mid land. The soil sample (0-15 cm depth) were collected, dried and passed through 2 mm sieve and analyzed for physical and chemical properties as described by Jackson (1973). Available nitrogen was analyzed by alkaline permanganate method (Subhaiah and Asija, 1956) available phosphorus by Olsen *et al.* (1954) method and available potassium was extracted using neutral ammonium acetate and determination was made flame photometrically as described by Jackson (1967).Three fertilizers treatment *viz.*,1- local check (farmers practice).Technical option 1 - 40 q/ha. targeted yield and technical option-2 42 Q/ha by STCR (Soil test crop response) techniques. Targeted yield of crop was decided as per yield potential of the variety. Pre-sowing sample were analyzed according to the standard procedures. Soil resource inventory of the study area is given in Table 1 "Quantity of nitrogen, phosphorus and potassium were calculated with the help of fertilizer adjustment equations" as follows:

FN=4.4T – 0.4 SN, FP_2O_5 = 4.0 T – 4.58 SP, FK_20 = 2.53 T-0.16SK.

where,

T is Target yield (Q/ha),

FN = Fertilizer nitrogen (kg ha^{-1})

F P_2O_5 = Fertilizer phosphorus (kg ha^{-1}),

FK_2O = Fertilizer potassium (kg ha^{-1})

SN = Soil available nitrogen (kg ha^{-1}),

SP = Soil phosphorus (kg ha^{-1})

SK = Soil available potassium (kg ha^{-1})

The crop received half N and full dose of P_2O_5 and K_2O as basal application and remaining half N was applied 21 days after sowing of wheat (crown root initiation). Remaining nitrogen was applied at panicle initiation stage. Nitrogen was applied through urea, phosphorus through DAP and potassium through muriate of potash. Variety of wheat is (CBW-38). The same variety was used in STCR treatment and local check. The initially soils was acidic in reaction with average PH 4.2 – 6.02 .The organic carbon content 0.31-0.58. Available N level low 147-232 kg/ha, available phosphorus 6.77- 33.63 kg/ha medium to high and available potassium 69-308 kg/ha low to high.

Research Findings and Discussion

Data present in Table 1 showed that the nutrients applied for targeted yield of wheat tech. option-1 (40 Q/ha) had helped to gain yield of 40.05 q/ha. The percentage increase in yield was 35.7 per cent over local cheek (29.50 q/ha). Under the same nutrients supply net return Rs. 3164.0 ha^{-1} and BC ratio 2.32:1 were obtained in on farm testing. Similar trends were also reported by Gayathri *et al.* (2009). Technical option-2 also increased yield but B:C ration was 2.30:1 less than technical option-1 no significant difference in yield in Technical 1 and 2. In conclusion for achieving the targeted yield in wheat doses of N: P_2O_5 : K_2) were 90:55:69 kg/ha at village Banadag, Block – Katkamdag and 65:87:88 kg/ha at village Pundoul, Block – Barkagaon, district – Hazaribag. The villages are representative site of the Hazaribag district with similar climatic condition where this technology can be applied.

This study will help to make guide lines for the amount of fertilizer to be used in wheat crops in Hazaribag

Table 1: Effect of soil test crop response technology on yield and economics of wheat crop

	No. of tillers / plant	Av. yield	Net return (Rs./ha)	B : C ratio
Farmers practice	6	29.50	19,723.00	1.93:1
Tech opt.-1	9	40.05	31,641.00	2.42:1
Tech opt.-II	10	40.42	31,714.00	2.30:1
C.D. (P=0.05)	1.067			

Table 2 : Physico-chemical properties of the experimental area

	Initial soil status		Initial soil status			Final soil status				
	pH	OC%	Avail N (kg/ha)	Avail P (kg/ha)	Avail K (kg/ha)	pH	OC %	Avail N (kg/ha)	Avail P (kg/ha)	Avail K (kg/ha)
PF	4.2	0.31	147	6.77	69	4.4	0.3	142.5	7.65	70.56
	-	-	-	-	-	-	-	-	-	-
	6.02	058	232	33.63	308	5.86	0.71	266.25	35.72	300
TO-1						4.42	0.4	180	9.07	95
						-	-	-	-	-
						6.25	0.68	255	38.01	310
TO-2						4.75	0.42	189	11.39	105
						-	-	-	-	-
						6.19	0.78	285	38.01	320

district of Jharkhand (on micro situation level). With the variations in condition like different cultivars and type of soils etc. fertilizer equations will change. However, the change will not be significant for cultivars with similar producing capacity. The developed specific targeted yield equation based on soil health will not only ensure sustainable crop production but will also steer the farmers toward economic use of costly fertilizer inputs. Thus it appears that higher level of yield can be achieved by using plant nutrients on targeted yield concept on soil test basis. Balanced fertilizers also help in maintaining the sustainable productivity of soil.

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