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STCR - IPNS based Fertilizer Prescriptions for Cotton in coastal Karaikal region

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Introduction

Cotton 'the king of apparel fibers' is an important fiber and cash crop. It supplies a major share of raw material for the textile industry and plays a key role in the economic and social affairs of the world (Vora *et al.*, 2015). The current fertilization practices do not put back in equal measure the nutrient to the soil as have been removed by crops, resulting in continuous depletion of soil fertility.

This can be offset only by adopting soil testing and applying integrated plant nutrient supply (IPNS) as has been enunciated as "The Law of Optimum", which has been demonstrated and validated in numerous farmer's field for obtaining targeted yield of crops under the All India Co-ordinated Research Project on Soil Test Crop Response (AICRP-STCR) project annual reports (Ramamoorthy and Velayutham, 2011, Tandon 2014 and Velayutham *et al.*, 2016).

Figure 1: Field view of test cotton crop

Methodology

The experiments were conducted at farmer's field of Varichikudy village of Karaikal district, Puducherry UT during 2020. The area comes under Thirunallar soil series which occupies 26.14 % of soils of the district.

Following the inductive methodology of Ramamoorthy *et al.* (1967), the experiment was conducted in 2 phases. In the 1st phase, fertility gradient experiment was conducted by raising Rice (ADT 45) as an exhaust crop during 2019. For this, the field was divided into three equal which were fertilized with $N_0P_0K_0$ (strip-I), $N_1P_1K_1$ (strip-II) and $N_2P_2K_2$ (strip-III) levels to create fertility gradient. Subsequently, in the second phase, after the harvest of the exhaust crop, Cotton hybrid (RCH 659) was raised as test crop. Each of the fertility strips was subdivided into 24 sub-plots resulting in 72 plots. There were 24 treatments consists of four levels of N (0, 60, 120 and 180 kg ha^{-1}), P_2O_5 (0, 30,60 and 90 kg ha^{-1}), K_2O (0, 30, 60 and 90 kg ha^{-1}) and FYM (0.6.25 and 12.5 t ha^{-1}).

The moisture and N, P_2O_5 and K_2O contents of FYM were 26, 0.56, 0.32 and 0.51 %, respectively.

Using the data on crop yield, nutrient uptake, pre-sowing soil available nutrient status and fertilizer doses applied, the basic parameters used in developing STCR based fertilizer prescription equation viz. nutrient (NR), contribution of nutrients from soil (CS), fertilizer (CF) and FYM (CFYM) were calculated as per procedure described by Ramamoorthy *et al.*(1967) and Santhi *et al.*(2002).

Table 1: Nutrient requirement, per cent contribution of nutrients from soil, fertilizer and FYM for cotton.

Parameters	Basic Data			Response yard stick (kg kg^{-1})
	N	P_2O_5	K_2O	
Nutrient requirement (kg q^{-1})	3.49	2.37	4.22	6.64
Contribution (%) from soil (Cs)	10.82	14.03	10.88	
Contribution (%) from fertilizers (Cf)	47.90	68.35	98.20	
Contribution (%) from FYM (Cfym)	38.45	21.25	26.04	

Table 2: Soil test based fertilizer N and reduction in N fertilizer requirement for different yield targets of cotton under IPNS

Treatments							
KMnO$_4$-N (kg ha^{-1})	NPK alone (kg/ha)	NPK + FYM 6.25 t ha^{-1} (kg/ha)	Fertilizer saving (kg ha^{-1})	% reduction over NPK	NPK + FYM 12.5 t ha^{-1} (kg ha^{-1})	Fertilizer saving (kg ha^{-1})	% reduction over NPK
31 q ha^{-1}							
280	163	137	26	15.9	111	52	31.9
300	158	132	26	16.4	106	52	32.9
320	154	128	26	16.8	102	52	33.7
340	149	123	26	17.4	97	52	34.8
360	145	119	26	17.9	93	52	35.8
380	140	114	26	18.6	88	52	37.0
400	136	110	26	19.1	84	52	38.2
33 q ha^{-1}							
280	177	151	26	14.7	125	52	29.3
300	173	147	26	15.0	121	52	30.0
320	168	142	26	15.5	116	52	30.9
340	164	138	26	15.9	112	52	31.7
360	159	133	26	16.4	107	52	32.7
380	155	129	26	16.8	103	52	33.5
400	150	124	26	17.3	98	52	34.7
35 q ha^{-1}							
280	192	166	26	13.5	140	52	27.1
300	187	161	26	13.9	136	52	27.8
320	183	157	26	14.2	131	52	28.4
340	178	152	26	14.6	127	52	29.2
360	174	148	26	14.9	122	52	29.8
380	169	143	26	15.4	117	52	30.8
400	164	139	26	15.9	113	52	31.7

This soil is classified as fine, smectitic isohyperthermic, *Typic Haplusterts*. The soils of experimental field was slightly alkaline (pH - 8.5), non-saline in reaction and sandy clay loam in texture. The P and K fixing capacities of the soil were 150 and 100 kg ha^{-1}, respectively. The fertility status of the soil is low in $KMnO_4$-N (268.4 kg ha^{-1}) and medium in organic carbon (0.69 %) and high in Olsen-P (48.5 kg ha^{-1}) and NH_4OAc-K (351 kg ha^{-1}). The experiment was carried out after the application of gypsum.

The percent nutrient contribution of nutrients from soil (CS), fertilizer (CF) and FYM (CFYM) were found to be 10.82, 47.90 and 38.45 for N, 14.03, 68.35 and 21.25 for P_2O_5 and 10.88, 98.20 and 26.04 for K_2O respectively.

Based on fertilizer prescription equations and nomograms formulated for a range of soil test values and desired yield target for cotton.

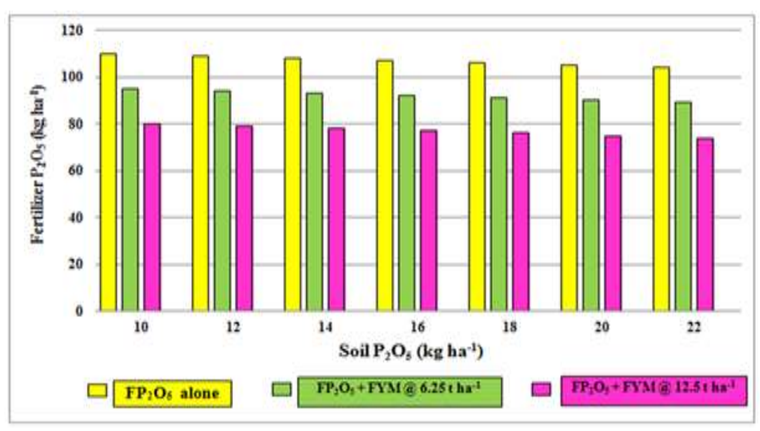

Figure 2: Soil test-based fertilizer P doses for 33 q ha^{-1} of cotton

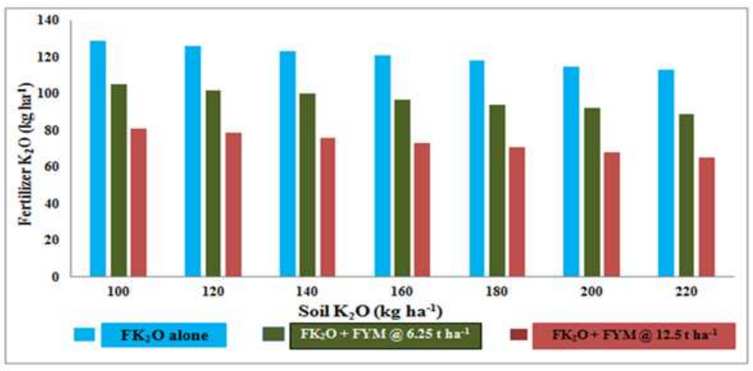

Figure 3: Soil test-based fertilizer K doses for 33 q ha^{-1} of cotton

Conclusion

It was revealed that under the treatment NPK + FYM @ 12.5 t ha^{-1} with 26 per cent moisture and 0.56,0.30 and 0.42 percent N,P and K , respectively, there was a saving of 52, 30 and 48 kg of fertilizer N , P_2O_5 and K_2O, respectively.

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