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Yield and Available Nutrient Status as Influenced by Nutrient Management Practices in Cotton

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ABSTRACT

In general, soils of Namakkal district are deficient in organic carbon (71%), available nitrogen (78%), zinc (86%), boron (29.5) and sulphur (18.6%) due to lack of nutrient management practices resulting in considerable decline in soil fertility and crop productivity. Hence, on farm trials was conducted at five farmer's field during summer season, 2020. Nutrient management practices developed from TNAU, Coimbatore, 2012 and CICR, Coimbatore 2016 were tested along with farmer's practice. TNAU practice was application of FYM @ 12.5 t/ha + Biofertilizers @ 2 kg/ ha + 100% RDF as per soil test + Mn mixture @12.5 kg/ha, CICR practice was FYM @ 5 t/ha and raise sunnhemp @ 15 kg/ha and in-situ incorporation in burrows within 30-45 d + Biofertilizers @ 2 kg/ha + 100per cent RDF as per soil test + Mn mixture @ 12.5 kg/ha and farmer's practice was application of DAP @ 125 kg/ha as basal dose and complex fertilizer (17:17:17) and muriate of potash each @ 50 kg/ha@ 45 d after planting were assessed. The results revealed that CICR recommended practice recorded the highest yield of 16.39 q/ha with net return of Rs.50941 ha^{-1} and BC ratio of 2.36. Incorporating green manure as one of the nutrient components recorded significant changes in available N status (27 kg/ ha) and organic carbon (0.08%) over its initial value, thereby the farmers can save up to Rs. 6500/-ha.

Key Words: Cotton-Nutrient Managementoptions-Yield-Economics-Soil properties

INTRODUCTION

Cotton is the major fibre crop in Tamil Nadu and cultivated to an extent of 1900 ha in Namakkal district. Continuous and intensive cropping without adequate restorative practices may pose threats to sustainability of agriculture. Indiscriminate and injudicious application of fertilizers without soil testing may have deleterious effect on soil health. As per test values, Namakkal district soils are 73per centdeficient in available nitrogen, 72% deficient in organic carbon, 86 per cent deficient in zinc, 29.5per cent deficient in boron, 19.2per cent deficient in sulphur, 5 per cent deficient in copper, 2.6per cent deficient in manganese and 2per cent deficient in iron. Nutrient depletion in soil affects the yield irrespective of soil and crops. In Namakkal district, cotton crops are being cultivated under both irrigated and rainfed condition. With the aim to influence the soil fertility and cotton yield, the performances of TNAU and CICR recommended nutrient management practices were assessed during 2020.

MATERIALS AND METHODS

On farm trials (OFT) was conducted at five farmer's field under summer season during 2020. The cotton variety Surabi was taken as the test crop. Nutrient management practices developed from Tamil Nadu Agricultural University (TNAU), Coimbatore, 2012 and Central Institute for Cotton Research (CICR), Coimbatore 2016 were tested along with farmer's practice. TNAU nutrient

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Table 1. Influence of nutrient management option on yield and economics of cotton crop (Mean of 5 replicates).

Particular	No. of bolls per plant	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross income (Rs./ha)	Net returns (Rs./ha)	B:C Ratio
Farmer's practice (FP)	52	12.31	41361	66452	25091	1.61
TNAU practice (TO1)	69	15.42	43919	83268	39349	1.90
CICR practice (TO2)	73	16.39	37544	88484	50940	2.36
SEd	0.313	0.056				
CD (P0.05)	0.664	0.120				

management practice was application of FYM @ 12.5 t/ha + Biofertilizers @ 2 kg/ha+100per cent RDF as per soil test + Mn mixture @12.5 kg/ha, whereas CICR practice was FYM @ 5 t/ha and raise sunnhemp @ 15 kg/ha and in-situ incorporation in burrows within 30-45 d + Biofertilizers @ 2 kg/ha + 100per cent RDF as per soil test + Mn mixture @ 12.5 kg/ha. The farmers practice was aapplication of DAP @ 125 kg/ha as basal dose, complex fertilizer (17:17:17) and muriate of potash each @ 50 kg/ha @ 45 d after sowing. Except nutrient management practices, all other package of practices were carried out as per the TNAU crop production guide.

Soil samples were collected in initial and post harvest soils for assessment and soil properties were studied as per standard procedures. pH and EC were determined in Soil: Water (1: 2.5ratio) extract by potentiometric and conductometric methods respectively (Jackson, 1973). Organic carbon was estimated by chromic acid wet digestion method (Walkley and Black, 1934). Available N in soil was estimated by alkaline permanganate method (Subbiah and Asija, 1956), available P by Colorimetry method (Olsen *et al*, 1954), available K by Neutral Normal Ammonium Acetate method (Stanford and English, 1949), available S by Turbidimetric method (Williams and Steinbergs, 1959) and available micronutrients Zn and B by colorimetric estimation using Mridaparikshak kit supplied by Nagarjuna Agro chemicals Pvt. Ltd., Hyderabad

RESULTS AND DISCUSSION

Yield and economics of cotton

Cotton yield was recorded the highest 16.39 q/ha in CICR recommended practice (FYM @ 5 t/ha and sunnhemp @ 15 kg/ha raised and in-situ incorporation in burrows within 30-45 d after planting + Biofertilizers @ 2 kg/ha + 100per cent RDF + Mn mixture @ 12.5 kg/ha), followed by TNAU practice (15.42 q/ha) and the lowest observed in farmer's practice (12.31 q/ha). Similarly, number of bolls/plant also recorded more (73) in TO2 and recorded lower (52) in FP (Table 1). The overall effect of inter sowing and in situ incorporation of any green manures on yield attributes and yield of cotton was significant irrespective of the seasons as compared to sole cotton (without intercropping any green manure). Similar finding was reported by Vaiyapuri *et al* (2007). The yield increase recorded in TO2 and TO1 was 33.14per cent and 25.26per cent, respectively, as compared to FP. Maximum gross return (Rs.88484/ha), net return (Rs.50940/ha) and benefit cost ratio (2.36) received in TO2, followed by TO1 and FP.

Influence of nutrient management options on soil properties

Initial soil analysis

Initial status of study soil sample was neutral (7.25) and non saline soil (0.052 dS m^{-1}) and low in organic carbon (0.47%). The availability of nitrogen, phosphorus and potassium were recorded as low (255 kg/ha), high (29.65 kg/ha) and medium

Table 2. Nutrient management option on initial soil properties in cotton crop (Mean of 5 replicates)

Parameters	pH	EC (dS/ m)	OC (%)	Avail. N (kg/ha)	Avail. P (kg/ha)	Avail.K (kg/kg)	Avail. S (mg/kg)	Avail. Zn (mg/kg^{1})	Avail. B (mg/kg)
Initial soil test value	7.25	0.052	0.47	255	29.65	178	17.64	1.05	0.45

(178 kg/ha), respectively (Table 2). Available sulphur content was recorded as high (17.64 mg/ kg), whereas, the available zinc (1.05 mg/kg) and boron (0.45 mg/kg) were insufficient.

Post harvest soil analysis

Soil pH was ranged from 7.45 to 7.56, EC ranged from 0.051 to 0.056 dS m^{-1} in post harvest soil samples collected from OFT trials. The results furthermore, revealed that treatment was not recorded greater changes in pH and EC when compared to initial experiment soils. This might be due to natural buffering capacity of soil to resist abrupt changes on soil properties by fertilizer scheduling (Table 3). The findings of Arulmozhiselvan *et al* (2013 & 2015) under long term fertilizer experiment of Tamil Nadu manifested that, normal quantity of nutrients with right source and proper nutrient scheduling does not alter the soil pH and EC significantly.

Maximum value of organic carbon (0.55%) was recorded in TO2, followed by TO1 (0.53%) and recorded minimum value (0.47%) in FP. There was an increase of 0.08per cent noticed from TO2, 0.06per cent from TO1 and 0.02 decrease from FP over its initial value of OC in trial (Table 3 & Fig.1). Due to the addition and incorporation of green manure crops significantly increased the organic manure content at various growth stages of plant (Singh *et al*, 2009).

Regarding available N, the value ranged from 250 to 282 kg/ha^{1}. The highest value recorded in TO2 and the lowest value recorded in FP. There was recorded an appreciable change in available N status 27 kg/ha and 32 kg/ha in TO2 and 13 kg/ha and 18 kg/ha in TO2 than initial value of experimental soil and post harvest soil of FP, respectively. The built up of N might be due to incorporation of green manure crop sunnhemp which has greater potential to fix atmospheric N in the root zone of crop (Table 3 & Fig.2). With respect to available P & K, TO2 recorded 30.82 kg/ha in P and 189 kg/ ha in K which was 3.95per cent (1.17 kg/ha) and 6.18 per cent (11 kg/ha) increase higher than initial soil test value, respectively. Regarding secondary and micronutrient status, there were minimum significant changes observed in TO2 followed by TO1 when compared to FP. Reduction of C-N ratios by decomposition of plant biomass and atmospheric N fixation through leguminous green manures might be the reasons for higher nutrient availability in post harvest soils of cotton (Divya Bhayal*et al*, 2018). In general, the mineralization losses of N from plant biomass is minimum than mineral N and favourable changes in soil pH due to the release of acids during composting of biomass, could significantly contributed to enhancement in N and P availability. Furthermore, according to findings of Selvi and Kalpana (2009), the practicing of green manuring as sole or intercropping with main crop significantly mobilizes nutrients like S, P, Si, Zn, Cu, Mn and other nutrient elements. The results also revealed that farmerscould save up to Rs. 6500/ha by sowing of green manure, skipping of one weeding and reduced application of FYM @ 5 t/ ha. The cost of sunnhemp seeds could be met out by atmospheric N addition, soil fertility improvement, reduction in inorganic fertilizer application.

CONCLUSION

Improved cotton yield, reduction in one weeding cost by sowing and incorporation of sunhemp in

Table 3. Influence of nutrient management option on soil properties in post harvest soil of cotton crop (Mean of 5 replicates)

Parameter	pH	EC (dS/m)	OC (%)	Avail. N (kg/ha)	Avail. P (kg/ha)	Avail.K (kg/kg)	Avail. S (mg/kg)	Avail. Zn (mg/kg^{1})	Avail. B (mg/kg)
Farmer's practice (FP)	7.45	0.056	0.45	250	27.68	169	16.60	0.99	0.43
TNAU practice(TO1)	7.56	0.051	0.53	268	30.65	185	18.76	1.08	0.45
CICR practice(TO2)	7.37	0.055	0.55	282	30.82	189	18.75	1.12	0.45
SEd	0.16	0.001	0.010	5.86	0.493	0.413	0.038	0.003	0.004
CD (P0.05)	NS	NS	0.021	12.25	0.102	0.863	0.079	0.006	0.008

between rows of cotton, buildup of 27 kg/ha in aval. N & 0.08per cent in OC was recorded in CICR practice. By seeing the results of OFT trial, 15 farmers in and around the villages started practicing sunnhemp intercropping in cotton in an area of 12 ha of Namakkal district.

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