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STUDIES ON MANAGEMENT OF INORGANIC AND ORGANIC NUTRIENTS ON YIELD AND QUALITY OF SEED COTTON

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Soil Test Crop Response field experiment was conducted at Tamil Nadu Agricultural University Farm, Coimbatore on Typic Ustivertept with cotton MCU 9 as test crop. The influences of inorganic nutrients as fertilizers and organic nutrients as farm yard manure on yield and quality parameters were studied for seed cotton. Four levels of N (0, 60, 120, 180 kg/ha), 3 levels of P_2O_5 and K_2O (0, 17, 34 kg/ha) and 3 levels of FYM (0, 6, 12 t/ha) were tried.

The results indicated that N fertilization and FYM incorporation significantly influenced the yield. P and K additions were not so impressive. Potash application exerted a positive trend on the quality parameters except firmness of fibre. FYM incorporation prominently influenced the ginning percentage. The post-harvest soil analysis revealed that there was a build up of the organic corbon status. The alk. $KMnO_4$-N status was also considerably enhanced at higher levels of FYM incorporation while NH_4OAc-K Was reduced prominently, however the soil contained sufficient available K.

The rapid expansion of cotton textile industry in India has warranted increased production of seed cotton to bridge the growing gap between production and consumption. Cotton is grown in India over an area of 8.0 million hactares with an annual production of 92 lakh bales of raw cotton and the consumption in near future is estimated to be 86 82 lakh bales (Anon. 1977). It has also been pointed out that to reach self sufficiency in cotton 15, 18 and 33 lakh bales should be produced in addition to the existing production within the year 1976 to 1979, 1979 to 1984 and 1984 to 1994 respectively (Chokhey Singh, 1977). By 2000 AD the requirement is 120 lakh bales.

In Tamil Nadu cotton is cultivated over an area of 3 5 lakh ha with a total production of 4 lakh bales of seed cotton while the textile industry requires about 12 lakh bales annua lly. The shortfall in production could only be achieved by adoptiog improved package of practices in a large scale. Experiences in other cotton growing countries like U.S S R, U.A.R. etc. indicate that the yields could be considerably increased by proper fertilization, good management coupled with integrated control of pests and diseases.

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Among the various inputs for increased yield and quality fibre, the fertilizer probably ranks first. With a view to study the effects of different doses of organic and inorganic nutrienta on yield and quality of fibre, this investigation was taken up.

MATERIALS AND METHODS

The STCR field experiment conducted during September 1982 - March 1983 with cotton MCU 9 as test crop grown on Typic Ustivertept (mixed black soil) at Tamil Nadu Agricultural University Farm, Coimbatore was utilised in this study.

The pre-sowing soil analysis revealed that the soil is of clay in texture with low in Alk. $KMnO_4$ -N, medium in Olsen,s-P and high in NH_4 OAc-K. The organic corbon content was 0.75 per cent with CEC of 26.3 me/100 g soil. The soil was free from sodicity (pH 8.1) and salinity (0.48 mmhos/cm) (Table 1).

TABLE 1. Physico-Chemical Characteristics of the Soil (Typic Ustivertept)

Properties			
Coarse sand (per cent)	—	—	27.05
Fine sand (Per cent)	—	—	24.10
Silt (per cent)	—	—	14.60
Clay [per cent]	—	—	33.40
pH	—	—	8.1
Electrical Conductivity [m.mhos/cm]	—	—	0.48
Cation Exchange Capacit [me/100 g soil]	—	—	26.3
Organic carbon [per cent]	—	—	0.75
KMnO,-N [kg/ha]	—	—	265
Olsen-P [kg/ha]	—	—	16.8
NH,OAc-K [kg/ha]	—	—	735

The test crop cotton MCU 9 was raised with 4 levels of N (0, 60, 120, 180 kg/ha), 3 levels of P_2O_5 and K_2O (0, 17, 34 kg/ha) and 3 levels of FYM (0, 6, 12 t/ha). Seed cotton yield was recorded. The kapas was analysed for quality parameters - ginning percentage, fibre length, fineness and bundle strength.

The post-harvest soil samples were analysed for alk. $KMnO_4$ - N

(Subbiah and Asija, 1956), Olsen's-P (Olsen *et al.*, 1954), neutral normal NH_4 OAc extractable K (Stanford and English, 1949) and organic carbon (Walkley and Black, 1934). Simple correlations were worked out on yield and quality parameters with organic and inorganic nutrients.

RESULTS AND DISCUSSION

Effect of fertilizers and FYM on yield

The seed cotton yield as influenced by the inorganic and organic nutrients are presented in Table 2. The results indicated that the application of FYM significantly influenced the yield irrespective of the levels tried. The addition of FYM at 12 t/ha (56.6 kg N, 28.4 kg P, 61.7 kg K) increased the yield significantly (F_0 - 16.71 q/ha, F_2 - 22.37 q/ha). Among the N levels, N application at 120 kg/ha recorded the highest seed cotton yield of 27.55 q/ha over the other levels. Quadratic trend in N levels was observed as seen from the mean yield, since the yield was prominent only up to 120kg N/ha, and a mild reduction in the yield of seed cotton at 180 N/ha. Rijke and Harrop (1969) reported that higher rates of nitrogen lead to a greater leafiness than was desirable and extensive leaf development was often associated with reduced seed cotton yields. The probable reason could be that higher N levels could have influenced the foliage growth rather than the yield. Hence the yield decline beyond 120 kg N/ha may be due to the greater pest infestation expected from foliage development resulting in a more conducive environment for survival and multiplication of insects and pests.

Phosphorus exhibited an insignificant response on seed cotton yield. Potassium application produced an variation ranging from 19.88 q/ha at K_0 level to 20.13 q/ha at K_2 level. Though there was numerical increase in yield of seed cotton, however, it was statistically not significant. The lack of response for P and K additions may be due to the available phosphorus and potassium status of the soil were sufficiently high to meet the requirements of the cotton crop

TABLE 2. Effect of Organic and Inorganic Nutrients on Seed Cotton Yield [q/ha] (Mean Values)

S. No.	FYM levels	Yield [q/ha]	N levels	Yield [q/ha]	P levels	Yield [q/ha]	K levels	Yield [q/ha]
1	F_0	16.71	N_0	16.71	P_0	18.25	K_0	19.88
2	F_1	20.58	N_1	19.75	P_1	18.94	K_1	19.18
3	F_2	22.37	N_2	27.55	P_2	18.64	K_2	20.13
4	—	—	N_3	21.33	—	—	—	—
CD [P=0.05]		1.28		2.34		NS		NS

NS — Not significant

Effect of fertilizers and FYM on quality paremeters

The FYM application significantly influenced the ginning percentage. However the levels of FYM additions were not differentiated in influencing the ginning percentage whereas the parameters - fibre length, fineness and bundle strength were remained unaffected due to FYM incorporation.

Nitrogen application did not exert any significant change in the quality parameters of seed cotton. However the visible reduction in fibre length (30.9 mm at N_0 level to 29.6 mm at N_4 level) and fineness (2.95 X 10^{-6} g/in at N_0 level to 2.8 X 10^{-6} g/in at N_4 level) were observed. The similar trend was also observed with phosphorus feriilization.

TABLE 3. Influence of Organic and Inorganic Nutrients on Quality of Cotton (Mean values)

S. No.	Fertilizer levels	Ginning percentage	Fibre length [mm[	Fibre fineness micronaire [10^{-6}g/in]	Bundle Strength '0' gauge[g/tex]
1	N_0	36.5	30.9	2.95	41.8
2	N_{20}	36.5	31.4	2.95	41.3
3	N_{40}	37.9	31.6	3.05	41.3
4	N_{60}	37.2	29.6	2.80	41.8
		NS	NS	NS	NS
5	P_0	37.8	31.8	3.00	42.3
6	P_{17}	37.6	30.2	3.10	42.3
7	P_{34}	37.3	31.0	2.80	41.4
		NS	NS	NS	NS
8	K_0	35.0	29.0	2.85	40.7
9	K_{17}	37.3	30.3	2.95	41.8
10	K_{34}	37.8	31.6	3.05	43.9
	CD [P=0.05]	1.2	1.3	NS	0.9
11	F_0	34.1	30.5	2.85	41.8
12	F_{17}	36.6	30.7	3.00	41.3
13	F_{34}	36.8	31.6	3.25	41.8
	CD [P=0.05]	1.5	NS	NS	NS

NS → Not significant

TABLE 4. Post-Harvest Soil Fertility Status [kg/ha]
[Mean values]

FYM				N				P				K			
OC (%)	N	P	K	OC (%)	N	P	K	OC (%)	N	P	K	OC (%)	N	P	K
0.79	235	12.6	685	0.78	228	12.7	675	0,76	230	12.8	675	0.77	225	11.8	680
0.83	255	19.7	697	0.80	235	12.7	685	0.76	235	14.7	690	0.79	240	12.1	705
0.85	275	14.4	705	0.82	250	14.0	685	0.77	235	16.8	685	0.79	243	12.3	725
—	—	—	—	0.83	275	14.0	690	—	—	—	—	—	—	—	—

N = Alk.KMn_2O_4-N (kg/ha)

P = Olsen's P (kg/ha)

K = NH_4OAc-K (kg/ha)

N 1, 2, 3, 4 - 0, 60, 120, 180 kg/ha

P 1, 2, 3 - 0, 17, 34 kg/ha

F 1, 2, 3 - 0, 17, 34 kg/ha

FYM 1, 2, 3 - 0, 6, 12 t/ha

Potassium application significantly increased the ginning pertentage, fibre length and bundle strength whereas the fineness of the fibre was not influenced. It was clearly observed that K application had marked influence in increasing the ginning percentage from 35.0 (K_0) to 35.8 (K_3). Similarly the fibre length was considerably enhanced from 29.0 mm (K_0) to 31.6 (mm K_3). The bundle strength also showed a positive relationship with K application and enhanced from 40.7 to 43.9 k/tex. The probable reason could be the adplication of potassium would have played a vital role in the translocation of photosynthate earlier and in the conversion of photosynthetic materials to cellulose in the later stage which in turn could have helped in improving the above mentioned quality parameters such as ginning percentage, fibre length and bundle strength.

Effect of added nutrients on soil fertility

The results of post-harvest soil analysis showed that organic carbon status was considerably enhanced from 0.76 to 0.85 per cent. It was clearly observed that the addition of FYM considerably increased the organic carbon per cent from 0.79 [F_0] to 0.85 [F_2] and higher levels of N fertilization increased organic carbon contentent to 0.83 per cent which may be due to vegetative growth and subsequent leaf fall on the soil could have favoured in increasing the organic carbon content of the soil. Due to the addition of phosphorus and potassium, the organic matter status was not altered.

FYM as well N fertilizers increased alk. $KMnO_4$ - N considerably from 228 to 275 kg/ha. FYM, nitrogen and potassium application had a very mild influence on the build up of available phosphorus status whereas phosphorus fertilization considerably enhanced the Olsen's-P [12.8 to 16.8 kg/ha]

Potassium levels significantly increased the build up of available K (680 to 720 kg/ha), while FYM, nitrogen and phosphorus addition had not exerted any marked influence on available potassium status.

CORRELATION STUDIES

The simple correlation between fertilizer nutrients on yield/quality revealed that among the inorganic nutrients, nitrogen significantly related to seed cotton yield ($r=0.628^{**}$). K addition was positively associated with ginning percentage ($r=0.692^{**}$), fibre length ($r=0.687^{**}$) and bundle strength [$r=0.682^{**}$] [Table 5].

TABLE 5. Correlations Between Fertilizers and Yield / Quality (N=16 pairs)

S. No.	Yield/quality [y]	Fertilizer [x] N	P	K
1	Cotton Yield	0.628**	NS	NS
2	Ginning percentage	NS	NS	0.692**
3	Fibre length	NS	NS	0.687**
4	Fineness	NS	NS	NS
5	Bundle strength	NS	NS	0.682**

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PERFORMANCE OF GRAM UNDER GRADED LEVELS OF IRRIGATION AND FERTILIZATION

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The field studies on the effect of irrigation and fertilization on production potential of gram (*Cicer arietinum* L.) during 1979-80 and 1980-81 revealed that it responded favourably to one irrigation applied at preflowering stage (45 days after sowing) along with full recommended fertilizer dose of 20-60-30. One more post sowing irrigation was not found beneficial. The mean maximum water use efficiency (167.4 kg grain / cm ha) and nutrient response (33 82 kg grain / kg nutrient applied) were obtained, respectively under control irrigation (I_0) and 33.3% of recommended fertilizer dose (F_0). In the other way, lower water use efficiency and nutrient response were obtained under I_2 F_2 because of less unit increase in grain yield with each unit addition of fertilizer and irrigation water over I_0 F_0.

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