Quality characters of cotton as influenced by residual effect of INM practices and direct effect of inorganic fertilizer

S. Ramesh, P. Sudhakar and S. Elankavi

Assistant professor, Department of Agronomy, Faculty of Agriculture,
Annamalai University, Annamalainagar – 608 002.

ABSTRACT

Field experiment were carried out at the Annamalai University, Experimental Farm, Department of Agronomy, Annamalai Nagar, Tamil Nadu to study the quality characters of cotton as influenced by residual effect of INM practices and direct effect of inorganic fertilizer during January to June 2006 (first season) and January to June 2007 (second season). The whole research consist of two experiments, first experiment include rice and second experiment with rice fallow cotton. First experiment (rice) comprised of eight treatments with recommended dose of nitrogen and graded dose of nitrogen along with different organic manures. It was laid out in a randomized block design (RBD) and replicated thrice. With regard to second experiment (cotton) all the main plots of rice (experiment-I) was divided in to three equal sub plots divided in to three equal sub plots in which rice fallow cotton was raised without and with fertilizer at different levels (0, 75 per cent and 100 per cent RDF). This paper mainly deals with quality characters of cotton crop under rice – cotton cropping system. The results of the experiment showed that among the main plots treatment, residual effect of 100% RDN + vermicompost @ 5 t ha^{-1} had significantly registered higher values of seed index and lint index. Also the same treatment registered numerically higher values *viz.*, bundle strength (g tex^{-1}), mean fibre fineness (Micronaire 10^{-6} g inch^{-1}) and fibre length. In respect of inorganic fertilizer, S_3 (100% RDF) registered higher values of seed index, lint index, ginning percentage, bundle strength, mean fibre fineness and fibre length. However, seed index and lint index were found significant only over control. Other quality parameters were not significant.

Keywords: Cotton, Ginning percentage, Seed index, Lint index, Bundle strength (g tex^{-1}), Mean fibre fineness (Micronaire 10^{-6} g inch^{-1}), Fibre length

Introduction

Cotton (Gossypium sp.), most important fiber crop plays a dominant role in its agrarian and industrial economy. It is backbone of our textile industry, accounting for 70 per cent of total fiber consumption in textile sector, 11 per cent to industrial production, 14 per cent to the manufacturing sector, 4 per cent to the GDP and 38 per cent of the country export, fetching over Rs. 214918.45 crores. (Ananymous, 2007). In India it's grown over an area of 116.14 lakh hectares with production of 334 lakh bales and productivity of 571 kg ha^{-1}. It is the most beneficial fiber and cash crop of India and earns a good fortune for the country in the form of foreign exchange . Increased nitrogen rate resulting in increased biological yield may be due to increase in N rate and increases mineral uptake, photosynthetic assimilation and accumulation in sinks Sawan *et al.,* (2006). The decline in soil fertility due to imbalanced fertilizer use has been recognized as one of the most important factor limiting crop yields (Nambiar *et al.,* 1989). Decline in yield has been observed in many cropping systems in many parts of the country due to nutrient depletion, soil structure deterioration and imbalanced use of plant nutrients, acidification, and sub-optimal addition of organic and inorganic fertilizers to soil. The capacity of soil for sustaining production depends on its fertility status.

Organic manures like green manure, pressmud and vermicompost deserves priority for sustained production and better utilization in intensive cropping system. The existing system of fertilizer management in

cropping system is based on the nutrient requirement of individual crop ignoring the carry over effect of manure or fertilizer applied to the preceding crop. Indications are also available of saving some fertilizer, if fertilizer management is done for the cropping system as a whole. Residual effect of nutrients may be more pronounced for organic sources of nutrients applied to the preceding crop, benefiting the succeeding crop to a greater extent (Hegde, 1998) and the system productivity becomes sustainable through integrated use of organic and inorganic sources of nutrients (Singh and Yadav, 1992). Therefore, the present investigation was study the quality characters of cotton as influenced by residual effect of INM practices and direct effect of inorganic fertilizer under tail end area of Cauvery Deltaic Zone of Tamil Nadu (India). This article mainly deals with quality characters of cotton crop under rice – cotton cropping system.

Materials and methods

Field experiment were carried out in farmlands of Faculty of Agriculture, Annamalai University to study the quality characters of cotton as influenced by residual effect of INM practices and direct effect of inorganic fertilizer during January to June 2006 (first season) and January to June 2007 (second season). The average annual rainfall of Annamalainagar is 1250 mm, distributed over 51 rainy days. The mean maximum and minimum temperature are 30.8°C and 24.7°C respectively. The soil of the experimental field was having a pH of 7.1 and EC of 0.32 dSm^{-1}. Taxonomically the soil is classified as Udic chromustert, low in available nitrogen (201 kg ha^{-1}), medium in available phosphorus (20.9 kg ha^{-1}) and high in available potassium (277 kg ha^{-1}). The whole research consist of two experiments, first experiment include rice and second experiment raised with rice fallow cotton. The first experiment (rice) comprised of eight treatments. It was laid out in a randomized block design (RBD) and replicated thrice. In respect of cotton, All the main plots of rice (experiment I) were divided in to three equal sub plots in which rice fallow cotton was raised without and with fertilizer at different levels (0, 75 per cent and 100 per cent RDF) in both the season. It was conducted in a split plot design and replicated thrice.

Treatment details:

Rice (Experiment-I) : T_1 - Control (No fertilizer and no organic manure), T_2 - 100% RDN (Recommended dose of nitrogen), T_3 - T_2 + Green manure @ 6.25 t ha^{-1} , T_4 - 75% RDN + Green manure @ 6.25 t ha^{-1} , T_5 - T_2 + Vermicompost @ 5 t ha^{-1} , T_6 - 75% RDN + Vermicompost @ 5 t ha^{-1} , T_7 - T_2 + Pressmud @ 10 t ha^{-1} , T_8 - 75% RDN + Pressmud @ 10 t ha^{-1} .

Cotton (Experiment- II) : Main plot treatments: Residual effect of INM practices of rice (experiment I) on rice fallow cotton. : T_1 - Control (No fertilizer and no organic manure), T_2 - 100% RDN (Recommended dose of nitrogen), T_3 - T_2 + Green manure @ 6.25 t ha^{-1} , T_4 - 75% RDN + Green manure @ 6.25 t ha^{-1} , T_5 - T_2 + Vermicompost @ 5 t ha^{-1} , T_6 - 75% RDN + Vermicompost @ 5 t ha^{-1} , T_7 - T_2 + Pressmud @ 10 t ha^{-1} , T_8 - 75% RDN + Pressmud @ 10 t ha^{-1} . **Sub plot treatments**: NPK fertilizer to rice fallow cotton. S_1 - 0% RDF (No fertilizer), S_2 - 75% RDF, S_3 - 100% RDF.

For rice, recommended dose of 150:50:50 kg ha^{-1} of N, P_2O_5 and K_2O was applied. The following organic manures were used in the study *viz.,* vermicompost, pressmud and green manure**.** All the organic manures were applied as per treatment schedule basally one week before transplanting of rice. For cotton, LRA 5166 chosen for this study and adopting seed rate of 7.5 kg ha^{-1} (acid delinted). The seeds were dibbled in rice stubbles immediately after harvest of rice. Two seeds $hill^{-1}$ were dibbled at a depth of 3 cm at waxy condition of the soil and adopting a spacing of 60 x 30 cm. Recommended dose of 60:30:30 kg ha^{-1} of N, P_2O_5 and K_2O was uniformly applied to all plots. All other improved recommended package of practices were followed to rice fallow cotton, as per the Crop Production Guide. The following quality charecters of cotton was assessed *viz.,* Ginning percentage, Seed index, Lint index, Bundle strength (g tex^{-1}), Mean fibre fineness (Micronaire 10^{-6} g $inch^{-1}$) and Fibre length.

Quality characters of cotton

Ginning percentage

It denotes the ratio of the weight of lint to the weight of seed cotton and expressed in percentage. Ginning percentage was calculated by employing the formula suggested by Santhanam (1976).

$$\text{Ginning percentage} = \frac{\text{Weight of fruit}}{\text{Weight of seed cotton}} \times 100$$

Seed index

Weight of hundred seeds selected at random after ginning and was expressed in g (Santhanam, 1976).

Lint index

Lint obtained from ginning of hundred seed cotton was weighed and expressed in g (Santhanam, 1976).

Bundle strength (g tex^{-1})

It is a ratio of breaking strength of a bundle of fibre to its weight. Duplicate tufts of fibre weighing one mg were fed into the "presseley strength tester" which gave reading in lb mg^{-1}. The value was expressed in g tex^{-1} by multiplying the presseley strength index with 5.36 (Sundaram, 1974)

Mean fibre fineness (Micronaire 10^{-6} g inch^{-1})

Mean fibre fineness is a measure of fibre weight in mg g^{-1} unit length of fibre fineness. This was determined by air flow method using micronaire instrument (Santhanam, 1976).

 Fibre length

The fibre length was determined by "Bolls sorter", where the weight ratio method was adopted and expressed in mm (Sundaram and Iyengar, 1968).

The data on various studies recorded during the investigation were subjected to statistical scrutiny as suggested by Gomez and Gomez (1984).

Result and Discussion

Quality characters of cotton

Ginning percentage

The residual effect of INM on cotton had not significantly influenced the ginning percentage. Among the main plot treatments, T_5 (residual effect of 100% RDN + vermicompost @ 5 t ha^{-1}) registered numerically higher values of ginning percentage of 36.76 and 36.31 during first and second season respectively. However, it was not superior over other treatment in both the years. In respect of sub plot treatments, S_3 (100% RDF) registered numerically higher values of 36.80 and 36.36 ginning percentage during first and second season respectively than other treatments. The interaction effect was also not significant.

Seed index and lint index

Among the main plot treatments, T_5 (residual effect of 100% RDN + vermicompost @ 5 t   ha^{-1}) registered significantly higher values of   seed index (10.49 and 10.22) and lint index (5.21 and 5.00) in first and second season respectively. The next in order was T_6 (residual effect of 75% RDN + vermicompost @ 5 t ha^{-1}). The lowest seed index (9.51 and 9.19) and lint index (4.78 and 4.65) was recorded in first and second season respectively under T_1 (No fertilizer and no organic manure).
Among the sub plot treatments, S_3 (100% RDF) registered significantly higher values of seed index (10.41 and 10.14) and lint index (5.19 and 5.02) in first and second season respectively. The lowest seed index (9.57 and 9.32) and lint index (4.84 and 4.68) was recorded in first and second season respectively under S_1 (0% RDF). The interaction effect was not significant.

Bundle strength, mean fibre fineness and fibre length

Among the main plot treatments, T_5 (residual effect of 100% RDN + vermicompost @ 5 t   ha^{-1}) registered numerically higher values of bundle strength, mean fibre fineness and fibre length. However, there was no significant difference noticed among the treatments in both the years.

In respect of sub plot treatments, S_3 (100% RDF) registered numerically higher values of bundle strength, mean fibre fineness and fibre length than other treatment. It was not significantly superior over other treatments in both the years. Aforesaid results might be due to the fact that quality characters are predominantly governed by genetical make up of the cultivar and cannot be altered by agronomic strategies (Gurumurthy, 1993 and Venkanna *et al.*, 1998). But according to Babu *et al.* (1989) quality parameters did increase under agronomical management practices. Such contradictory results were also obtained by Mukundan *et al.* (1990) and Sawan (2001).

Table 1. Residual effect of INM practices and graded doses of fertilizer on ginning percentage in cotton during first and second season

Treatments	Ginning percentage							
	2006 (First season)				2007 (Second season)			
	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	Mean	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*
T_1	36.41	36.84	36.72	36.66	36.05	36.16	36.28	36.16
T_2	36.44	36.88	36.74	36.69	36.06	36.17	36.3	36.18
T_3	36.52	36.75	36.81	36.69	36.14	36.27	36.4	36.27
T_4	36.51	36.73	36.79	36.68	36.12	36.23	36.38	36.24
T_5	36.58	36.8	36.91	36.76	36.19	36.32	36.43	36.31
T_6	36.54	36.78	36.86	36.73	36.17	36.29	36.41	36.29
T_7	36.5	36.73	36.78	36.67	36.12	36.22	36.38	36.24
T_8	36.47	36.71	36.76	36.65	36.08	36.19	36.32	36.20
Mean	36.50	36.78	36.80		36.12	36.23	36.36	

	Main	Sub	M at S	S at M	Main	Sub	M at S	S at M
S.E$_D$	0.09	0.13	0.19	0.27	0.11	0.14	0.23	0.30
CD (p =0.05)	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Residual effect of INM practices and graded doses of fertilizer on seed index in cotton during first and second season

Treatments	Seed index							
	2006 (First season)				2007 (Second season)			
	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*
T_1	9.14	9.49	9.91	9.51	8.85	9.18	9.53	9.19
T_2	9.23	9.61	10.14	9.66	8.97	9.41	9.89	9.42
T_3	9.71	10.36	10.58	10.22	9.5	10.19	10.32	10.00
T_4	9.60	10.23	10.43	10.09	9.36	10.05	10.19	9.87
T_5	9.99	10.62	10.86	10.49	9.74	10.32	10.59	10.22
T_6	9.85	10.49	10.73	10.36	9.62	10.21	10.46	10.10
T_7	9.57	10.19	10.39	10.05	9.3	10.03	10.12	9.82
T_8	9.44	10.04	10.26	9.91	9.18	9.9	10.01	9.70
Mean	9.57	10.13	10.41		9.32	9.91	10.14	

	Main	Sub	M at S	S at M	Main	Sub	M at S	S at M
S.E$_D$	0.05	0.06	0.19	0.25	0.05	0.07	0.23	0.31
CD (p =0.05)	0.09	0.12	NS	NS	0.11	0.15	NS	NS

Table 3. Residual effect of INM practices and graded doses of fertilizer on lint index in cotton during first and second season

Treatments	Lint index							
	2006 (First season)				2007 (Second season)			
	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*
T_1	4.62	4.75	4.96	4.78	4.47	4.64	4.85	4.65
T_2	4.68	4.81	5.02	4.84	4.54	4.69	4.90	4.71
T_3	4.92	5.14	5.28	5.11	4.75	4.92	5.10	4.92
T_4	4.86	5.07	5.21	5.05	4.71	4.87	5.05	4.87
T_5	5.02	5.24	5.38	5.21	4.82	5.02	5.18	5.00
T_6	4.97	5.19	5.33	5.16	4.78	4.96	5.14	4.96
T_7	4.85	5.06	5.19	5.03	4.70	4.87	5.03	4.86
T_8	4.79	4.98	5.11	4.96	4.64	4.80	4.96	4.80
Mean	4.84	5.03	5.19		4.68	4.85	5.02	

	Main	Sub	M at S	S at M	Main	Sub	M at S	S at M
S.E$_D$	0.010	0.020	0.043	0.086	0.015	0.025	0.064	0.098
CD (p =0.05)	0.02	0.04	NS	NS	0.03	0.05	NS	NS

Table 4. Residual effect of INM practices and graded doses of fertilizer on bundle strength (g tex^{-1}) in cotton during first and second season

Treatments	Bundle strength (g tex^{-1})							
	2006 (First season)				2007 (Second season)			
	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*
T_1	28.13	28.49	29.23	28.62	28.92	29.35	30.05	29.44
T_2	28.19	28.54	29.26	28.66	28.99	29.41	30.10	29.50
T_3	28.3	28.96	29.44	28.90	29.11	29.79	30.28	29.73
T_4	28.28	28.91	29.38	28.86	29.09	29.73	30.22	29.68
T_5	28.35	29.05	29.52	28.97	29.16	29.88	30.36	29.80
T_6	28.31	29.01	29.47	28.93	29.12	29.84	30.31	29.76
T_7	28.25	28.91	29.37	28.84	29.06	29.73	30.21	29.67
T_8	28.22	28.86	29.32	28.80	29.02	29.68	30.16	29.62
Mean	28.25	28.84	29.37		29.06	29.68	30.21	

	Main	Sub	M at S	S at M	Main	Sub	M at S	S at M
S.E$_D$	0.08	0.13	0.17	0.28	0.11	0.15	0.24	0.32
CD (p =0.05)	NS	NS	NS	NS	NS	NS	NS	NS

Table 5. Residual effect of INM practices and graded doses of fertilizer on mean fibre fineness (10^{-6} g inch^{-1}) in cotton during first and second season

Treatments	Mean fibre fineness (10^{-6} g inch^{-1})							
	2006 (First season)				2007 (Second season)			
	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*
T_1	3.31	3.38	3.44	3.38	3.37	3.45	3.53	3.45
T_2	3.33	3.41	3.47	3.40	3.40	3.47	3.55	3.47
T_3	3.43	3.48	3.55	3.49	3.50	3.55	3.63	3.56
T_4	3.42	3.46	3.53	3.47	3.49	3.53	3.61	3.54
T_5	3.45	3.53	3.61	3.53	3.50	3.61	3.69	3.60
T_6	3.44	3.5	3.58	3.51	3.51	3.58	3.66	3.58
T_7	3.39	3.45	3.52	3.45	3.46	3.52	3.60	3.53
T_8	3.37	3.43	3.49	3.43	3.44	3.50	3.57	3.50
Mean	3.39	3.46	3.52		3.46	3.52	3.61	

	Main	Sub	M at S	S at M	Main	Sub	M at S	S at M
S.E$_D$	0.07	0.12	0.15	0.26	0.09	0.14	0.19	0.28
CD (p =0.05)	NS	NS	NS	NS	NS	NS	NS	NS

Table 6. Residual effect of INM practices and graded doses of fertilizer on fibre length (mm) in cotton during first and second season

Treatments	Fibre length (mm)							
	2006 (First season)				2007 (Second season)			
	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*	S_1 0% RDF	S_2 75% RDF	S_3 100%RDF	*Mean*
T_1	29.07	29.17	29.29	29.17	29.21	29.41	29.51	29.38
T_2	29.08	29.19	29.31	29.19	29.23	29.41	29.52	29.39
T_3	29.14	29.28	29.37	29.26	29.31	29.49	29.59	29.46
T_4	29.13	29.26	29.36	29.25	29.28	29.48	29.56	29.44
T_5	29.17	29.32	29.41	29.30	29.34	29.52	29.62	29.49
T_6	29.15	29.29	29.39	29.28	29.34	29.49	29.6	29.48
T_7	29.13	29.25	29.36	29.25	29.27	29.47	29.56	29.43
T_8	29.09	29.21	29.32	29.21	29.24	29.44	29.55	29.41
Mean	29.12	29.25	29.35		29.28	29.46	29.56	

	Main	Sub	M at S	S at M	Main	Sub	M at S	S at M
$S.E_D$	0.15	0.22	0.32	0.46	0.11	0.16	0.23	0.35
CD (p =0.05)	NS	NS	NS	NS	NS	NS	NS	NS

REFERENCES

Anonymous. (2007) Evaluation of new Bt hybrids of fertilizer levels. Annual Progess Report of Cotton Research. Agronomy and Soil Science, 2007, 24

Babu, M., R. Govindasamy and S.Chandrasekaran. 1989. Effect of humic acids on the yield and composition of peanut in calcareous soil. In: National seminar on 'Humic acids in agriculture", Annamalai Univ., Annamalai Nagar, Tamil Nadu, India. pp.131-138.

Gomez, K.A. and Gomez, A.A. 1984. Statistical procedures for agricultural research. A Willey Inter Science Publication, New York, pp.76-83.

Gurumurthy, S. 1993. Studies on irrigation, seedling technique and plant density and nitrogen management in summer irrigated cotton (MCU 7) under Periyar-Vaigai command area. **Ph.D. Thesis**, Tamil Nadu Agricultural Univ., Coimbatore, Tamil Nadu, India.

Hegde, D.M. 1998. Long term sustainability of productivity in rice (*Oryza sativa*) - Wheat (*Triticum aestivum*) system in sub humid ecosystem through integrated nutrient supply. **Indian J. Agron., 43**(2): 189-198.

Mukundan, S., K.V.Janardhanan, B.M.Reddy and A.S.Reddy. 1990. Effect of nitrogen and phosphorus on fibre quality of cotton. **J. Indian Soc. Cotton Improv., 15**(1): 30-33.

Nambiar, K.K. Mandal and Abrol, I.P.1989. Long-term fertilizer experiments in India –an over view. Fertilizer News. 34: 11-20.

Santhanam, V. 1976. Cotton low priced series (1). ICAR. New Delhi.

Sawan, Z. M., Mahmoud M. H and ElGuibali, A. H. (2006). Response of yield, yield components, and fiber properties of Egyptian cotton (Gossypium barbadense L.) to nitrogen fertilization and foliar-applied potassium and mepiquat chloride. The Journal of Cotton Science. 10:224–234.

Singh, G.B. and D.V. Yadav. 1992. INSS in sugarcane and sugarcane based cropping system. **Fert. News, 37**(4): 15-22.

Sundaram, V. 1974. Definition of some technical terms used in cotton development, trade and technology. **Cotton Dev., 4**(1): 35-40.

Sundaram, V. and R.C.N. Iyengar. 1968. Hand book of methods of tests for cotton fibre, yarns and fabrics. **In. Cotton Technol. Res.** Lab. ICAR, New Delhi.

Venkanna, K., S. Mukundan, S.P. Moula and S.N. Nagwekar. 1998. Effect of manures, fertilizers and monocropping on yield and fibre quality of cotton variety LK.861. **J. Indian Soc. Cotton improve., 22**(6): 120 - 123.