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EFFECT OF ORGANIC AND INORGANIC SOURCES OF NITROGEN ON GROWTH, YIELD AND QUALITY OF COTTON (*Gossypium hirsutum* L.)

***Ramesh, S., Sudhakar, P. and Elankavi S.**

Department of Agronomy, Faculty of Agriculture, Annamalai University, Tamilnadu, India

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ABSTRACT

A field experiment was conducted during 2013 at experimental farm, Faculty of Agriculture, Annamalai University to study the effect of organic and inorganic sources of nitrogen on growth, yield and quality of cotton. The soil of the experiment farm is deep clay, low in available nitrogen, medium in available phosphorus and high in available potassium. The experiment was conducted in randomized block design and replicated thrice. The experiment comprised of eight treatments which includes absolute control (No fertilizer and no organic manure), recommended dose of fertilizer alone and graded dose of fertilizer nitrogen along with different organic manures *viz.,* farmyard manure, pressmud compost, vermicompost, poultry manure, water hyacinth compost and sugar cane trash compost. Use of different sources and combination sources of nitrogen had significant influence on growth and yield of cotton. The results of the experiment showed that 75% N through fertilizer along with 25 % N through vermicompost significantly recorded maximum growth and yield of cotton over other organic manures in combination with inorganic fertilizer which was followed by 75% N through fertilizer along with 25 % N through pressmud compost. As per quality characters were concerned, INM practices had not significant influence on quality parameters *viz*., ginning percentage, bundle strength (g tex^{-1}) and fibre fineness. Significantly lowest values for growth attributes, yield attributes and seed cotton yield was recorded in the control (No fertilizer and no organic manure). Based on the above results, it could be concluded that 75% N through fertilizer along with 25%N through vermicompost will be more promising combination which resulted in higher yield of seed cotton.

INTRODUCTION

Cotton is popularly called as "White Gold" and is considered as "King of fibre crops". It is an important cash and fibre crop of global significance, which plays a dominant role in the world agriculture and industrial economy. Cotton accounts for more than 70 % of the raw fiber used by the world textile industry and handlooms. In India cotton is cultivated in an area of 12.65 million ha with a production of 40 million bales of lint. It contributes to 80 per cent of the raw material to the textile industry and provides employment to nearly 60 million people. India ranks first in area and second in global cotton production. The productivity of cotton in India is significantly lower (518 kg ha^{-1}) as compared to the four major cotton growing countries i.e. China (1300 kg ha^{-1}), USA (900 kg ha^{-1}), Pakistan (700 kg ha^{-1}) and Brazil (2027 kg ha^{-1}) (CICR, 2013). Lower cotton productivity could be attributed to highly varying factors and management practices mainly low soil fertility status. Among the nutrients, nitrogen is the key element to which cotton shows a good response, as most of the soils are low in N. It is most often the major limiting factor to cotton production, after water (Fageria *et al.,* 2011). Use of chemical fertilizers alone does not sustain productivity under continuous intensive cropping, whereas inclusion of organic materials improves physical soil properties, builds up soil fertility and increases crop yield (Edwards and Hailu, 2011). So effort is needed to formulate an input package with a combination of organic and inorganic fertilizers for cotton crop. The research work on vermicompost and water hyacinth compost on cotton is meagre. Therefore, the present study was conducted to evaluate the effect of organic and inorganic sources of nitrogen on growth, yield and quality of cotton.

***Corresponding author:* Ramesh, S.,**
Department of Agronomy, Faculty of Agriculture, Annamalai University, Tamilnadu, India.

MATERIALS AND METHODS

Field experiment was conducted during 2014 at the experimental farm, Department of Agronomy, Annamalai University, Annamalai nagar Tamil Nadu to study the effect of

Table 1. Effect of organic and inorganic sources of nitrogen on growth, yield parameters, seed cotton yield and quality characters of cotton

Treatments	Plant height (cm)	Leaf area index	DMP (kg ha^{-1})	Number sympodial branches plant^{-1}	Number of bolls plant^{-1}	Boll weight (g)	Seed cotton yield (q ha^{-1})	Ginning percentage	Lint index	Fibre finness
T_1	71.54	2.86	2575	3.58	7.15	3.58	7.15	36.55	4.62	4.02
T_2	93.64	3.75	4307	9.36	18.73	4.68	16.86	36.62	5.04	4.31
T_3	105.38	4.22	4847	10.54	21.08	5.27	18.97	36.79	5.23	4.39
T_4	111.31	4.45	5120	11.13	22.26	5.57	20.04	36.87	5.32	4.42
T_5	116.54	4.66	5361	11.65	23.31	5.83	20.98	36.94	5.39	4.45
T_6	106.98	4.28	4921	10.70	21.40	5.35	19.26	36.82	5.26	4.41
T_7	100.86	4.03	4640	10.09	20.17	5.04	18.15	36.72	5.16	4.36
T_8	98.87	3.95	4548	9.89	19.77	4.94	17.80	36.68	5.12	4.34
SED	1.64	0.12	96	0.18	0.44	0.07	0.32	0.24	0.12	0.09
CD (P=0.05)	3.28	0.22	184	0.34	0.86	0.15	0.62	NS	NS	NS

T_1- control (no fertilizer and no organic manure), T_2- 100% recommended dose of nitrogen (RDN), T_3- 75% N through fertilizer + 25% N through FYM , T_4 – 75% N through fertilizer + 25% N through pressmud compost, T_5 - 75% N through fertilizer + 25% N through vermicompost, T_6 – 75% N through fertilizer + 25% N through poultry manure, T_7 – 75% N through fertilizer + 25% N water hyacinth compost and T_8 – 75% N through fertilizer + 25% N sugarcane trash compost.

organic and inorganic sources of nitrogen on growth, yield and quality of cotton. The experimental soil was clay loam in texture with pH 7.7, EC 0.45 dsm^{-1}, organic carbon 0.62, and low N (218.0 Kg ha^{-1}), medium in P (24 Kg ha^{-1}) and high in K (264 Kg ha^{-1}). The experiment was laid out in a randomized block design with eight treatments and replicated thrice. The treatments were T_1 - control (no fertilizer and no organic manure), T_2- 100% recommended dose of nitrogen through fertilizer (RDN), T_3 - 75% N through fertilizer + 25% N through FYM , T_4 -75% N through fertilizer + 25% N through pressmud compost, T_5 - 75% N through fertilizer + 25% N through vermicompost, T_6 – 75% N through fertilizer + 25% N through poultry manure, T_7 - 75% N through fertilizer + 25% N through water hyacinth compost and T_8 - 75% N through fertilizer + 25% N through sugarcane trash compost. The organic manures were applied as basal one week before sowing as per treatment schedule. The cotton variety LRA 5166 used as test variety for this experiment. The seeds were sown at a spacing of 75 X 30 cm. Recommended dose of 80:40:40 kg of N, P_2O_5 and K_2O was applied. As per treatment schedule 50 per cent of N, entire dose of P_2O_5 and K_2O were applied as basal and remaining 50 per cent N was applied on 40 DAS. N, P_2O_5 and K_2O were supplied through urea, single superphosphate and muriate of potash, respectively. Recommended cultural practices were also adopted as per need of the crop. Cotton growth and yield attributing characters such as plant height, LAI, DMP, number of sympodial branches per plant, number of bolls per plant, boll weight were recorded from 10 randomly selected plants and seed cotton yield was recorded from each plot. The data on various studies recorded during the investigation were subjected to statistical scrutiny suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Integrated application of organic and inorganic fertilizers increased the growth attributes of cotton. Application of 75% N through fertilizer + 25% N through vermicompost (T_5) recorded significantly higher plant height (116.54 cm), LAI (4.66) and dry matter production (5361 kg ha^{-1}). Favourable effect of vermicompost on plant height and LAI could be attributed to sustained availability of major and micronutrients with different growth hormones like gibberellins resulting in increased plant height, LAI and DMP. This results coincides with the work of Gebaly (2011). Lesser response of cotton to other organic manures could be attributed to slow mineralization of organically bound nutrients and low population of beneficial microbes as compared to vermicompost (Katkar *et al*., 2002). The least values of growth parameters were recorded under T_1 (no fertilizer and no organic manure). The yield potential of cotton is determined by yield attributes and the values of yield attributes were in accordance with that of growth parameters. Among the INM treatments, application of 75% N through fertilizer + 25% N through vermicompost (T_5) registered higher number of sympodial branches plant^{-1} (11.65), number of bolls plant^{-1} (23.31) and boll weight (5.83 g). This might be due to higher amount of nutrients supplied through vermicompost along with inorganic fertilizer, which have increased the availability of nutrients in soil, thus more uptake of nutrients and increased photosynthetic efficiency as evident from increased LAI resulted in yield attributes. These results are in accordance with the reports of Balamurugan and Sudhakar (2012). The control plot T_1(no fertilizers and no organic manure), recorded the least values of yield attributes. Integration of 75% N through fertilizer along with 25% N through vermicompost (T_5) significantly recorded a higher seed cotton yield of 20.98 q ha^{-1} which was 193.42 per cent higher than T_1 (no fertilizer and no organic manure) and 24.43 per cent over 100% RDN (T_2). This might be due to the fact that vermicompost offer a balanced nutritional release pattern to plants, providing nutrients such as available N, soluble K, exchangeable Ca, Mg, and P that can be taken readily by plants (Edwards, 2004). The least seed cotton yield (7.15 q ha^{-1}) was registered under T_1 (No fertilizer and no organic manure). As per quality characters concern, Integrated nutrient management practices had no significant influence on winning percentage, bundle strength (g tex^{-1}) and fibre fineness. However, numerically higher values of all quality parameters were registered under 75% N through fertilizer along with 25% N through vermicompost (T_5).

This might be due to fact that quality parameters are genetic character of a variety which were not influenced by fertilizer levels. The results were in accordance with the report of Srinivasulu and Hema (2007). Thus, on the basis of the experimental results, it could be concluded that for realising higher yield of seed cotton, farmers are recommended to take up 75% N through fertilizer along with 25% N through vermicompost for achieving higher yields in seed cotton.

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