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Effect of Quality Parameters of *Desi* Cotton as Influenced by Different Nutrient Sources

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ABSTRACT

A field investigation on "Nutrient management for organic cotton (*Gossypium arboreum* L.) production" was carried out at All India Coordinated Research Project, Cotton Improvement Project, Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra (India) during *kharif* season of 2017 and 2018. The experiment was carried on the same site and same randomization of treatments during both the years. After these two year cycles, the quality parameters *viz.*, ginning (%), micronaire value (mg inch^{-1}), UHML (mm), bundle strength (g tex^{-1}), uniformity index (%), elongation (%) were not much affected due to different organic and inorganic nutrient sources except the lint index. Significantly higher values of lint index were recorded with application of fertilizer through inorganic (80:40:40 N, P and K kg ha^{-1}) to cotton. Among the organic nutrient sources, application of FYM based on P equivalent recorded maximum values of lint index followed by seed treatment with (*Azotobactor* + PSB) + soil application of *Azotobacter* + PSB) and foliar application of PPFM (1% spray at 45 and 65 DAS) + neem cake 250 kg ha^{-1} + raising of sunnhemp between two rows (1:1) and incorporation in soil at flowering stage during both the years.

***Key words*:** Desi *cotton, Different nutrient sources, Growth, Yield and quality parameters*

Introduction

Cotton (*Gossypium* spp.) popularly known as "the white gold" is an important commercial fiber crop grown under diverse agro-climatic conditions around the world. It provides fiber, a raw material for textile industry and plays a vital role in economy of the country. It is one of the most important fibre and cash crop of global importance and being cultivated in tropical and subtropical regions of almost 77 countries of the world. The top five producers are China, India, USA, Pakistan and Uzbekistan. Cotton is said to be king of cash crop because of having vast importance in global economy. It is the basic raw material of the textile industries which are the backbone of industrial economy especially in India.

The world area under cotton cultivation is increased from 292.23 to 333.85 lakh hectare in the year 2017-18. The world cotton production is estimated to be 121.37 million bales during the year 2017-18 and there is an increase of 14.81 % than previous year (Anonymous, 2018a). World organic cotton production is 241276 MT (1.1 million bales) grown on 0.46 million ha of land. The organic cotton

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farm and fiber report reveals that India, Syria, and Turkey are the leading organic cotton producers in the world.

India remains the top producer of organic cotton, out of the 23 organic cotton-producing countries, growing 80% of the fiber grown worldwide (Anonymous, 2018b). In India, organic cotton is grown over an area of about 57,705 ha with a production of 2,58,823 bales which is 25% of the world share. The global retail market of organic cotton has increased from 583 million to 4.3 billion in 2009 with an annual growth rate of 3.5%. In India, cotton was grown over an area of about 11.14 million ha with a total production of 33.43 m bales (Anonymous, 2012). In India cotton growing area 105.00 lakh ha and production 351.00 (568 kg ha^{-1}) lakh bales (Anonymous, 2016-17).

Materials and Methods

A field investigation on "Nutrient management for organic cotton (*Gossypium arboreum* L.) production" was carried out at All India Coordinated Research Project, Cotton Improvement Project, Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra (India) during *kharif* season of 2017 and 2018. The soil of the experimental field was clayey in texture with low in available nitrogen (180.49 kg ha^{-1}), medium in available phosphorous (20.12 kg ha^{-1}) and high in potassium (348.37 kg ha^{-1}). The soil slightly alkaline in reaction (pH 8.27) with electrical conductivity (0.33 dSm^{-1}) and 0.43 organic carbon content.

The field experiment was laid out in Randomize Block Design and in three replications. The treatment consist of nine treatments for *desi* cotton *viz.,* T_1- Absolute control, T_2- Application of recommended dose of fertilizer through inorganic (80:40:40 NPK kg ha^{-1}), T_3- Application of nutrients through FYM based on P equivalent, T_4- Seed treatment with *Azotobactor* + PSB + soil application of *Azotobactor* and PSB + foliar application of PPFM (1% Spray at 45 and 65 DAS), T_5- Neem cake @250 kg ha^{-1}, T_6- Raising of sunnhemp between rows (1:1) incorporation in soil at flowering stage (45 DAS), T_7- T_4 + neem cake @250 kg ha^{-1}, T_8- T_4 + raising of sunnhemp between rows (1:1) incorporation in soil at flowering stage (45 DAS), and T_9- T_4 + neem cake 250 kg ha^{-1} + raising of sunnhemp between rows (1:1) incorporation in soil at flowering stage (45 DAS).

The quality parameters like ginning percentage, lint index and others *viz.,* Micronaire value (µg inch-1), UHML-Upper Half Mean Length (mm), Uniformity index (%), Bundle strength (g tex-1) and Elongation (%) were measured with the help of a high volume instrument (HVI) at Central Institute for Research on Cotton Technology (CIRCOT) lab, Matunga (East), Mumbai.

Ginning percentage

The produce of five observation plants was bulked and a clean representative sample was drawn. The seed cotton was then ginned treatment wise and the weight were taken for lint and seed obtained. The ginning percentage was calculated by using following formula.

$$\text{Ginning percentage} = \frac{\text{Lint weight (g)}}{\text{Seed cotton weight (g)}} \times 100$$

1. Lint index

Lint index was calculated by following formula.

$$\text{Lint index} = \frac{\text{Weight of 100 seeds} \times \text{Ginning \%}}{100 - \text{Ginning \%}}$$

Micronaire value (Fiber fineness)

Micronaire (MIC) is a measure of the air permeability of compressed cotton fibers. It is often used as an indication of fiber fineness and maturity.

Fiber fineness is usually expressed in terms of weight per unit length of fiber in units of 10^6 g in^{-1} or millitex. Militex is the weight in milligrams of one kilometer length of fiber. The fiber fineness was measured by Micronaire instrument in which 50 g of sample was taken and compressed in a cylinder of specified dimension. Air at specified pressure is passed through the material. The amount of air flow was measured on a scale calibrated directly to read the weight per unit length of fineness. It is also called micronaire value.

Upper Half Mean Length (UHML-mm)

Upper half mean length is normally equivalent to the staple length. It was determined by the Digital Fibro graph instrument in the Central Institute of Research on Cotton Technology, Mumbai. UHML is the mean length by the number of fibers in the largest half by weight of fibers in a cotton sample.

Bundle strength (g tex^{-1})

Bundle strength test are generally carried out by

using fibre bundle. It was determined by stelometer in which a tuft of fibre was taken between two special clamps and breaking strength was determined. The broken fibre were taken and weighted. The values are expressed in terms of g tex^{-1}, tex denotes the weight in g of one km of the fibre.

Uniformity Index (UI)

The ratio between mean length (ML) and Upper Half Mean Length (UHML) is called uniformity index, express as a percentage.

$$UI\ (\%) = \frac{ML}{UHML} \times 100$$

Uniformity index (%)

Length of Uniformity	Uniformity index (%)
Very low	Less than 77
Low	77-79
Intermediate	80-82
High	83-85
Very high	More than 85

Elongation (%)

Elongation per cent was determined by using a Stelometer. It was calculated as the elongation of the fibers at the breaking load as a percentage of the original length. It was determined at Central Institute of Research on Cotton Technology, Mumbai.

Results and Discussion

Quality parameters of *Desi* Cotton

Lint index

The mean lint index of *desi* cotton was 6.15 and 6.54 during first and second year, respectively. The data presented in Table 1 and 2 revealed that the lint index of cotton was influenced significantly due to different nutrient sources treatments during both years. Application of fertilizer through inorganic (80:40:40 N, P and K kg ha^{-1}) showed significantly highest lint index during both the years.

Table 1. Quality parameters of desi cotton as influenced by different treatment during 2017

Treatment		Quality parameters						
		Lint index	Ginning (%)	Micronaire value (mg inch^{-1})	UHML (mm)	Bundle strength (g tex^{-1})	Uniformity index (%)	Elongation (%)
T_1	Absolute control	4.34	36.89	6.63	16.20	20.06	75.98	6.06
T_2	Application of fertilizer through inorganic (80:40:40 NPK kg ha^{-1})	8.59	37.86	7.20	17.57	21.47	78.04	6.65
T_3	Application of FYM based on P equivalent basis	7.13	37.51	7.00	17.37	21.29	77.67	6.61
T_4	ST with (*Azotobactor* + PSB) + SA of (*Azotobactor* + PSB) and FA of PPFM (1 % Spray at 45 and 65 DAS)	5.44	37.27	6.73	16.70	20.14	76.54	6.24
T_5	Neem cake @250 kg ha^{-1}	5.68	37.34	6.77	16.77	20.57	76.85	6.34
T_6	Raising of sunnhemp between rows (1:1) incorporation in soil at flowering stage	5.02	37.14	6.67	16.30	20.26	75.92	6.14
T_7	T_4 + neem cake @250 kg ha^{-1}	6.01	37.39	6.80	16.90	20.90	77.10	6.36
T_8	T_4 + raising of sunnhemp between rows (1:1) incorporation in soil at flowering stage	6.46	37.43	6.83	17.00	20.87	77.12	6.47
T_9	T_4 + neem cake 250 kg ha^{-1} + raising of sunnhemp between rows (1:1) incorporation in soil at flowering stage	6.68	37.48	6.87	17.13	21.09	76.74	6.56
	S.Em.(±)	0.15	0.30	0.11	0.33	0.33	0.49	0.17
	C.D at 5 %	0.46	NS	NS	NS	NS	NS	NS
	General mean	6.15	37.37	6.83	16.88	20.74	76.88	6.38

SA- Soil application, **ST**- Seed treatment, **FA**- Foliar application, **PPFM-**Pink pigmented facultative methylotrophs, **UHML**- Upper half mean length.

Among the organic treatments, maximum lint index was recorded with application of FYM based on P equivalent basis during both the year and it was at par with treatment T_9-[(**T_4**- seed treatment with (*Azotobactor* + PSB) + soil application of *Azotobactor* + PSB) and foliar application of PPFM (1 % spray at 45 and 65 DAS) + neem cake 250 kg ha^{-1} + raising of sunnhemp between two rows (1:1) incorporation in soil at flowering stage)] during second year. The treatment absolute control recorded significantly lowest lint index during both the years of experiment.

Maximum lint index was recorded with application of FYM based on P equivalent basis followed by seed treatment with (*Azotobactor* + PSB) + soil application of *Azotobactor* + PSB) and foliar application of PPFM + neem cake 250 kg ha^{-1} + raising of sunnhemp between two rows incorporation in soil at flowering stage. This might be due to boll enlargement by meeting translocation demand of adequate amount of phosphorous and potassium from farmyard manure and different organic nutrient sources resulting increase the size and weight of boll to increase the seed weight and ginning percentage. Similar findings were also reported by Sarkar and Majumadar (2002), Dhillon *et al*. (2006), Kefyalew *et al*. (2007), Narayanan *et al*. (2009) and Singh *et al*. (2017).

Other Genetic Quality Parameters of *Desi* Cotton

The mean ginning percentage, micronaire value, UHML, bundle strength, uniformity index, elongation of *desi* cotton was 37.37 and 37.66 %, 6.83 and 6.87 mg inch^{-1}, 16.88 and 17.12 mm, 20.74 and 21.33 g tex^{-1}, 76.88 and 77.27 %, 6.38 and 6.44 % during first and second year, respectively.

The data pertaining in Table 1 and 2 revealed that the ginning percentage of *desi* cotton remained unaffected significantly due to various nutrient sources treatments during both years, however application of fertilizer through inorganic (80:40:40 N, P and K kg ha^{-1}) showed numerically higher value of ginning

Table 2. Quality parameters of *desi* cotton as influenced by different treatment during 2018

Treatment		Quality parameters						
		Lint index	Lint index	Micronaire value (mg inch^{-1})	UHML (mm)	Bundle strength (g tex^{-1})	Uniformity index (%)	Elongation (%)
T_1	Absolute control	4.40	37.22	6.59	16.41	20.53	76.00	6.08
T_2	Application of fertilizer through inorganic (80:40:40 NPK kg ha^{-1})	9.20	38.19	7.27	18.01	22.24	78.51	6.77
T_3	Application of FYM based on P equivalent basis	7.64	37.80	7.05	17.61	21.99	78.13	6.70
T_4	ST with (*Azotobactor* + PSB) + SA of (*Azotobactor* + PSB) and FA of PPFM (1 % Spray at 45 and 65 DAS)	5.77	37.53	6.77	16.90	20.67	76.96	6.29
T_5	Neem cake @250 kg ha^{-1}	6.07	37.63	6.80	16.97	21.07	77.27	6.40
T_6	Raising of sunnhemp between rows (1:1) incorporation in soil at flowering stage	5.28	37.41	6.70	16.49	20.84	76.23	6.18
T_7	T_4 + neem cake @250 kg ha^{-1}	6.44	37.69	6.85	17.10	21.47	77.55	6.41
T_8	T_4 + raising of sunnhemp between rows (1:1) incorporation in soil at flowering stage	6.92	37.73	6.87	17.20	21.47	77.58	6.52
T_9	T_4 + neem cake 250 kg ha^{-1} + raising of sunnhemp between rows (1:1) incorporation in soil at flowering stage	7.14	37.74	6.92	17.41	21.73	77.21	6.61
	S.Em.(±)	0.19	0.32	0.14	0.32	0.38	0.51	0.19
	C.D at 5 %	0.56	NS	NS	NS	NS	NS	NS
	General mean	6.54	37.66	6.87	17.12	21.33	77.27	6.44

SA- Soil application, ST- Seed treatment, FA- Foliar application, PPFM-Pink pigmented facultative methylotrophs, **UHML**- Upper half mean length.

per cent, micronaire value, UHML, bundle strength, uniformity index, elongation per cent during both the years of experiment.

Among organic nutrient sources treatment application of nutrient through FYM based on P equivalent recorded numerically higher value of ginning percentage micronaire value, UHML, bundle strength, uniformity index, elongation per cent than the rest of the organic nutrients sources treatments during both the years.

Ginning percentage micronaire value, UHML, bundle strength, uniformity index, elongation micronaire value, UHML, bundle strength, uniformity index, elongation per cent of *desi* cotton was not influenced significantly due to inorganic and different organic nutrient sources during both the years. The quality parameters are the genetic characters that are not modified by organic nutrient management in *desi* cotton, but numerically show higher ginning percentage with application of fertilizer through inorganic (80:40:40 N, P and K kg ha^{-1}) followed by application of FYM based on P equivalent basis. These results are corroborative with that of Anup *et al*. (2006) Kambale *et al*. (2009), Jagtap and Bhale (2011), Modhvadia *et al*. (2011) and Singh *et al*. (2017).

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