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Response of cotton varieties to varied sowing dates and nutrient levels on growth and seed cotton yield

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ABSTRACT: The field experiment was conducted at College of Agriculture Farm, Raichur on medium black soil during *kharif*, 2017 to study response of cotton (*Gossypium hirsutum* L.) varieties to varied sowing dates and nutrient levels. Among the varieties, BGDS1063 produced significantly higher seed cotton yield (2143 kg/ha) over SCS 793 (1690 kg/ha). Significantly higher seed cotton yield was noticed in case of cotton sown on 1st fortnight of July (2159 kg/ha) as compared with cotton sown on 2nd fortnight of July (1675 kg/ha). Application of 150 per cent of recommended dose of fertilizer (RDF) noticed significantly higher seed cotton yield (2049 kg/ha) over 100 per cent RDF (1744 kg/ha). However, it was *on par* with 125 per cent RDF (1958 kg/ha). All the interaction effects were found be non-significant. Significantly higher net returns (₹1,03,741 /ha), gross returns (₹ 1,41,900 /ha) and B:C ratio (3.72) registered by application of 150 per cent RDF with cotton variety BGDS1063 and it was followed by application of 100 per cent RDF and it was *on par* with application of 125 per cent RDF.

Key words: Cotton varieties, economics, RDF, seed cotton yield

Cotton (*Gossypium* sp.) is an important commercial fibre crop grown under diverse agro-climatic conditions and is called as *'White Gold'* and also as *'King of Fibre"*. It is an important cash crop of global significance, which plays a dominant role in the world agriculture and also in industrial economy. Cotton is cultivated in nearly 100 countries with China, India, United States, Pakistan and Brazil being the five largest producers of cotton. India is the important grower of cotton on a global scale and acts as the back bone of textile industry and provides raw materials in the form of lint to the textile industry. It is also grown in tropical and subtropical regions. The cotton was cultivated in 122.35 lakh/ha with a production of 377 lakh bales and lint yield of 524 kg/ha in India.

The low productivity of cotton is on account of several reasons *viz.,* monocropping, decline in soil fertility status, late sowings, pests and diseases are the major constraints. In drylands, farmers are unable to sow the seeds at optimum time due to scarcity of rainfall and delayed release of water in the canal especially in north-eastern dry zone of Karnataka. Among various agronomic factors, sowing time is the most important non monetary input influencing growth and yield of cotton as it influences the duration of vegetative and reproductive period of the crop. There is a positive relationship between sowing time and seed cotton yield in cotton crop. Early sown crop attains excessive vegetative growth and has negative effect on fruiting behavior of the crop, whereas late sown

crop flowers late and results in boll development in cooler weather resulting in reduced seed cotton yield.

Supply of nutrients is the major limiting factor in cotton production and most of the soil in rainfed areas is not only thirsty but also hungry. It is well established fact that sufficient quantity of nutrients at proper time are needed for achieving high yield. The nutrient management in cotton is a complex phenomenon due to simultaneous production of vegetative and reproductive structures during the active growth phase. Cotton plant being a heavy feeder requires adequate supply of nutrients to optimize the seed cotton yield, quality and net profit in cotton production (Aladakatti *et al.,* 2011).

In field, it is observed that optimum planting time and balanced nutrition of major nutrient elements is essential for harvesting higher yields. New cotton varieties *viz.*, SCS 793 and BGDS 1063 are tested in 23 locations across the country with consistent superior performance. However these are likely to respond to higher fertilizer doses. Therefore, there is a need to establish the threshold level for these genotypes. Often sowing dates and recommended dose of fertilizer application to cotton varieties has resulted in inconsistent yield, exhibility nutrient deficiency symptoms and which is one of the main reasons for declining yield of Indian cotton cultivation. Fulfillment of nutritional requirements of the crop is essential for achieving the higher yields and fibre quality (Kalaichelvi, 2009).

The field experiment was conducted during 2017-2018 at Main Agricultural Research Station, Raichur, which is situated in north-eastern dry zone (Zone 2) of Karnataka at 16°12' N latitude and 77° 20' E longitude with an altitude of 389 meters above mean sea level. The experiment was laid out in randomized complete block design (factorial concept) with two cotton genotypes *i.e,* SCS 793 (V_1) and BGDS 1063 (V_2), two sowing dates *i.e,* 1st fortnight of July (D_1) and 2nd fortnight of July (D_2) and three nutrient levels (100% RDF (F_1), (125% RDF (F_2), and (150% RDF (F_3). The treatment combinations are replicated thrice and composite soil sample was collected from experimental site from top 30 cm depth before initiation of experiment. The soil was air dried, grounded and allowed to pass through 2 mm sieve and was analysed for both physical and chemical properties.

Physical properties of the soil in experimental site includes sand (20.18 %), silt (23.02 %) and clay (56.80 %) and chemical properties of the experimental site includes soil reaction (pH- 7.80), electrical conductivity (0.33 dS/m), organic carbon (0.50 %), available nitrogen (257.2 kg/ha), available phosphorus (26.30 kg/ha) and available potassium (178.5 kg/ha).

Certified cotton varieties, seeds of SCS 793 and BGDS 1063 were used for sowing. The crop was sown on 15th-July-2017 and 31st-July-2017, 1st and 2nd date of sowing, respectively as per the plan of treatments. Two seeds/hill were dibbled by maintaining 60 cm space between two hills in a row and 90cm between rows. To ensure even stand and to maintain required plant population, gap filling was done nine days after sowing. Only one plant/hill was retained after thinning. The cotton crop was sown with 90 cm between the rows and 60 cm space has been given plant to plant.

Three levels of fertilizer doses namely

(100% RDF) 80:40:40 NPK kg/ha, (125% RDF) 100:50:50 NPK kg/ha and (150% RDF) 120:60:60 NPK kg/ha. Half of nitrogen, entire dose of phosphorous and potassium in the form of urea, diammonium phosphate (DAP) and muriate of potash (MOP), respectively were band placed as per the treatments. Fertilizer was applied 4-5 cm deep and 5 cm away from the seed as a basal dose. Remaining half dose of nitrogen in the form of urea was top dressed in three equal splits at 50, 80 and 110 days after sowing in the ring formed 5 cm away from the plant.

Growth parameters and seed cotton yield : The plant height, monopodial branches, sympodial branches and dry matter production/ plant differed significantly among the different cotton varieties, varied sowing dates and with application of increased nutrient levels. Among cotton varieties BGDS 1063 recorded significantly higher plant height, monopodial branches, sympodial branches and dry matter production/plant (126.62 cm, 2.03, 23.65 and 288.22 g/plant) compared to the cotton variety SCS 793 (124.22 cm,1.69, 21.85 and 279.06 g/ plant). Cotton crop sown on 1st fortnight of July registered significantly higher plant height, monopodial branches/plant, sympodial branches/plant and dry matter production/plant *viz.,*(128.14 cm, 2.06, 23.67 and 292.60 g/plant) as compared to 2nd fortnight of July (122.69 cm, 1.66, 21.83 and 274.68 g/plant) and finally among different nutrient levels, application of 150 per cent recommended dose of fertilizers noticed significantly higher plant height, monopodial branches, sympodial branches and dry matter production/plant (129.33 cm, 2.00, 23.57 and 294 g/plant) followed by application of 100 per cent recommended dose of fertilizers (121.05 cm, 1.72, 22.13 and 272.65 g/plant) and however it was *on par* with application of 125 per cent recommended dose of fertilizers (125.87 cm, 1.87, 22.55 and 283.47 g/plant) respectively.

Plant height differed significantly with different sowing dates at 45, 90 and 135 DAS and at final picking (Table 1). At 45 DAS, crop sown on 1st fortnight of July recorded significantly higher plant height (31.90 cm) over crop sown on 2nd fortnight of July (27.46 cm). Similar trend was observed at 90, 135 DAS and at final picking. The reduction in plant height of late sown crop at all the growth stages might be due to shorter life span of the crop and early commencement of reproductive phase. The decrease in sympodial branches/plant in later sowing dates of May 10th, May 20th and May 30th was due to poor growth and development of late sown crop as evident from less plant height.

In the investigation, registered significantly higher seed cotton yield (kg/ha), bolls/plant, boll weight (g) and seed index (g) (2143, 28.32, 4.65 and 9.50) was observed in cotton variety BGDS 1063 as compared to cotton variety to SCS 793, (1690, 27.29, 4.15 and 9.41). Among sowing dates, the early sown crop *i.e.* crop sown on 1st fortnight of July recorded significantly higher seed cotton yield (kg/ha), bolls/plant, boll weight (g) and seed index (g) *viz.,* (2159, 28.62, 4.50 and 9.53) as compared to crop sown on 2nd fortnight of July (1675, 26.99, 4.29, and 9.39), respectively. Among different nutrient levels, application of 150 per cent recommended dose of fertilizers recorded significantly higher seed cotton yield (kg/ha), bolls/plant, boll weight (g) and seed index (g) *i.e.* (2049, 29.48, 4.58 and 9.71) and it was followed by 100 per cent (1744,

26.10, 4.19 and 9.22) and however it was *on par* with 125 per cent (1958, 27.83, 4.42 and 9.45) respectively.) depicted in Table.2. These results confirms the findings of Kaur *et al.,* (2010). In late sown crop, much of the boll maturation took place under unfavorable weather conditions particularly, the minimum temperature of about 18°C or less, resulting in lower weight as compared to the favorable minimum temperature of (22-24°C) during boll development period under earlier sowing dates. These results are close in agreement with those reported by and Reddy and Kumar (2010). The reduction in picked bolls/plant in later sowing dates might be due to poor environmental conditions particularly minimum temperature falling below 20°C at the time of boll maturation stage and these Results are in accordance with Manjunatha *et al.,* (2014).

The increase in the yield attributing characters with 150 per cent RDF might be due to significantly higher amount of dry matter accumulation in reproductive parts, leaf area and LAI up to the harvest. These results are in compliance with the findings of Gadade *et al.*, (2015).

Net return was maximum in BGDS-1063 sown on 1st fortnight of July with 150 per cent recommended dose of fertilizers (Rs.1,03,741) followed by in BGDS 1063 sown on 1st fortnight of July with 125 per cent RDF (Rs.97,931). This can be attributed to higher seed cotton yield over other treatment combinations depicted in Table 3 and Fig.1. However, lowest net returns was realized by cotton variety SCS 793 sown on 2nd fortnight of July provided with RDF (Rs.34, 225). This is mainly attributed to lowest gross returns and higher cost of cultivation in this treatment combination, as a result of considerable reduction in yield due to delayed

Table 1. Growth attributes of cotton varieties as influenced by sowing dates and nutrient levels

Treatments	Plant height (cm)	Monopodial branches/ plant	Leaf area (cm^2)	Leaf area index	Dry matter production/plant (g/plant)
COTTON GENOTYPES					
$\mathbf{V_1}$	126.62	2.03	66.06	1.22	288.22
$\mathbf{V_2}$	124.22	1.69	64.13	1.19	279.06
SEm±	0.78	0.04	0.37	0.02	0.694
CD (p=0.05)	1.61	0.08	0.76	0.04	1.439
SOWING DATES					
$\mathbf{D_1}$	128.14	2.06	66.91	1.24	292.6
$\mathbf{D_2}$	122.69	1.66	63.27	1.17	274.68
SEm±	0.78	0.04	0.37	0.02	0.694
CD (p=0.05)	1.61	0.08	0.76	0.04	1.439
NUTRIENT LEVELS					
$\mathbf{F_1}$	129.33	2	66.84	1.24	294.8
$\mathbf{F_2}$	125.87	1.87	65.23	1.21	283.47
$\mathbf{F_3}$	121.05	1.72	63.21	1.17	272.65
SEm±	0.95	0.05	0.45	0.02	0.85
CD (p=0.05)	1.98	0.1	0.93	0.05	1.76

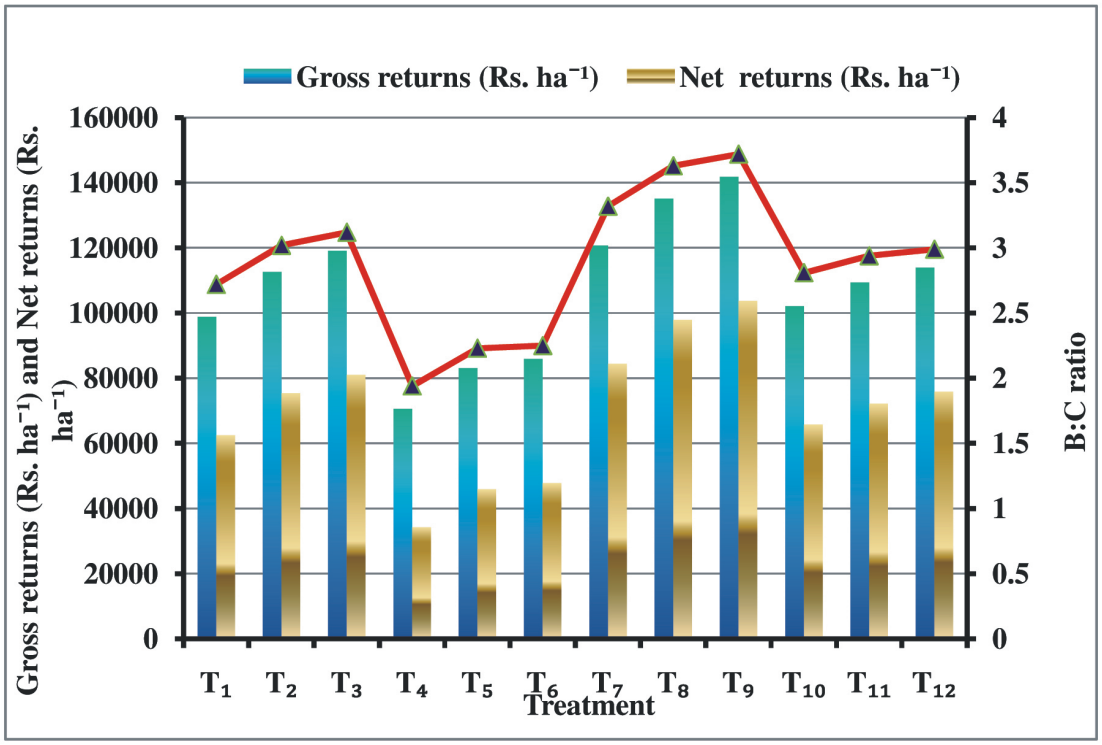

Fig 1. Economics of cotton genotypes as influenced by dates of sowing and nutrient levels

sowing and lower nutrient levels. These results are in agreement with the findings of Rajesh Kumar *et al.,* (2014).

Higher benefit cost ratio (3.72) was obtained in the cotton genotype, BGDS 1063 sown on 1st fortnight of July with 150 per cent recommended dose of fertilizers. This is mainly due to higher net returns as a result of higher seed cotton yield over other treatment combinations. The minimum B:C ratio (1.94) was obtained in cotton genotype SCS 793 sown on 2nd fortnight of July and provided with RDF which can be attributed to minimum net returns as a result of drastic reduction in seed cotton yield and relatively higher cost of cultivation in this treatment combination. These results are in accordance with the findings of Pandagale *et al.,* (2015) and also these findings are accordance with the results of Jadhav *et al.,* (2012).

CONCLUSION

The cotton genotype, BGDS 1063 produced higher seed cotton yield (2143 kg/ha) compared to variety SCS 793, (1690 kg/ha). The cotton sown on 1st fortnight of July gave higher seed cotton yield (2159 kg/ha) over crop sown on 2nd fortnight of July (1675 kg/ha).The cotton genotype, BGDS 1063 sown on 1st fortnight of July with 150 per cent recommended dose of fertilizers gave maximum seed cotton yield of cotton (2049 kg/ha), net returns (Rs.103741/ha) and higher B:C ratio (3.72) over other treatment combinations.

Table 2. Yield attributes of cotton varieties as influenced by sowing dates and nutrient levels

Treatments	Sympodial branches/plant	Bolls/plant	Boll weight (g)	Seed index (g)	Seed cotton yield (kg/ha)
COTTON GENOTYPES					
V_1	21.85	27.29	4.15	9.41	1690
V_2	23.65	28.32	4.65	9.5	2143
SEm±	0.19	0.22	0.01	0.06	39.61
CD (p=0.05)	0.4	0.46	0.03	0.13	82.15
SOWING DATES					
D_1	23.67	28.62	4.5	9.53	2159
D_2	21.83	26.99	4.29	9.39	1675
SEm±	0.19	0.22	0.01	0.06	39.61
CD (p=0.05)	0.4	0.4	0.03	0.13	82.15
NUTRIENT LEVELS					
F_1	22.13	26.1	4.19	9.22	1744
F_2	22.55	27.83	4.42	9.45	1958
F_3	23.57	29.48	4.58	9.71	2049
SEm±	0.24	0.27	0.01	0.08	48.51
CD (p=0.05)	0.49	0.56	0.03	0.16	100.61

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