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Production potential and nutrient uptake of *Bt* cotton genotypes as influenced by different establishment methods

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Abstract
A field experiment was conducted to evaluate the production potential and nutrient uptake of *Bt* cotton genotypes as influenced by different establishment methods during 2018-19 and 2019-20, at Agricultural Research Station, Malnoor, University of Agricultural Sciences, Raichur, which is situated in Upper Krishna Project area of Karnataka. The experiment was laid out in split plot design with three replications. There were 12 treatments combinations. Main plot treatments consisted of three *Bt* cotton genotypes *i.e.,* Jaadoo BG II, ACH 199 BG II and Bindass BG II. Sub plot treatments consisted of four methods of establishments namely, seedlings raised in black polythene bags, seedlings raised in pro trays, seedlings raised in biodegradable paper cups and dibbling (direct sowing). The data revealed that significantly higher seed cotton yield was recorded in Jaadoo BG II seedlings were raised in black polythene bags (3140 kg ha^{-1}) followed by ACH 199 BG II seedlings were raised in black polythene bags (3099 kg ha^{-1}), Jaadoo BG II seedlings were raised in biodegradable paper cups (3124 kg ha^{-1}) and ACH 199 BG II seedlings were raised in biodegradable paper cups (3087 kg ha^{-1}) which were found on par with each other. The yield increase was due to increase in number of bolls per plant, boll weight and seed cotton yield per plant. Significantly higher nutrient uptake was recorded in Jaadoo BG II and it was on par with ACH 199 BG II. Among methods of establishment, uptake of NPK were significantly higher in transplanted seedlings were raised in black polythene bags and biodegradable paper cups which were on par with each other. Transplanting ensures timely planting and higher uptake of resources in the soil.

Keywords: *Bt* cotton, seed cotton yield, transplanting, dibbling, nutrient uptake

Introduction
Cotton (*Gossypium hirsutum* L.) is a leading fiber crop and it contributed two per cent to the GDP of India and employs more than 45 million people in 2017-18 and also it contributed 15 per cent to the export earnings of India in 2017-18 and this sector is the second largest provider of employment after agriculture (Anon., 2018) [1]. *Bt* cotton is intensively cultivated in the North Eastern Dry Zone and Northern Dry Zone of the Karnataka (Zone 2 and 3) covering partly the Tungabhadra and Upper Krishna irrigation commands on black soil. Among different agronomic practices, time of sowing places an important role in deciding the yield. In these command areas delayed sowing is the main hurdle that contributes for lower yield which is due to uncertainty of rainfall and delayed release of water in canals. In order to ensure timely sowing, raising the seedling one month in advance to release of canal water and transplanting is the best solution. Rajakumar and Gurumurthy (2008) [4] reported that raising seedling in polythene bags and transplanting resulted in significantly higher yields over direct sowing. But during present days the use of polythene bags are banned and discouraged due to its un-ecofriendly and pollution problem. Hence, bio-degradable and reusable materials need to be tested to establish cotton seedlings.
In these command areas *Bt* cotton is generally grown but performance under different method of establishment is needed to be studied. Hence, the popularly grown *Bt* cotton genotypes in the command area has been included in the study.

Materials and Methods
The field experiment was conducted during 2018-19 and 2019-20, at Agricultural Research Station, Malnoor, University of Agricultural Sciences, Raichur, which is situated in Upper Krishna Project area of Karnataka. The soil of the experimental field was medium deep black with clay loam texture, slightly high in pH (8.14), normal EC (0.35 dS m^{-1}), medium in OC (0.56%), available nitrogen (344 kg ha^{-1}), phosphorus (29.21 kg ha^{-1}) and high in available potassium (355 kg ha^{-1}).

The experiment was laid out in split plot design with three replications. There were 12 treatments combinations. Main plot treatments consisted of three *Bt* cotton genotypes *i.e.*, Jaadoo BG II, ACH 199 BG II and Bindass BG II. Sub plot treatments consisted of four methods of establishments namely, seedlings raised in black polythene bags, seedlings raised in pro trays, seedlings raised in biodegradable paper cups and dibbling (direct sowing). During July, *Bt* cotton seedlings were raised by sowing single seed in a mixture of Soil:FYM (3:1) in polythene bags (15 cm x 10 cm size), biodegradable paper cups (9 cm x 7.5 cm) and pro trays (The pro trays were of 52 cm length and width of 27 cm having 98 cells) after moisturizing them to field capacity. Soil moisture was maintained by watering regularly as per the requirement. During both the years 30 days old seedlings were transplanted to main field in the month of August after release of canal water. Dibbling of seeds was also done on the same day of transplanting of seedlings.

The recommended dose of 180: 90: 90 N, P and K kg ha^{-1} was applied to the soil in the form of urea, diammonium phosphate and muriate of potash. FYM @ 10 t ha^{-1} was applied fifteen days before the treatment imposition. Entire dose of P, 50 per cent of N and K were applied to cotton as basal placement by the side of seed line. The remaining 50 per cent of recommended dose of nitrogen and potassium was top dressed in three equal splits at 30, 60 and 90 days after dibbling / transplanting by placement method. Totally six irrigations were given at 20 days interval and all the recommended package of practices of UAS, Raichur were followed to raise the healthy crop. Data on growth and yield attributes were recorded from 5 randomly selected plants in each net plot. Seed cotton yield (kg ha^{-1}) was recorded from net plot and expressed in kg ha^{-1}. The data were analyzed statistically as per the procedure described by Gomez and Gomez (1984) [3].

Results and Discussions

Performance of *Bt* cotton genotypes

Among *Bt* cotton genotypes, Jaadoo BG II (2188 kg ha^{-1}) has recorded significantly higher seed cotton yield hectare^{-1} closely followed by ACH 199 BG II (2145 kg ha^{-1}) which were on par with each other but recorded significantly higher seed cotton yield hectare^{-1} over Bindass BG II (1738 kg ha^{-1}) in pooled data and followed similar trend during individual year. The increased yield was due to increase in yield attributes *viz.*, number of bolls per plant, boll weight and seed cotton yield per plant (Table 1) which followed similar trend. This was corroborated with the results of Giri *et al.* (2008) [2]. Jaadoo BG II (83.71, 20.80, 115.79 NPK kg ha^{-1}) and ACH 199 BG II (82.73, 19.41, 117.37 NPK kg ha^{-1}) recorded significantly higher uptake of nitrogen, phosphorus and potassium and they were on par with each other. Lower NPK uptake was recorded in Bindass BG II (76.59, 16.68, 110.71 NPK kg ha^{-1}) in pooled data (Table 2). The genotypes Jaadoo BG II and ACH 199 BG II showed higher uptake of NPK indicating the efficiency of genotypes. Apart from this, these genotypes were very efficient in tapping solar radiation to photosynthate, thus helped production of higher yield attributes and increased the overall yield of the crop.

Table 1: Yield attributes and seed cotton yield of *Bt* cotton genotypes as influenced by different methods of establishment

Treatments	Number of bolls plant^{-1}			Boll weight (g boll^{-1})			Seed cotton yield (g plant^{-1})			Seed cotton yield (kg ha^{-1})		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
Main plot												
G_1- Jaadoo BG II	42.70	42.26	42.48	5.42	5.31	5.37	120.39	117.72	119.05	2215	2161	2188
G_2- ACH 199 BG II	42.05	40.89	41.47	5.30	5.24	5.27	117.85	115.88	116.86	2164	2127	2145
G_3- Bindass BG II	36.26	35.27	35.76	4.41	4.49	4.45	102.82	91.14	96.98	1851	1626	1738
S. Em±	0.38	0.67	0.35	0.05	0.02	0.03	1.84	2.46	1.83	35	66	41
C.D. at 5%	1.48	2.62	1.11	0.21	0.08	0.11	7.23	9.65	5.77	137	260	129
Sub plot												
E_1- Seedlings raised in Black Polythene bags	46.53	44.22	45.38	5.43	5.42	5.43	159.17	153.35	156.26	2942	2787	2864
E_2- Seedlings raised in Pro trays	35.49	35.50	35.50	4.72	4.65	4.68	69.42	66.06	67.74	1265	1221	1243
E_3- Seedlings raised in Biodegradable Paper cup	45.41	43.17	44.29	5.33	5.36	5.34	158.76	150.02	154.39	2934	2772	2853
E_4- Dibbling (Direct Sowing)	33.92	35.00	34.46	4.70	4.63	4.66	67.39	63.56	65.47	1164	1104	1134
S. Em±	0.75	0.59	0.52	0.05	0.03	0.03	2.06	3.41	1.86	50	65	39
C.D. at 5%	2.23	1.74	1.49	0.16	0.10	0.08	6.12	10.12	5.30	148	192	111
Interaction												
G_1E_1	49.54	47.50	48.52	5.81	5.72	5.77	171.19	168.68	169.94	3164	3117	3140
G_1E_2	36.71	37.03	36.87	5.09	4.96	5.03	71.68	70.29	70.98	1325	1299	1312
G_1E_3	49.90	45.90	47.90	5.68	5.60	5.64	170.49	167.57	169.03	3151	3097	3124
G_1E_4	34.66	38.60	36.63	5.11	4.95	5.03	68.20	64.34	66.27	1219	1132	1175
G_2E_1	49.46	46.27	47.86	5.56	5.62	5.59	168.68	166.74	167.71	3117	3081	3099
G_2 E_2	36.51	37.57	37.04	5.07	4.90	4.99	68.61	68.48	68.55	1268	1265	1267
G_2 E_3	47.33	46.43	46.88	5.55	5.56	5.56	168.27	165.83	167.05	3110	3065	3087
G_2 E_4	34.91	33.30	34.10	5.01	4.89	4.95	65.83	62.48	64.15	1159	1096	1128
G_3 E_1	40.59	38.90	39.75	4.91	4.93	4.92	137.65	124.63	131.14	2544	2163	2353
G_3 E_2	33.25	31.90	32.58	4.00	4.07	4.03	67.98	59.43	63.71	1204	1098	1151
G_3 E_3	38.99	37.17	38.08	4.75	4.91	4.83	137.51	116.65	127.08	2541	2156	2348
G_3 E_4	32.20	33.10	32.65	3.98	4.04	4.01	68.13	63.87	66.00	1114	1085	1100
S. Em±	1.19	1.10	1.21	0.09	0.05	0.08	3.60	5.67	4.72	83	117	101
C. D. at 5%	3.53	3.28	3.46	NS	NS	NS	10.68	16.85	13.45	245	332	288

Table 2: Nutrient uptake by *Bt* cotton genotypes as influenced by different methods of establishment

Treatments	Nitrogen uptake (kg ha^{-1})			Phosphorous uptake (kg ha^{-1})			Potassium uptake (kg ha^{-1})		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
Main plot									
G_1- Jaadoo BG II	84.24	83.17	83.71	21.16	20.44	20.80	116.09	115.49	115.79
G_2- ACH 199 BG II	83.99	81.47	82.73	19.79	19.03	19.41	117.90	116.83	117.37
G_3- Bindass BG II	77.37	75.80	76.59	16.88	16.48	16.68	111.08	110.34	110.71
S.Em. ±	1.17	1.38	1.18	0.47	0.36	0.40	1.16	1.24	1.19
C.D. at 5%	4.59	5.40	4.63	1.84	1.41	1.56	4.55	4.88	4.68
Sub plot									
E_1- Seedlings raised in Black Polythene bags	90.63	88.43	89.53	22.81	21.78	22.29	143.22	142.14	142.68
E_2- Seedlings raised in Pro trays	74.47	73.22	73.84	16.09	16.09	16.09	86.87	86.33	86.60
E_3- Seedlings raised in Biodegradable Paper cup	89.19	87.05	88.12	22.22	20.92	21.57	147.01	145.65	146.33
E_4- Dibbling (Direct Sowing)	73.19	71.89	72.54	15.98	15.81	15.90	83.00	82.77	82.88
S.Em. ±	3.08	3.04	2.93	0.96	0.94	0.92	4.86	4.92	4.87
C.D. at 5%	9.15	9.02	8.70	2.85	2.81	2.72	14.44	14.61	14.48
Interaction									
S. Em. ±	5.33	5.26	5.07	1.51	1.46	1.43	7.38	7.48	7.41
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

Effect of methods of establishment

Significantly higher seed cotton yield hectare^{-1} was recorded in transplanted seedlings raised in black polythene bags (2864 kg ha^{-1}) followed by seedlings raised in biodegradable paper cups (2853 kg ha^{-1}) which were found on par with each other. Seedlings raised in pro trays (1243 kg ha^{-1}) and dibbling method (1134 kg ha^{-1}) recorded lower seed cotton yield hectare^{-1} and they were on par with each other.

The increased yield was due to improved yield attributes *viz.*, number of bolls per plant, boll weight and seed cotton yield per plant (Table 1). This was due to the fact that in black polythene bags and biodegradable paper cups media was sufficient to support the growth of seedling while in pro trays were too small to hold sufficient media to support the seedlings. Low yields and its attributes in dibbling was due to delayed sowing. Rajakumar and Gurumurthy (2008) [4] found that direct seeding recorded a boll setting percentage of 30.29 as against 33.43 per cent under planting through poly bag seedlings which resulted in higher seed cotton yield (2253 kg ha^{-1}).

Among methods of establishment, in pooled data, significantly higher NPK uptake was recorded in seedlings raised in black polythene bags (89.53, 22.29 and 142.68 kg ha^{-1}, respectively) and seedlings raised in biodegradable paper cups (88.12, 21.57 and 146.33 kg ha^{-1}, respectively), which inturn were on par with each other. Seedlings raised in pro trays (73.84, 16.09 and 86.60 kg ha^{-1}, respectively) and dibbling method (72.54, 15.90 and 82.88 kg ha^{-1}, respectively) recorded lower NPK uptake and they were on par with each other in pooled data (Table 2). Similar results were recorded during individual years.

Interaction effect between *Bt* cotton genotypes and methods of establishment

In pooled data, the interaction effect of *Bt* cotton genotypes with methods of establishment were significant with respect to seed cotton yield hectare^{-1}. Significantly higher seed cotton yield hectare^{-1} was recorded in Jaadoo BG II and ACH 199 BG II when seedlings raised in black polythene bags (3140 and 3099 kg ha^{-1}, respectively) or biodegradable paper cups (3124 and 3087 kg ha^{-1}, respectively) and these treatment combinations were significant over other treatment combinations (Table 1). Similar results were recorded during individual years of 2018 and 2019. This may be attributed to earlier sowing (*i.e.*, by growing in black polythene bags or biodegradable paper cups) that inturn increased the yield attributes thus increased the seed cotton yield under late sowing situation.

The uptake of nutrients was also higher in these treatments due to early sowing of the crop and better initial growth. The *Bt* cotton genotypes had efficiently utilized the applied nutrients in increasing the yields.

Conclusion

From the two years experiment concluded that the *Bt* cotton genotypes *viz.*, Jaadoo BG II and ACH 199 BG II responds to transplanting and it will solve the problem of late sowing in the command area and biodegradable paper cups can be used in place of black polythene bags for raising seedlings in nursery.

References

1. Anonymous, India Brand Equity Foundation 2018.
2. Giri AN, Aundhekar RL, Kapse PS, Suryavanshi SB. Response of *Bt* cotton hybrids to plant densities and fertilizer levels. Journal of Cotton Research Development 2008;22(1):45-47.
3. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research, 2nd Editn. A wiley Inter-Science Publications, New York (USA) 1984.
4. Rajakumar D, Gurumurthy S. Effect of plant density and nutrient spray on the yield attributes and yield of direct sown and polybag seedling planted hybrid cotton. Agricultural Science Digest 2008;28(3):174-177.