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Influence of Method of Plant Spacing on Establishment of Cotton in Rainfed Vertisols of Southern Tamil Nadu

S. Krishnasamy*, R. Babu, P.P. Mahendran and A. Gurusamy
AICRP on Water Management, Department of Agronomy
Agricultural College and Research Institute, Madurai – 625 104

Field experiments were conducted at farmer's holding in Sengapadai village in Madurai district of Tamil Nadu to study the performance of direct seeding and transplanting of cotton seedling through auger hole method for rainfed vertisols. The experiments were conducted in a split plot design replicated thrice for three years. The main plot treatment consisted of four methods of establishmen *viz.,* M_1 – Direct sowing in flat beds, M_2 – Direct sowing in pits filled with fortified coir pith, M_3 – Transplanting in flat beds and M_4 – Transplanting in pits filled with fortified coir pith. The sub plot treatments consisted of different spacing *viz.,* S_1 – 100 x 50 cm, S_2 – 100 x 75 cm and S_3- 100 x 100 cm.Bt cotton hybrid Bunny NCS 529 was used for the study. Farmer's practice of raising cotton in ridges and furrows was raised for comparison. The growth and yield attributes were higher when cotton seedlings were transplanted in auger hole filled with fortified coir pith. However, direct seeding of cotton in auger pits filled with fortified coir pith did not differ significantly from transplanting. Among the various spacing tested 100 x 100 cm recorded higher growth and yield attributes, but 100 x 50 cm recorded higher seed cotton yield and B:C ratio.

Key words: Cotton, rainfed, auger hole seeding, transplanting

In Tamil Nadu cotton is one of the major commercial crops in rainfed area. During 2009-2010, the crop occupied an area of 1.04 lakh ha with a production of 2.25 lakh bales, with an average productivity of 367 kg /ha. This low productivity was mainly due to the cultivation of the (72 per cent) cotton under rainfed. As the crop is under rainfed during the North East monsoon season, the failure of monsoon particularly late onset of monsoon, early cessation of monsoon or both shortens the length of growing period thus making the standing crop highly susceptible for terminal drought leading to low productivity. Based on the long term analysis of rainfall data, Solamalai *et al.* (2011) stated that pre-monsoon sowing of cotton has to be taken at 35th standard week in Aruppukottai and 39th standard week at Kovilpatti. This was based on the initial probability of 25 mm of rainfall with 75 per cent probability and a wet week followed by another wet week. So, only delay in onset of monsoon will upset the cultivation of cotton in these regions as it will reduce the length of growing period. Moreover, the rainfed soils are also poor in soil nutrient status, which add to the above mentioned problem. Hence, there is an urgent need for improving the management technology of raising of cotton crop in rainfed areas so that the only commercial crop which can be grown under rainfed condition is economically viable for the farmers to cultivate.

Hence, with these ideas in view, this experiment was planned to study the performance of direct seeding and transplanting of cotton seedling through auger hole method for rainfed vertisols

Materials and Methods

Field experiments were conducted from 2007 to 2011 for three years at farmers holding in Sengapadai village of Madurai district. The experiments were laid out in split plot design with three replications. The main plot treatment consisted of methods of establishment *viz.,* M_1 – Direct sowing in flat beds, M_2 – Direct sowing in pits filled with fortified coir pith, M_3 – Transplanting in flat beds and M_4 – transplanting in pits filled with fortified coir pith. The sub plot treatments consisted of different spacing *viz.,* S_1 – 100 x 50 cm, S_2 – 100 x 75 cm and S_3 – 100 x 100 cm. Bt cotton hybrid Bunny NCS 529 was used for the study.

For transplanting of cotton, the hybrid seeds were sown in protrays filled with fortified coir pith and then the raised seedlings were transplanted immediately after the receipt of first monsoon showers when the seedlings attained an age of 20 to 25 days. For treatments M_2 and M_4 pits of 30 cm in diameter and 15 cm deep were dug using mechanical auger and the pits were filled with fortified coir pith and then sowing

/planting was done as per the treatments. Farmer's method of raising cotton crop with

*Corresponding author email: anuj_choudhary23@yahoo.com

conventional variety SVPR -2 was raised in ridges and furrow at 60 x 30 cm spacing for comparison.

Results and Discussion

Plant height

In all three years of study direct sowing of cotton in pits filled with fortified coir pith recorded taller plants among the main plot treatments and was at par with transplanting of seedlings in pits filled with fortified coir pith. Transplanting of cotton seedlings in flat beds recorded the lowest plant height.

Sympodial branches per plant

Higher numbers of sympodial branches per plant were recorded with sowing of cotton in pits filled with fortified coir pith. This treatment was followed by transplanting of cotton in pits filled with fortified coir pith. Transplanting in flat beds registered the lowest number of sympodial per plant.

Among the various spacings tried, 100 x 100 cm recorded more sympodial branches per plant and 100 x 50 cm spacing recorded the lowest number of sympodial branches per plant.

Table 1. Effect of establishment methods and spacing on growth and yield attributes of rainfed cotton

Treatment	Plant height (cm)			Sympodial branches / per plant			No. of bolls / plant			Mean boll weight (g)			Seed cotton yield (kg/ha)		
	2007 - 2008	2008 - 2009	2009 - 2010	2007 - 2008	2008 - 2009	2009 - 2010	2007 - 2008	2008 - 2009	2009 - 2010	2007 - 2008	2008 - 2009	2009 - 2010	2007 - 2008	2008 - 2009	2009 - 2010
Main plot treatment															
M_1 - Direct sowing in flat beds	101.0	90.0	113.7	14.0	12.0	13.6	18.4	14.2	16.9	4.2	4.1	4.2	984	1020	907
M_2- Direct sowing in pits filled with fortified coir pith	113.9	97.8	119.8	17.9	15.8	16.6	25.5	18.0	27.9	4.6	4.3	4.4	1470	1302	1372
M_3- Transplanting in flat beds	91.8	88.4	110.0	13.0	12.2	13.1	19.2	15.0	16.7	4.3	4.3	4.2	804	910	887
M_4- Transplanting in pits filled with fortified coir pith	110.4	92.5	117.5	17.8	15.0	16.1	27.2	19.5	28.6	4.6	4.4	4.5	1528	1382	1382
SEd	3.1	2.5	2.2	0.6	1.7	0.4	0.8	2.3	1.6	0.2	0.1	0.06	61.5	48	45
CD(0.05)	7.5	5.6	4.7	1.5	3.5	0.8	2.0	4.8	3.3	0.4	0.2	0.14	150.0	102	110
Sub plot treatments															
S_1- 100 x 50 cm	103.9	91.6	112.0	14.7	12.6	14.3	20.7	15.2	21.3	4.2	4.2	4.2	1468	1270	1257
S_2- 100 x 75 cm	109.2	94.2	114.6	15.8	14.4	14.9	22.6	16.4	22.4	4.5	4.3	4.4	1224	1087	1114
S_3- 100 x 100 cm	114.8	98.2	119.1	16.5	14.3	15.3	24.4	18.4	23.9	4.5	4.4	4.6	904	880	1041
SEd	2.3	2.95	1.9	0.6	0.7	0.3	0.96	0.7	1.3	0.1	0.1	0.1	56	86	36
CD(0.05)	5.0	6.4	4.0	1.4	1.6	0.7	2.05	1.5	NS	0.2	0.2	0.1	120	186	77
Farmer's Method	98.2	85	10.2	13.4	10.0	10.5	18.6	10.5	12.0	4.1	4.0	4.1	1095	812	942

Bolls per plant

Transplanting of cotton seedlings in pits filled with fortified coir pith recorded the highest number of bolls per plant and was comparable with direct sowing of cotton in pits with fortified coir pith. The lowest number of bolls per plant was recorded with direct sowing of cotton in flat beds.

Among the various spacings, square geometry of 100 x 100 cm registered higher number of bolls per plant than rest of the spacing tried. The lowest number of bolls per plant was associated with rectangular geometry of 100 x 50cm

Mean boll weight

The mean boll weight was highest with transplanting of cotton seedlings in pits filled with fortified coir pith. However, direct sowing in pits filled with fortified coir pith did not statistically differ from the above mentioned treatment. Direct sowing of cotton in flat beds produced bolls with lesser weight.

Among the various spacings tried, wider spacing of 100 x 100 cm recorded higher boll weight than the rest of the spacings. The spacing of 100 x 50 cm registered the lowest mean boll weight.

Seed cotton yield

The highest seed cotton yield of 1528 kg/ha during 2007-08, 1382 kg/ha during 2008-09 and 1382 kg/ha during 2009-2010 was associated with transplanting of cotton seedlings in pits filled with fortified coir pith. In all the three years of study, direct sowing of cotton seeds in pits filled with fortified coir pith did not differ significantly from the above mentioned treatment. The treatments with fortified coir pith proved its superiority over sowing in flat beds or transplanting in flat beds. The farmers

Table 2. Pooled economic analysis of rainfed cotton raised under auger hole method

Main plot treatments	Net return(Rs. /ha)	B:C ratio
M_1 - Direct sowing in flat beds	10488	1.57
M_2 - Direct sowing in pits filled with fortified coir pith	21435	2.03
M_3 - Transplanting in flat beds	9730	1.57
M_4 - Transplanting in pits filled with fortified coir pith	20039	1.97
Sub plot treatments		
S_1 - 100 x 50 cm	19181	1.92
S_2 - 100 x 75 cm	15484	1.80
S_3 - 100 x 100 cm	11603	1.62
Farmer's method	11574	1.70

method of cotton cultivation recorded a seed cotton yield of 1095 kg/ha during 2007-2008, 812 kg/ha during 2008-2009 and 942 kg/ha during 2009-2010. The increase in seed cotton yield over farmers practice was 39.54 per cent during the first year, 70.19 per cent during the second year and 46.70 during the third year. This variation was due to the rainfall received during the respective years. Sarkar and Malik (2004) also reported that transplanting of cotton seedlings increased the seed cotton yield by

17 to 25 per cent over farmers method of dibbling of cotton under rice fallow conditions.

As regards various spacings tried, 100 x 50 cm recorded higher cotton yield than the rest of the treatments. This was followed by sowing of cotton with a spacing of 100 x 75 cm. Square sowing / planting at 100 x 100 cm recorded the lowest seed cotton yield. The lowest seed cotton yield at 100 x 100 cm was mainly due to decrease in population as compared to rest of the treatments. This decrease in population could not make up for the individual increase in growth and yield parameters and yield. The same phenomenon was earlier reported by Halikeri (2007), Bhalerao *et al.* (2008) Aruna and Reedy (2009) and Manjunatha *et al.* (2010). They also reported that under auger hole method of cotton planting, wider spacing recorded higher values of growth and yield attributes, but closer spacing recorded higher seed cotton yield, due to higher population.

The highest seed cotton yield in Direct sowing in pits filled with fortified coir pith and Transplanting in pits filled with fortified coir pith was mainly due to high soil moisture availability during the monsoon period and the extended moisture availability during the post monsoon period.

Moreover, transplanting of seedling reduced the length of growing period in main field by 25 days, thus favours a condition of a certain crop even during years where early cessation of monsoon occurs.

Economics

The highest net return per hectare and benefit cost ratio was observed with direct sowing in pits filled with fortified coir pith with a net return of Rs.21,435 and B:C ratio of 2.03. As regards to spacing, 100 x 50 cm recorded higher net return per hectare with a value of Rs.19181 and with B:C ratio of 1.92. The farmers method of sowing recorded net return of only Rs.11574 and with a B:C ratio of 1.70.

From the study it can be concluded that hybrid cotton can be successfully raised either as direct seeding or as transplanting in pits filled with fortified coir pith with a spacing of 100 x 50 cm than the farmers method of raising in ridges and furrows with the existing varieties for higher seed cotton yield and B:C ratio.

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