

Paper tube Nursery technique in Cotton:

Timely establishment and enhanced yield

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Transplanting of cotton has many advantages which include reducing main field duration, maintaining of plant population and timely sowing of crop. Paper tube Nursery technique was developed during 2013–14 and 2014–15 at Central Institute for Cotton Research, Regional Station, Coimbatore. The results revealed that 25th August transplanting registered 15.34% higher seed cotton yield as compared to corresponding date of direct sown crop. However, 5th October transplanting registered enhanced performance of 64.7% higher seed cotton yield as compared to corresponding date of direct sown crop. The results revealed that 25th August transplanting realized 4.8% higher net return but transplanting of 15th September arrived 44.4% of higher net return as compared to direct sown crop of same date respectively. It was also found that seed cotton yield of Mallika BG II Bt was equal to Suraj. Transplanting (23.2 q/ha) registered significantly higher yield than direct sown (20.3 q/ha). It was concluded that the transplanting had more advantage in late sown and was not genotype specific.

Keywords: Higher seed cotton yield, Monetary advantage, Paper tube Nursery, Transplanting

COTTON plays an important role in the Indian economy as the country's textile industry is predominantly cotton based. Area and production wise, India ranks first (13.3 mha) in global scenario, and has about 34.0% of world cotton area and production of 360.0 lakh bales. In cotton productivity front, we are far behind in comparison to Australia (2055 kg/ha), Brazil (1415 kg/ha), China (1403 kg/ha) and world average (759 kg/ha). Thus searching for new strategies/techniques for enhancing yield are gaining momentum.

Cotton transplanting is successfully adopted in large scale in China and Iran and is identified as one of the yield maximization techniques in cotton. Few research attempts are made in India and transplanting is adopted up to the level of gap filling in cotton. However, transplanting of cotton has many advantages which include reduction in main field duration, maintenance of plant population, manipulation

of the time of sowing to achieve optimum time and fitting crop into low length of growing period region and, is also suitable for the farm that has undesirable quality of irrigation water for germination. However, the tap root system of cotton is the bottle neck in transplanting. In red gram with similar tap root system, higher productivity is achieved by successful transplanting. The success story in red gram transplanting enthralls interest on cotton transplanting in the country.

Transplanting in Canal water irrigated Cotton

Cotton is generally established through direct sowing of seeds. However, certain farming/ecological situations necessitate transplanting for stand establishment, maintaining optimum plant population and enhanced yield and quality parameters. The productivity of cotton is low in command area of Upper Krishna Project, Karnataka as compared to its real potential.

The reasons for low productivity are delayed sowing due to late release of water, and poor germination and establishment due to poor soil conditions caused by accumulation of salts. In addition to that, irrigation coupled with high rainfall received during July and August leads to water logging resulting in stunted growth, rotting and reduced vigour of seedlings. Therefore, transplanting of cotton has been suggested as an alternate strategy for timely establishment of crop.

In North Cotton Zone (Punjab, Haryana and Rajasthan) canal water is the sole source of irrigation for agriculture. However, its availability during the recommended sowing time of cotton (i.e. April–mid May) is often meagre because of ongoing repair work required for safe flow in approaching kharif. As a result, timely sowing of cotton is severely hampered. Consequently, crop sown after pre-sowing irrigation with brackish underground water results in poor germination owing to high

sensitivity of cotton germination due to accumulated salts in the soil. This situation is further deteriorated when seedlings are exposed to rising high temperature often exceeding 40°C resulting in high seedling mortality. High soil temperature coupled with frequent light showers received during sowing time, result in crust formation which hamper the germination. Direct sown cotton requires 4–5 irrigations before onset of monsoon and repeated gap filling, despite this optimum plant stand is not ensured, resulting in low productivity. Frequent irrigations to crop leads to severe weed infestation which causes cost escalation by frequent weeding. Thus, establishment of an optimum population is an important issue in cotton to harness higher yields in North Zone. The situation warrants for transplanting of cotton at appropriate time.

Transplanting in delayed sowing situation

Cotton is very specific to its climatic requirements and reacts unfavourably for any shift in dates of sowing from optimum range of sowing periods. The cotton plant unlike rice and wheat possesses narrow range of ecological adaptability and is very much influenced by the climatic conditions and sowing seasons. Sowing period ranges from 15–30 days in most of the region. Any further delay leads to drastic reduction of yield. However, delay in sowing is unavoidable for a number of reasons. But this delay of 15–25 days can be managed by successful transplanting.

Transplanting in rice fallow cotton

The constraints in germination and other environmental factors in direct sowing of cotton result in poor plant stand, which leads to yield reduction. Sowing of more than one seed could ensure a desirable crop stand. However, the high cost involved especially with hybrids necessitates going for a single seed per dibble; however, transplanting of seedlings may ensure a desirable stand. Low LGP (length of growing period) is not recommended but is cultivated in many places for cotton

where productivity can be improved by transplanting, a way of reducing field duration. In rice fallow cotton, where land preparations are difficult to be carried out immediately after rice because of high soil moisture and waxy conditions, and having adequate moisture, transplanting may be advantageous.

Transplanting shock

Transplanting shock is unavoidable but it is manageable. This is simply the plants reaction to having been moved. It is generally caused by damage to the roots of the plant during transplanting. These tiny roots are covered by even tinier hairs which absorb most of the water that is eventually carried to the growth of the plant. Imbalance between the moisture demands in plants and the reduced ability of the roots to meet those demands manifest as transplanting shock. Besides major effects on the roots, plants can also sense delicate changes like wind, light and temperature, and take some time to re-adjust themselves to these new factors. The shock management includes selection of healthy seedlings, optimum transplanting time and proper planting methods, fertilization with root boosters and management of water. Application of irrigation, immediately after transplanting can reduce transplanting shock. The seedling produced from Paper tube nursery technique observed less transplanting shock.



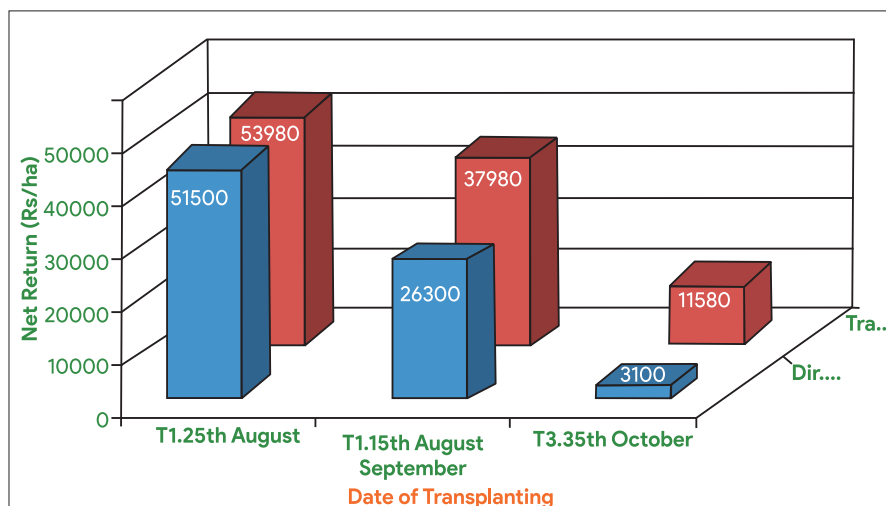
Performance of transplanting in different times of sowing

Paper tube Nursery technique was developed by vigorous testing procedures during the year of 2013–14 and 2014–15 and field trial was carried out during 2015–16 at Central Institute for Cotton Research, Coimbatore. The seedling of paper tube nursery was transplanted in hole made by crow bar and was pressed gently to avoid air pockets and was irrigated immediately.

Paper tube Nursery: Paper tube with size of 1 cm diameter and height of 20 cm were filled (top 1 cm left unfilled to pore water) with equal portion of vermicompost, sand and soil and was packed gently (the compactness of packing was ensured in every tube for proper germination). The healthy single seed was dibbled in each tube and water was sprinkled from the top. The tubes were kept in iron tray filled with moist sand at bottom covered with wire mesh facilitate to keep paper tubes upwards. The seedlings at the age of 21 days were transplanted. The nursery and transplanting cost per

Table 1. Seed cotton yield (q/ha) and gross return (₹/ha) as influenced by different dates of transplanting

Date of planting	Seed cotton yield (q/ha)			Gross Return (₹/ha)		
	Transplanting	Direct Sown	Mean	Transplanting	Direct Sown	Mean
T1. (25th August)	21.8	18.9	20.4	109000	94500	101750
T2. (15th September)	17.8	12.6	15.2	89000	63000	76000
T3. (5th October)	11.2	6.8	9.0	56000	34000	45000
Mean	16.9	12.8	14.9	84667	63833	74250
Anova	Dos	Trp	DosXTrp	Dos	Trp	DosXTrp
SEd	1.37	1.12	1.93	4531	3704	6384
CD (5%)	3.05	2.49	NS	10088	8236	14256



Net Return (Rs/ha) by transplanting of cotton seedling in different late planting



Cotton seedling grown in paper tube

hectare was arrived as ₹10,500 as against of ₹1,500 by manual sowing (Table 1). The machine made tubes are available for use.

Enhancement of yield: The advantages of transplanting of cotton by using seedlings produced from paper tube nursery techniques were experimented. The results found that 25th August transplanting registered 15.34% higher seed cotton yield as compared to corresponding date of direct sown crop. However 5th October transplanting registered enhanced performance of 64.7% higher seed cotton yield as compared to corresponding date of direct sown crop.

Economics: The results revealed that 25th August transplanting realized 4.8% higher net return but transplanting of 15th September gave 44.4% higher net return as compared to direct sown of same date respectively. The results concluded the visible advantage of transplanting observed in late sown situations.

Transplanting–Genotype performance

The experiment was attempted

with two genotypes (Mallika BG II Bt and Suraj) and method of planting (transplanting and direct sown). The results of the experiment found that (120 DAP) plant height (cm) was influenced by genotypes and method of planting. The highest plant height (cm) was recorded by Mallika (111.5 cm), and transplanting (113.9 cm). LAI at 120 DAS was higher with Suraj (2.9), and transplanting (3.0). The significantly highest no. of bolls were counted with Mallika (29.1) and transplanting (26.2) at 120 DAS. Mallika BG II Bt registered higher boll weight (4.9 g) than Suraj (4.2 g). The highest no. of busted bolls was counted with Mallika (25.8), and transplanting (23.5).

Seed cotton yield

Seed cotton yield of Mallika BG II Bt was equal to Suraj (Table 2). Between genotypes, Suraj registered less biometrics and yield attributes on per plant basis, however, the seed cotton yield harvested was comparable with Mallika Bt BG II, because of the fact that higher population was (29629) accommodated by planting of Suraj

at recommended spacing of 75 cm × 45 cm as compared to the population (18518) maintained by spacing of 90 cm × 60 cm planted by Mallika Bt BG II. Transplanting (23.2 q/ha) registered significantly higher yield than direct sown (20.3 q/ha).

SUMMARY

Cotton is generally established through direct sowing of seeds. However certain farming/ecological situations necessitate transplanting for stand establishment, maintaining optimum plant population and enhanced yield and quality parameters. The healthy single seed of cotton was dibbled in each paper tube and water was sprinkled from the top. The tubes were kept in iron tray filled with moist sand at bottom and covered with wire mesh facilitate to keep paper tubes upwards and were transplanted at 21 days. The nursery and transplanting cost per hectare was arrived as ₹10,500 as against of ₹1,500 by manual sowing. Transplanting at optimum time registered 15.34% and 4.85% higher seed cotton yield and net return as compared to corresponding date of direct sown crop. However transplanting in late sown arrived as 44.4% of higher net return. The Seed cotton yield of Mallika BG II Bt was equal to Suraj. The results concluded that the transplanting had more advantage in late sown and is not genotype specific.

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Table 2. Seed cotton yield (q/ha) of genotypes as influenced by methods and times of planting

Genotype	Transplanting	Direct sown	Mean
Mallika	24.1	21.2	22.7
Suraj	22.2	19.4	20.8
Mean	23.2	20.3	21.7
ANOVA	Genotypes	Method	GXM
SED	0.91	0.91	1.29
CD (0.5%)	NS	1.9	2.69