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RESEARCH ARTICLE

Influence of Different Transplanting days on Yield attributes of Mini clones under Field Conditions for *Morus indica* (V1)

Karthick mani Bharathi B[1], Susikaran S[1*], Parthiban K T[1], Vasanth V[1] and Vijay S[2]

[1]Tamil Nadu Agricultural University, Coimbatore - 03
[2]Central Silk Board, Bengaluru.

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ABSTRACT

An experiment was carried out to compare yield attributes ofapical cuttings developed using Mini-clonal technology of variety V1 along with the regular stem cuttings. Both apical and stem cutting plants were evaluated under field conditions at Forest College and Research Institute, Mettupalayam, Tamil Nadu. In this study, yield parameters like fresh leaf weight (g), no of branches (no's per plant), no of leaves (no's per plant) and plant yield (g) were evaluated. The results clearly indicates superior performance was noticed in V1 apical cuttings, treatment 60DAP-AC (V1) mini clones recorded yield attributes like fresh leaf weight (5.33 g), no of branches (2.92 no's) per plant, no of leaves (49.23 no's) per plant and plant yield (103.98g) better than stem cuttingsfresh leaf weight (4.94 g), no of branches (2.56 no's) per plant, no of leaves (41.85 no's) per plant and plant yield (89.14 g).Evaluating yield traits under primary field conditions in relation to various transplantation days was the primary goal of the study.

Keywords: clonal variation, mini clones, mulberry, mini clonal technology, yield attributes

INTRODUCTION

Mulberry (*Morus* spp.) is a member of the Moraceae family of deep-rooted perennial and deciduous herb with foliage that produces a lot of biomass. The silkworm (*Bombyxmori* L.), which only consumes mulberry leaves, is essentially a monophagous insect. Mulberry production alone accounts for about 60% of the total cost of cocoon production in sericulture (Zafar*et al.,* 2013). To choose the most desirable traits, a methodical investigation of the variations in each and every characteristic of the species and variants is required. Mulberry creates a variety of natural hybrids with numerous intermediate forms because to its high heterozygous, dioecious, and perennial nature(Magadum*et al.,* 2019). In order to choose superior kinds for optimal rearing performance, mulberry plants are evaluated based on a number of parameters, one of which is leaf quality.

As a result, increasing focus has been placed on improving mulberry yield and quality in recent years(Tikader and Vijayan, 2010). Mulberry leaf yield is mostly determined by genotype, agronomic techniques, and a variety of leaf yield contributing characteristics. The improvement of mulberry quality and quantity is also significantly influenced by leaf yield and yield-related parameters. The quantity and length of shoots, the distance between internodes, and the leaf yield per plant all affect mulberry leaf yield(Sudhakar*et al.,*2018).Three main components are necessary for successful silkworm rearing: mulberry leaves, the surrounding environment, and the health and characteristics of the hybrid worms, which are greatly influenced by the type and amount of food consumed(Singh *et al.,* 2013).

Innovative methods for rooting micro- or mini-cuttings have demonstrated their potential to replace rooted stem cuttings by increasing rooting potential, speed, and quality while lowering costs (Seenivasan*et al.,*2012). Stem cuttings is a highly significant method in the establishment of mother clonal hedges, but it has drawbacks as well, such as the hedges' ontogenetic aging that causes them to lose their rooting power (Shanmugam and Seenivasan, 2010). For the purpose of swiftly transferring genetic advantages and addressing the drawbacks of traditional vegetative

*Corresponding author's e-mail: susikaran.s@tnau.ac.ingmail.com

propagation in *Morus* spp., the mini-cutting technique for the species mentioned earlier must be standardized for large-scale production in India(Parthiban*et al.,* 2019). The mini-cutting approach can root in shorter periods of time, clone production using this method minimizes the amount of time spent in the mist chamber (Parthiban*et al.,* 2021). Apart from this, the usage of seed material is completely eliminated in the mini-cutting method of clone manufacturing when clonal garden once established(Bharathi*et al.,* 2022). This will eventually impact the rise in mist chamber utilization (Titon*et al.,* 2006). As a result, the mini-cutting approach raised the mist chamber's unit area production rate (Assis*et al.,* 2004). Because of their larger lateral root systems, plants developed using mini clonal technology performed better under main field conditions(Parthiban and Seenivasan, 2017).

MATERIALS AND METHODS

The experimental location

The experimental research were carried out to validate mini clones propagated using Mini clonal Technology for *Morusindica*(V1). The experimental study was done in Clonal complex nursery and Department of Sericulture, Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam, Coimbatore district, Tamil Nadu (11˚20'N, 76˚55'E, 300 meters above mean sea level with average rainfall of 800mm) during the year 2021- 2022.

Rooting hormone and rooting medium for mini clonal propagation of mulberry

Rooting hormone was prepared using ingredients like talc powder, fungicide, boric acid crystal, IBA powderat 3000ppm concentration as recommended by Kiruthika (2020). The source of explant for mini clones preparation was excised from healthy plants in mother clonal garden. The excised apical tips are usually collected at morning and immediately used in the preparation of mini clones to avoid drying of apical cuttings. The excised tips are then dipped in systemic fungicide at 0.2%. The ideal size of apical cuttings was 15cm size. This was supported by Sabarish (2017). The root trainers are disinfected with 0.2% systemic fungicide and filled with rooting medium intactly for proper formation of roots. Soil: coir pith: FYM at proportion 1:1:1 was considered as an ideal rooting medium. This was strengthened by Kiruthika (2020).

Among different rooting hormone concentration *viz.* 1000 ppm, 2000 ppm, 3000 ppm, 4000 ppm and 5000 ppm. Treatments at IBA 3000ppm have performed well compared to other concentrations in nursery. Therefore, ideal rooting hormone for V1 mulberry varieties was Indole-3 butyric acid @ 3000 ppm (Kiruthika, 2020). The apical tips are applied with ideal rooting hormone concentration of IBA 3000ppm without damaging cambium section at base. Watering was provided once in a week. Exogenously synthesized auxin will stimulate root growth provided high temperature of 30˚C ± 3˚C and high relative humidity of 80 and 85 per cent. The desired temperature was provided by low budget poly tunnel structure.

To study the effect of different transplanting days on yield parameters of V1 apical cuttings under field conditions

A study was conducted in main field environment to record yield parameters likefresh leaf weight (g),number of leaves per plant (no's),number of shoots per plant (no's) and plant yield (kg/plant) were taken at 30 DAT, 60 DAT, 90 DAT intervals (DAT- Days After Transplanting in main field).At nursery level, healthy plants at 3000ppmwere taken for the study.

The selected plants are transplanted to main field conditions at different intervals *viz.* 50 DAP, 60 DAP, 70 DAP, 80 DAP and 90 DAP(DAP- Days After Planting in nursery)of V1 mini clones and regular stem cutting of V1as a check to study the influence of transplanting days in yield attributes at different growth intervals in main field. Main field was prepared and plants are planted at spacing of 10 feet x 10 feet. Weeding was done at sixth day after transplanting. Irrigation was provided once in a 5-6 days. Each replication consists of ten plants and has four replications following standard package of practices. The research was experimented out in Factorial Randomized Block Design (FRBD).

Experimental details

Crop : Mulberry

Variety : V1

Treatments : Six

Replications :Four

Spacing : 10 feet x 10 feet

Treatments

T1: V1 Variety transplanting on 50th day (Apical cuttings)

T2: V1 Variety transplanting on 60th day (Apical cuttings)

T3: V1 Variety transplanting on 70th day (Apical cuttings)

T4: V1 Variety transplanting on 80th day (Apical cuttings)

T5: V1 Variety transplanting on 90th day (Apical cuttings)

T6: V1 Variety transplanting on 90th day (Stem cuttings) – check

Observations recorded

The observations were recorded on yield parameters like fresh leaf weight (g),number of leaves per plant,number of shoots per plant and plant yield.

Yield attributes of mulberry

Each replication consists of ten mulberry plants from which five plants were randomly selected under main field conditions and labelled for recording yield parameters.

Fresh leaf weight (g)

The leaves from middle portion of the plants was collected and weighed immediately after harvesting and expressed in grams.

Number of leaves per plant (no's/plant)

Total number of leaves per plant was counted and expressed in numbers/plant.

Number of shoots per plant (no's/plant)

Total number of shoots per plant was observed and expressed in numbers/plant.

Plant yield (g/plant)

Leaves from whole parts of the plant was collected and weighed. The average value was expressed in g/plant.

Statistical analysis

The data collected from above experiments were critically analysed by adopting Factorial Randomized Block Design (FRBD).During statistical analysis of data, the treatments which were found significant, the critical differences were calculated and analysed at five per cent level of probability. AGRES software package was used to analyse the stage wise data.

RESULTS AND DISCUSSION

Number of leaves/plant

There is an interaction effect between transplanting days and number of leaves per plant. Number of leaves per plant significantly increased with increase in growth period (Fig 1). In V1, highest number of leaves observed in T5 were 28.72 no's, 43.80 no's and 62.51 no's during 30 DAT, 60 DAT and 90 DAT. This was followed by T4 were 27.63 no's (30 DAT), 41.22 no's (60 DAT) and 54.31 no's (90 DAT) whereas T1 showed lowest number of 11.23 no's, 23.31 no's and 32.72 no's during 30 DAT, 60 DAT and 90 DAT respectively (Table 1). The statistical analysis of number of leaves per plant revealed that in V1 at 90 DAT, T2 (49.23 no's) and T3 (51.40 no's) also treatment T4 (54.31 no's) and T5 (62.51 no's) were found to be statistically on par with each other.

The increase in number of leaves coincided with the increase in growth of the plant. The present findings are in line with Bheevi (2010) who reported 32 leaves at 150 days old plants of variety V1 (SC).

Table1. Effect of different transplanting days on number of leaves/plant (no's) of V1 mini clones at different time intervals

Treatment	30DAT	60DAT	90DAT
50 DAP-AC (T1)	11.23^{d}	23.31^{d}	32.72^{d}
60 DAP-AC (T2)	21.57^{b}	38.28^{b}	49.23^{b}
70 DAP-AC (T3)	23.11^{b}	39.63^{b}	51.4^{b}
80 DAP-AC (T4)	27.63^{a}	41.22^{ab}	54.31^{a}
90 DAP-AC (T5)	28.72^{a}	43.8^{a}	62.51^{a}
90 DAP-SC (T6)	15.47^{c}	32.13^{c}	41.85^{c}
SE(d)	1.13	1.48	1.13
CD(0.05)	2.53**	3.29**	2.53**

Note: AC - Apical cuttings; SC - Stem cuttings

**Highly significant, *Significant

Each value is the mean of four replications

Means followed by same alphabets are on par with each other by LSD (P=0.05)

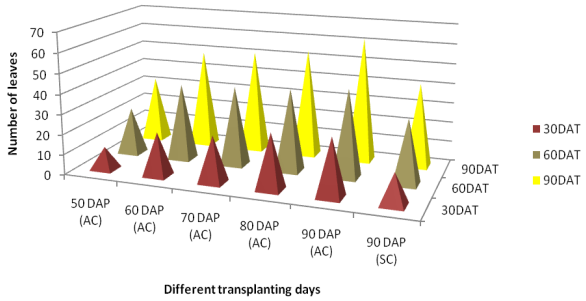

Figure1. Effect of different transplanting days on number of leaves/plant (nos.) of V1 mini clones at different time intervals

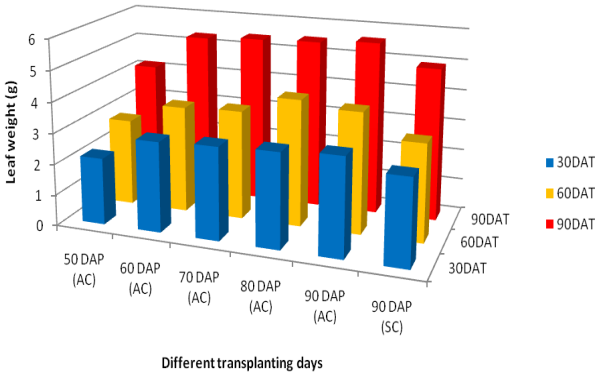

Figure2. Effect of different transplanting days on single leaf weight (g) of V1 mini clones at different time intervals

Single leaf weight

The leaf weight values differed significantly at three intervals *i.e.* 30 DAT, 60 DAT and 90 DAT in V1 mini clones and stem cuttings was taken as check (Fig 2). In V1, maximum leaf weight was recorded in T5 were 3.16g, 3.91g and 5.61g during 30 DAT, 60 DAT and 90 DAT. This was followed by T4 were 3.05g (30DAT), 4.10g (60DAT) and 5.49g (90 DAT) whereas T1 showed minimum weight of 2.16g, 2.82g and 4.18g during 30 DAT, 60 DAT and 90 DAT respectively (Table 2). From statistical analysis, it was found that in V1 at 90 DAT, T3 (5.43g), T4 (5.49g) and T5 (5.61g) were found to be statistically on par with each other.

There was a significant difference in single leaf weight at different growth periods *viz.,* 30 DAT, 60 DAT and 90 DAT in V1 mini clones. The age of the plant and variety have direct impact on leaf weight. The present study strengthened by Sudhakar*et al.* (2020) who registered 5.3 to 5.6g in V1 variety.

Number of branches /plant

At different growth time periods *i.e.* 30 DAT, 60 DAT and 90 DAT in both V1 and MR2 mini clones and stem cuttings, number of branches per plant significantly differed among the treatments due to effect of different transplanting days (Fig 3) which was proved statistically. In V1, highest number of branches recorded in T5 were 1.62 no's, 2.71 no's and 3.40 no's during 30 DAT, 60 DAT and 90 DAT. This was followed by T4 were 1.48 no's (30 DAT), 2.66 no's (60 DAT) and 3.28 no's (90 DAT) whereas T1 showed lowest number of 1.18 no's, 1.57 no's and 1.71 no's during 30 DAT, 60 DAT and 90 DAT respectively (Table 3). From statistical analysis, it was found that in V1 at 90 DAT, T4 (3.28 no's) and T5 (3.40 no's) found to be statistically on par with each other.

Table2. Effect of different transplanting days on single leaf weight (g) of V1 mini clones at different time intervals

Treatment	30DAT	60DAT	90DAT
V1 50 DAP-AC (T1)	2.16^{c}	2.82^{d}	4.18^{c}
60 DAP-AC (T2)	2.92^{ab}	3.46^{bc}	5.33^{ab}
70 DAP-AC (T3)	2.99^{ab}	3.53^{b}	5.43^{a}
80 DAP-AC (T4)	3.05^{a}	4.10^{b}	5.49^{a}
90 DAP-AC (T5)	3.16^{a}	3.91^{a}	5.61^{a}
90 DAP-SC (T6)	2.78^{b}	3.15^{cd}	4.94^{b}
SE(d)	0.11	0.16	0.17
CD(0.05)	0.26**	0.36**	0.39**

Note: AC - Apical cuttings; SC - Stem cuttings

**Highly significant, *Significant

Each value is the mean of four replications

Means followed by same alphabets are on par with each other by LSD (P=0.05)

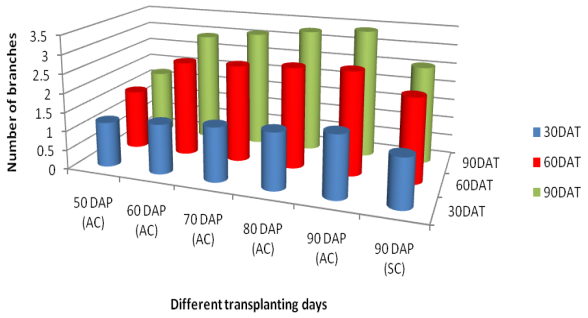

Figure3. Effect of different transplanting days on number of branches/plant (nos.) of V1 mini clones at different time intervals

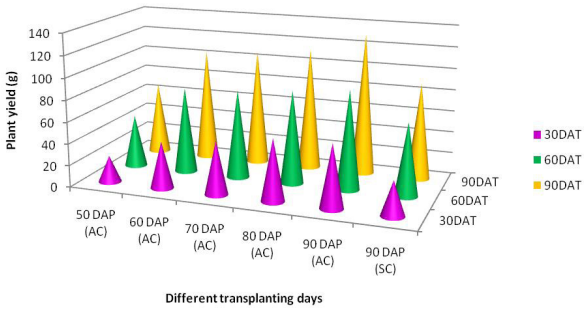

Figure4. Effect of different transplanting days on plant yield (g) of V1 mini clones at different time intervals

The number of branches among the clones varied at different growth periods. Similarly, the findings derive support from Mithilasri*et al.* (2021) who observed 2.94 branches in V1 mini clones after three months after plantation.

Plant yield

There was a significant difference due to different hardening periods in plant yield data at different growth periods *viz.,* 30 DAT, 60 DAT and 90 DAT in both V1 and MR2 mini clones (Fig 4) which was confirmed by statistical analysis. In V1, maximum plant yield noticed in T5 were 57.85g, 91.37g and 131.29g during 30 DAT, 60 DAT and 90 DAT. This was followed by T4 were 56.72g (30 DAT), 86.14g (60 DAT) and 113.42g (90 DAT) whereas T1 showed minimum yield of 24.18g, 48.31g and 67.23g during 30 DAT, 60 DAT and 90 DAT respectively (Table 4). The statistical analysis of plant yield revealed that in V1 at 90 DAT, T2 (103.98g) and T3 (107.15g) found to be statistically on par with each other.

There was a significant difference due to different hardening periods in plant yield data at different growth periods *viz.,* 30 DAT, 60 DAT and 90 DAT in V1 mulberry mini clones. Leaf yield was considered as an important parameter to evaluate a variety and vary with different growth period of the plant. The present results are in agreement with Bheevi (2010) who registered 95.5g leaf weight in 150 day old V1 mulberry plant.

CONCLUSION:

Treatment 60 DAP-AC (V1) produced highest number of leaves of 49.23 numbers. Mini clones 60 DAP-AC (V1) registered mean leaf weight of 5.33g. Mini clones 60 DAP-AC (V1) produced more number of branches such as 2.92 numbers. Treatment 60 DAP-AC (V1) yielded maximum leaves of 103.98g.Stem

Table3. Effect of different transplanting days on number of branches/plant (no's) of V1 mini clones at different time intervals

Treatment	30DAT	60DAT	90DAT
50 DAP-AC (T1)	1.18^{d}	1.57^{c}	1.71^{d}
60 DAP-AC (T2)	1.31^{bcd}	2.52^{a}	2.92^{b}
70 DAP-AC (T3)	1.42^{bc}	2.57^{a}	3.1^{ab}
80 DAP-AC (T4)	1.48^{ab}	2.66^{a}	3.28^{a}
90 DAP-AC (T5)	1.62^{a}	2.71^{a}	3.4^{a}
90 DAP-SC (T6)	1.27^{cd}	2.21^{b}	2.56^{c}
SE(d)	0.08	0.09	0.14
CD(0.05)	0.18**	0.21**	0.32**

Note: AC - Apical cuttings; SC - Stem cuttings

**Highly significant, *Significant

Each value is the mean of four replications

Means followed by same alphabets are on par with each other by LSD (P=0.05)

Table4. Effect of different transplanting days on plant yield (g) of V1 mini clones at different time intervals

Treatment	30DAT	60DAT	90DAT
50 DAP-AC (T1)	24.18^{e}	48.31^{d}	67.23^{e}
60 DAP-AC (T2)	43.16^{c}	79.8^{b}	103.98^{c}
70 DAP-AC (T3)	49.35^{b}	81.96^{b}	107.15^{c}
80 DAP-AC (T4)	56.72^{a}	86.14^{ab}	113.42^{b}
90 DAP-AC (T5)	57.85^{a}	91.37^{a}	131.29^{a}
90 DAP-SC (T6)	31.51^{d}	67.23^{c}	89.14^{d}
SE(d)	2.26	3.79	2.41
CD(0.05)	5.04**	8.44**	5.37**

Note: AC - Apical cuttings; SC - Stem cuttings

**Highly significant, *Significant

Each value is the mean of four replications

Means followed by same alphabets are on par with each other by LSD (P=0.05)

cuttings registered number of leaves of 41.85 no's, single leaf weight of 4.94 g, number of branches of 2.56 no's and plant yield of 89.14g. From the above data, it clearly indicated that plants developed using apical cuttings showed better yield attributes compared to plantsgenerated using regular stem cuttings.

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Ethics statement

No specific permits were required for the described field studies because no human or animal subjects were involved in this research.

Consent for publication

All the authors agreed to publish the content.

Competing interests

There were no conflict of interest in the publication of this content

Author contributions

All the authors are equally contributed to research work.

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