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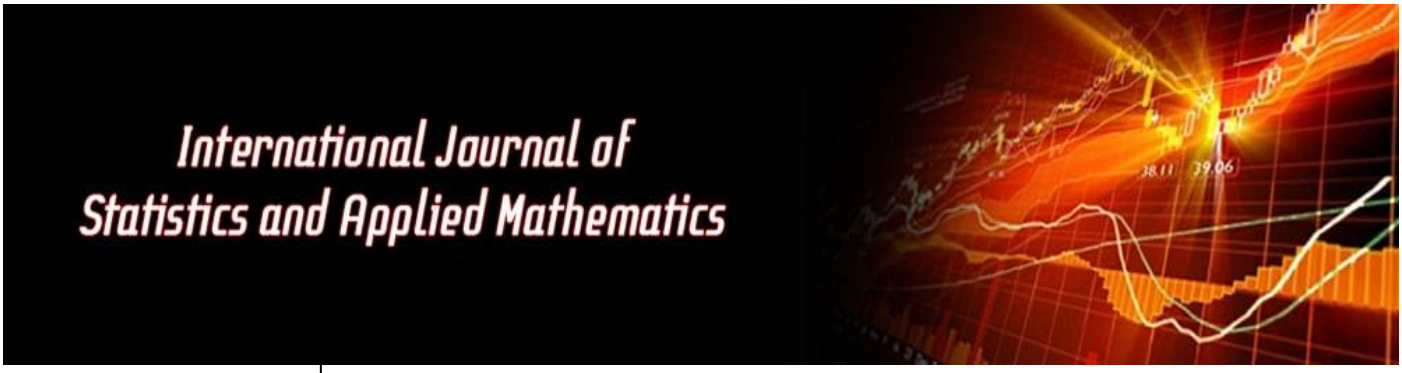

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Sabarish M
Department of Sericulture, Government of Tamil Nadu, India

Kalpana R
Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu, India

Menaka S
Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu, India

Moulidharshan R
Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu, India

Nandha Kumar R
Department of Sericulture, Forest College and Research Institute, Mettupalayam, Tamil Nadu, India

Rubeesh Kumar
Department of Economics, Bharathiar University, Coimbatore, Tamil Nadu, India

Corresponding Author:
Sabarish M
Department of Sericulture, Government of Tamil Nadu, India

Economics of mini clonal technology for mulberry (*Morus sinensis*)

Sabarish M, Kalpana R, Menaka S, Moulidharshan R, Nandha Kumar R and Rubeesh Kumar

Abstract
Mini clonal is a propagation technology very effective in mass multiplication of proven superior individuals occurring in nature and one among familiar vegetative propagation method for multiplying sapling of forest tree. As mulberry is a perennial tree and it is maintained as bush for convenient purpose. This study concludes to formulate of mini clonal technology for mulberry (*Morus sinensis*) and calculating economics for commercial multiplication mulberry saplings. Analysis of various economic tools have shown that mulberry nurseries using mini clonal technology have an edge over traditional method of propagation. Whole technology was evaluated for cost and returns. The total cost incurred was accounted for Rs. 71, 113.12 and gross return of Rs. 1,20, 000 was obtained by selling 60, 000 sapling at rate of Rs. 2 per saplings. The return per one rupee of expenditure was worked out to 1.68.

Keywords: Economics, propagation, gross return, propagation technology

Introduction
Mulberry is amenable for sexual and asexual modes of reproduction. Owing to heterozygosity of parents, propagation through seeds is not commercially viable as seed grown plants show high degree of variability and poor survival percentage 20-30 per cent (Vijayan, 1997) [6]. Therefore, propagation of mulberry for large scale production is done using stem cuttings by planting the cutting directly in the field or raising saplings in nursery and then transplanting to main field. The advantage of propagating through stem cuttings is the ability of perpetuating the good characteristics of mother plant without any alteration and adapts to various agro-climatic conditions. Likewise, triploid varieties could only be propagated vegetatively due to its sterile nature (Narayan *et al.*, 1989) [4].

Though propagation through stem cutting is easy, it has some restriction *viz.*, low rooting potential in (MR2 variety), less number of harvests per plant and long juvenile period. Additional problem involved in developing saplings in nursery is the maintenance and management cost for 3-6 months (Khan *et al.*, 2003) [3]. So to overcome these limitations, it was planned to establish an alternate method with which mulberry can be propagated rapidly in a cost-effective way.

Mini clonal propagation provides an alternative tool for rapid and cost-effective multiplication for mulberry as large number of clones could be produced in short time and space. Mini clonal technology has been developed for *Casuariana* and *Melia* and successfully implemented in Tamil Nadu for commercial multiplication (Parthiban, 2016) [5]. In contrast when compared to stem cutting, mini cutting system showed improved rooting potential, rooting speed, and rooting quality as well as reduced cost. Additionally, this system offer propagules with increased uniformity and greatly reduces topophysis effect (Francisco *et al.*, 2004) [2]. The main feature of the technique is the use of juvenile plants or plants rejuvenated *in vitro*, as a source of vegetative propagules. Shoot apices are used as micro-cuttings which are placed to root in a greenhouse equipped with temperature and humidity control. The actual size of micro-cuttings is about 7 to 8 cm with two to three leaf-pairs. Presence of shoot apex is important for quality of the root system as its presence induces taproot-like system.

The micro-stumps left after micro-cutting harvest sprout rapidly, producing new micro-propagules which can be harvested for use within a period of 15 days in the summer and 30 days in the winter.

Any propagation technology is found to be viable when there is a positive increase in net return over total cost incurred for mass multiplication. This study promulgates correlation between cost and returns of mini clonal technology.

Material and Methods

This study was conducted during 2016-2017 at Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam the propagules required for standardizing cutting size for mini clonal propagation were collected from juvenile stem cuttings of MR2.

Preparation of mini clonal hedge garden

Semi hard wood cuttings were excised from selected MR2 mulberry variety. The cuttings were further trimmed to a length of approximately 15 cm with minimum three to four active buds. A slanting cut was given at the basal part of all the cuttings. Then the cuttings were treated with 0.2 per cent bavistin for 10 minutes. Treated cuttings were planted in bed of 30 × 30 cm spacing and each bed accommodated 50 cuttings. In total for five beds 250 cuttings were planted. Each bed is prepared by mixing 5.00 kg of FYM with soil and periodic application of fertilizers *viz*., Urea, Single super phosphate and Muriate of potash after each harvest of clonal cuttings from clonal hedge garden.

Preparation of mini cuttings

Apical shoot cuttings were excised from mother garden and the cuttings were further trimmed to different length of (2 cm, 4 cm, 6 cm, 8 cm, 10 cm and 15 cm). All the leaves of the shoot except two leaves near the apical point were removed before using for different hormonal treatments. A slanting cut was given at the basal part of all the cuttings. Then the cuttings were treated with 0.2 per cent bavistin for 10mins and subjected to different root inducing hormones *viz.*, Indole Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) at 6000 ppm on quick dip basis. Such treated cuttings were planted in poly bags of 10 x 15 cm size and kept inside the low-cost poly tunnels. Watering was done once in a week in order to maintain desired humidity between 80 and 90 per cent. The temperature in the poly tunnel was maintained at 33±1℃. The studies were conducted in a Completely Randomized Block Design (CRD) with four replications, with 25 cuttings per replication.

The economic measures used in the study to evaluate the nursery is given below Net income

Net income indicates all profit that business makes after deducting all the expenses.

B:C ratio

Benefit cost ratio is used to evaluate the investment in a project for their profitability or viability. B:C ratio = | PV (Benefit) | / | PV (Cost) |.

BCR < 1, Investment in loss

BCR = 1, Investment neither loss not profitable BCR > 1, Investment is profitable

Results and Discussion

This study was conducted in $15m^2$ area, but the cost and return for whole technology was projected for 1 acre. The quantities of inputs included under each operation are manipulated for 1 acre

Cost incurred for establishment of mother garden (A)

Cost for establishment of mother garden for the first six months was Rs. 15013.12. The maximum expenditure was incurred towards labour charge (Rs. 9500; 63.28%) followed by planting material cost (Rs.2, 248; 14.97%), fertilizer (Rs. 1, 455.12; 9.70%), Bio fertilizer (Rs.1, 000; 6.66%), fungicide (Rs. 530; 3.53%), while the minimum cost was incurred towards insecticides (Rs. 280; 1.87%), (Table 1).

Cost incurred for mini clonal propagation (B)

Cost incurred for mini clonal propagation per batch was Rs. 56, 100. Major share is from polybags accounting to Rs. 38, 500 (68.63%), followed by polythene sheet Rs. 8, 500 (15.51%), labour charges Rs. 6, 000 (10.70%), growth regulators Rs. 1800 (3.20%) and minimum cost incurred towards thread Rs. 400 (0.71%). Total cost (A+B) for whole technology accounted to (Rs. 71, 113.12). The gross return obtained were Rs. 1, 20, 000 by selling 60, 000 sapling at rate of Rs. 2 per sapling. Net return obtained was Rs. 48,886.88. The return per one rupee of expenditure was worked out to 1.68 (Table 1).

During establishment of mulberry mother garden, the maximum expenditure (Rs. 9, 500) was incurred towards labour charge (63.28%) followed by cost of planting material (Rs.2, 248; 14.97% per acre), fertilizer (Rs.1455.12; 9.70%), *Tricoderma* (Rs.1, 000; 6.66%), fungicide (Rs.530; 3.53%), while minimum cost of (280; 1.87%) was incurred towards insecticides. The total cost of maintenance of mulberry garden during the first six months Rs.15, 013.12.

In addition, the cost incurred and return from raising of mulberry saplings through mini clonal technology were worked out. The total cost for raising of mulberry saplings for 1 acre per batch was Rs.56,100 and maximum share of 68.63% was incurred towards polybags (Rs.38, 500) followed cost of polythene sheet (Rs.8, 500; 15.51%), labor charge (Rs.6000; 10.70%), growth regulators (Rs.1800; 3.20%) and minimum cost incurred towards thread Rs. 400 (0.71%)

The total cost incurred for whole technology was Rs.71, 113.12 and gross returns were Rs. 1, 20,000 per acre per batch. The net returns of Rs. 48,886.88 per acre per batch were obtained by selling 60,000 saplings at the rate of 2 per sapling The return per rupee of expenditure was 1.68.

Similar type of economic analysis was done by Baqual *et al*. (2007) [1] for one hectare, who reported that major expenditure incurred for raising of saplings was towards planting material using polythene bags (33,740 per ha) and grafting method (33,740 per ha) during the first year, while it was Rs.18,620 and Rs.29,315 per ha, respectively during second year followed by labour cost. They found the cost of raising of 10,000 saplings were 68,825 and 1,47,840 by polythene bag and grafting methods, respectively and the cost of raising of each sapling worked out respectively.

Conclusion

Sericulture is a rural based cottage industry capable of generating income every month highly benefitting marginal and small-scale farmers. As mulberry holds the maximum share for good quality silk production so at most care should be taken during initial establishment of mulberry garden which is attributed to quality saplings at lower cost. This study examines the viability of mini clonal technology for mass multiplication of mulberry sapling by means of two

factors cost and returns. Whole technology was evaluated for cost and returns. The total cost incurred was accounted for Rs. 71, 113.12 and gross return of Rs. 1,20, 000 was obtained by selling 60, 000 sapling at rate of Rs. 2 per saplings. The return per one rupee of expenditure was worked out to 1.68. Based on the study mini clonal technology is viable method for propagation of mulberry cutting in terms of cost and returns.

Table 1: Cost and return for mini-clonal technology

S. No.	Particulars		Quantity	Unit Price (Rs)	Total cost (Rs)	Per cent Share
A. Cost incurred for mother garden establishment/acre						
1.	Mulberry cuttings (Nos.)		4496	0.50	2,248	14.97
2.	*Tricoderma viride* @ Rs.100/(Kg)		10	100	1,000	6.66
3.	Fertilizer	Urea @ Rs. 5.52/(Kg)	50	5.52	276.12	1.84
		Phosphorus @ Rs 6.78/(Kg)	50	6.78	339	2.26
		Potash @ Rs 16.8/(kg)	50	16.8	840	5.60
4.	Fungicide – Bavistin @ Rs 530/(Kg)		1	530	530	3.53
5.	Insecticide – Chlorpyrifos @ Rs 140/(5ml)		2	140	280	1.87
6.	Preparation of mother bed (MDs)**		10	350	3,500	23.31
7.	Application of fertilizers/ twice a week (MDs)*		2	300	600	4.00
8.	Application of insecticide (MDs)*		4	300	1,200	7.99
9.	Harvesting of cuttings (MDs)*		8	300	1,800	11.99
10.	Irrigation @ twice a week (MDs)*		6	300	1,800	11.99
11.	Weeding @ twice a month (MDs)*		2	300	600	4.00
	Subtotal A				15013.12	100
B. Cost incurred for mini clonal propagation/acre						
1.	Poly bags @ 154/(Kg)/batch		250	154	38,500	68.63
2.	Rooting hormone	IBA @ Rs 250/(5g)	6	250	1,500	2.67
		NAA @ Rs 300/(25g)	1	300	300	0.53
3.	Polythene sheet @ Rs 425/Roll		20	425	8,500	15.15
4.	Soil @ 2,000/load/batch		2	2,000	4,000	7.13
5.	Cotton thread @ Rs 20/bundle		20	20	400	0.71
6.	Planting (MDs)*		20	300	6,000	10.70
	Subtotal B				56,100	100
	Total (A+B)				71,113.12	-
C. Returns						
1.	B:C ratio @ Rs. 2 per sapling (Nos.)		60,000	2	1,20,000	-
2.	Net profit (C-Total)		-	-	48,886.88	-
3.	Benefit cost ratio		-	-	1.68	-

** Male *Female

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