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Impact of potting medium and cutting types on rooting and survival performance of male plants of *Momordica dioica*. Roxb (Thumba Karawila)

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ABSTRACT

Momordica dioica. Roxb was selected among the wild varieties in the past as a vegetable due to high medicinal value and this vegetable is very popular in Sri Lanka. Farmers use seeds, bulbs, roots and cuttings for the propagation of this plant and the most famous method is cuttings. However, the success percentage of male cuttings is around 40% and the farmers have faced some issues when they propagate male plants using cuttings. Therefore, the present research was focused mainly to find a solution to improve the success percentage and growth performance of male cuttings. There was four different potting media viz., 1) *equal proportions of sand, compost and top soil, 2) coir dust only, 3) sand and coir dust in equal proportions, 4) coir dust, sand, compost & top soil in equal proportions and two different cutting types of male plants (semi-hard wood and hard wood). The field trail was carried out with three treatments viz., 1) equal proportions of sand, compost and top soil, 2) coir dust only 3) sand and coir dust in equal proportion. The experiment was conducted as a two factor factorial complete randomized design with 20 replicates. Result showed the semi hardwood cuttings planted in coir dust medium significantly increase the rooting and plant growth in the nursery and better adaptation of Momordica dioica male plants in the field also.*

***Keywords*:** Cutting types, male plants*, Momordica dioica,* potting media,

INTRODUCTION

In Sri Lanka, Momordica dioica (Cucurbitaceae) commonly known as spine gourd, small bitter-gourd or Thumba karawila. It is considered as an underutilized vegetable in the Indo-Malayan region and it has a high nutritional and medicinal value. It helps to build natural immunity of a human body. M. dioica contains 84.1g moisture, 7.7 g of carbohydrate, 3.1 g of protein, 3.1 g of fat, 3.0 g of fiber, 1.1 g of minerals and small quantities of essential vitamins like ascorbic acid, carotene, thiamin, riboflavin and niacin in 100g of spine gourd (Singh *et al.*, 2009). M. dioica can be propagated through underground tubers, stem cuttings and seeds (Agrihortico, 2007). In Sri Lanka, spine gourd is mainly propagated by stem cuttings. There is a high demand for planting material of this crop to satisfy its market potential. It is observed that the propagation success of male stem cuttings at nursery stage is lower (40%) than the female stem cuttings (80%). Besides, growth performance of stem cuttings of male plants is slower as compared to stem cuttings of female plants. This results in delayed flowering in male vines that affects the productivity of the crop. For better fruit setting and yield it is necessary synchronize flowering of female and male plants. Therefore, an experiment was taken up with a view to increase rooting success and to improve the plant growth by using different potting media and different cuttings types of male plants.

MATERIAL AND METHODS

The experiment was conducted at the Institute for Agro-technology and Rural Sciences, University of Colombo (UCIARS), Hambantota. Four mixtures of potting media were tested with 1) equal proportions of sand, compost and top soil, 2) coir dust only, 3) coir dust and sand in equal proportions, 4) coir dust, sand, compost and top soil in equal proportions. Two types of stem cuttings were used viz., semi-hard wood and hard wood cuttings. The experiment was conducted as a two factor factorial complete randomized design with 20 replicates.

Planting Pots were prepared using black polythene packets of size 12.5cm x 10cm 300 gauge thickness Potting media were sterilized with a commercially available fungicide (captan 2g/10L/ 2m2) after filling the pots. Male cuttings were collected separately from mother plant in water bucket to avoid drying of cutting end. Two nodal cuttings were prepared to plant after dipping in captan fungicide solution (2g/10L). Cuttings were planted in pots after applying rooting hormone (0.3 % Indole 3 - butyric Acid) in the cutting surface. Pots were kept in shade house (60%) for 6 weeks.

Study at nursery stage

Germination and growth parameters of M. dioica male cuttings were evaluated. Data were collected twice per week intervals until 6 weeks for the time taken for bud initiation (days) and data on number of new branches, length of the new branch (cm) and cumulative leaf number in new branches from 2nd week of planting were collected. Data on number of roots and root length (cm) were collected after 6 weeks.

Establishment study in the field

This study was carried out with successful treatments, which showed the best performance at nursery stage. According to the result, semi hard wood cuttings planted in pots having equal proportions of a) sand, compost and top soil; b) coir dust only and c) coir dust and sand in equal proportions were taken for field establishment study. The rooted plants from above 3-treatments were planted in the field at the age of four weeks for field establishment study. Randomized Complete Block Design with 3 replicates was used as experimental design and the Plot size was 24 m2. Planting pits were prepared in plots in recommended spacing (1.5 m x 1 m) given by the Department of Agriculture, Sri Lanka (Techno guide, DOA, 1999). Spacing between two blocks was 1.5 m.

Plant growth and yield parameters study in the field

Data collection was started one week after planting in the field and continued until the end of 16 weeks. Growth parameters such as plant height (cm), cumulative number of leaves and number of branches were collected two weeks intervals. Yield parameters such as time taken for 50% flowering (days), number of male flowers/plant, were collected in weekly intervals.

RESULTS AND DISCUSSION

At nursery stage

Time Taken for initiation of new buds

Results revealed that, there was no significance different for time taken for the initiation of new buds on cutting type of semi hard wood and hard wood (Figure 1). The significantly shortest time taken for the initiation of new buds was observed on cuttings planted in coir dust medium compared to the cutting planted in all the other potting media (Figure 1). Present study showed that the semi hard wood cuttings is the best cutting type and coir dust was found to be the best potting medium in relation to the time taken for rooting. The reason for this may be that more moisture is available in coir dust to prevent drying the potting medium especially during the dry climatic conditions in Hambantota where the experiment was conducted. This findings was in agreement with Nandi et al (2019), studied on dragon fruit. They found that maximum number alive cuttings were obtained from the semi hardwood part.

Length of new buds

The significantly highest vine length was recorded in semi hard wood cuttings at 4 and 7 weeks after planting (Figure 2). The significantly longest vine length was observed in coir dust medium compared to all the other potting mixtures at 4th and 7thweeks after planting. Similar results were observed 7weeks after planting (Figure 3).

Cumulative leaf number of new buds

The cumulative number of leaves on new buds of the M. dioicia male plants cutting was also not significantly influenced by different potting mixtures at 4 weeks after planting. But, at 7 weeks after planting, cumulative numbers of leaves on new buds showed a significantly higher value in coir dust media compared to all the other treatments (Figure 4).

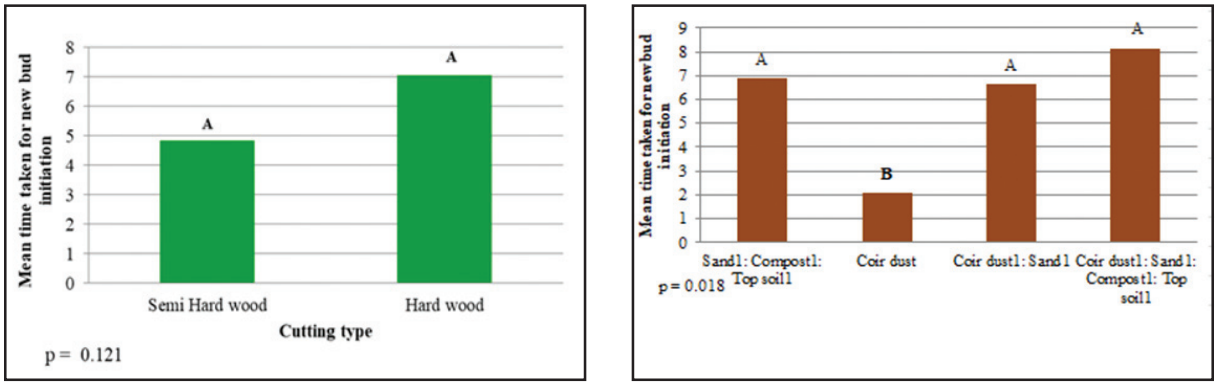

Fig. 1: Effect of cutting type and potting mixture on mean time taken for new buds initiation of *M. dioicia* cuttings

Means on the bars represent the same letter are not significantly different at P ≤ 0.05 probability level.

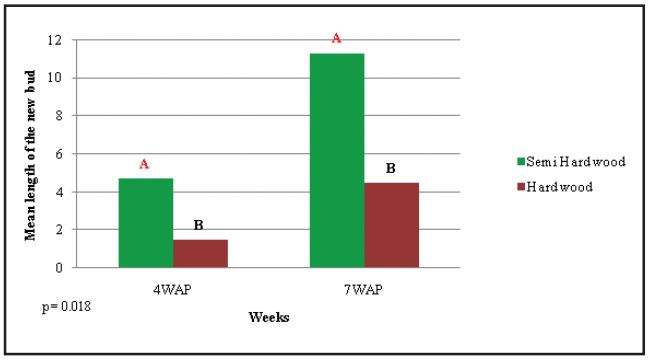

Fig. 2: Effect of cutting type on length of the new bud of *M. dioicia* cuttings at 4 weeks and 7 weeks after planting.

Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level

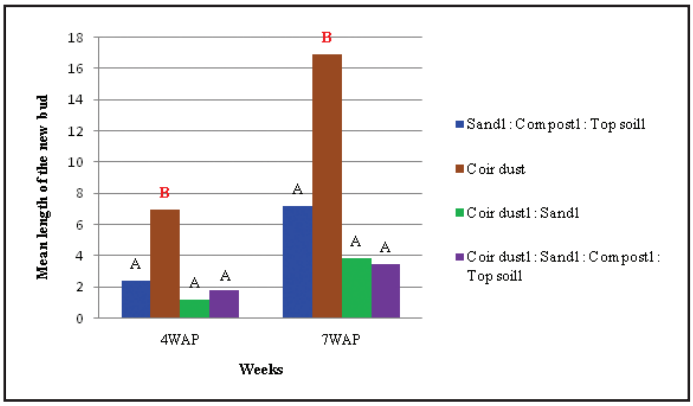

Fig. 3: Effect of potting mixture on mean length of the new bud of M. dioicia cuttings at 4 weeks and 7 weeks after planting.

Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level.

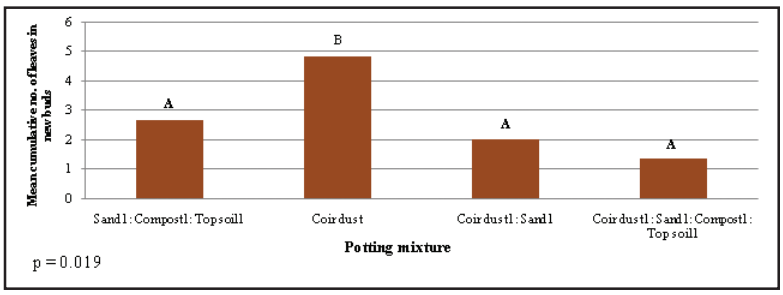

Fig. 4: Effect of potting mixture on mean cumulative number of leaves on new buds of *M. dioicia* cuttings at 7 weeks after planting.

Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level

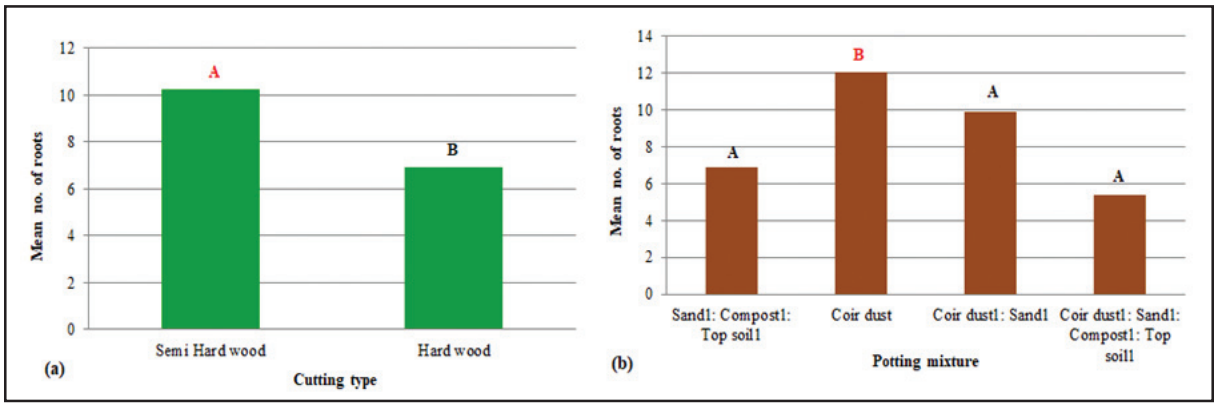

Fig. 5: Effect of cutting type (a) and potting mixture (b) on number of roots per cutting of *M. dioicia* cuttings at 7 weeks after planting.

Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level

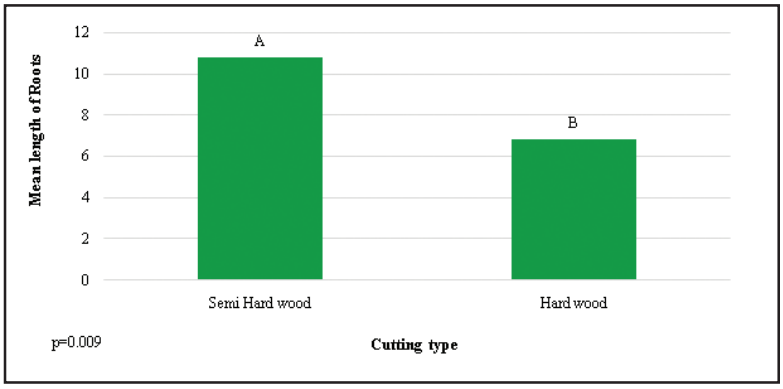

Fig. 6: Effect of cutting type on root length of *M. dioicia* at 7 weeks after planting.

Means on the bars represent the same letter are not significantly different at P ≤ 0.05 probability level

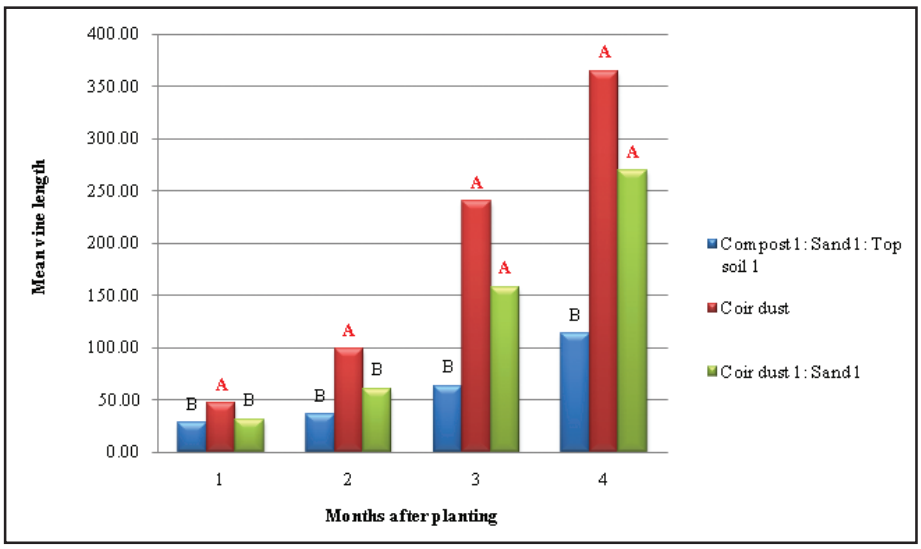

Fig. 7: Effect of potting medium on mean vine length of *M. dioicia* after 1st, 2nd, 3rd and 4th month of field planting.

Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level.

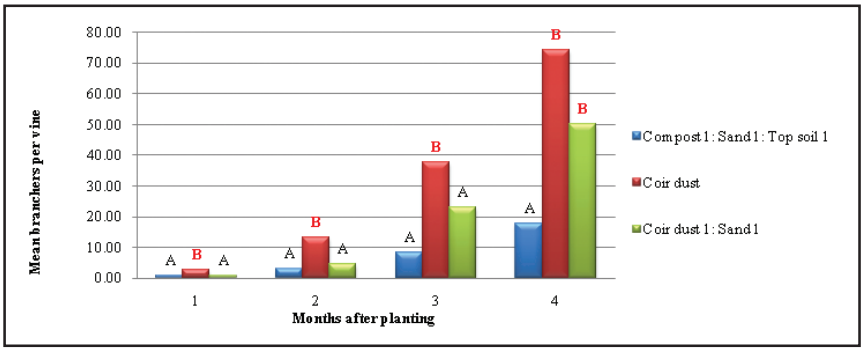

Fig. 8: Effect of potting medium on mean new branches per vine of *M. dioicia* during 4 months of field planting.

Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level.

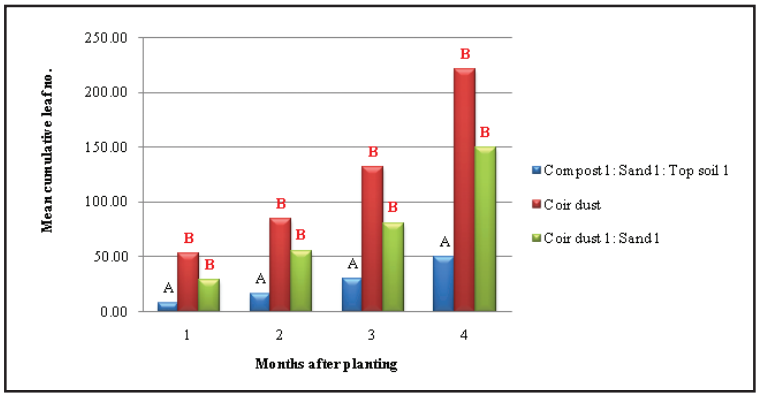

Fig. 9: Effect of potting medium on mean cumulative leaf number per vine of *M. dioicia* during 4 months of field planting.

Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level.

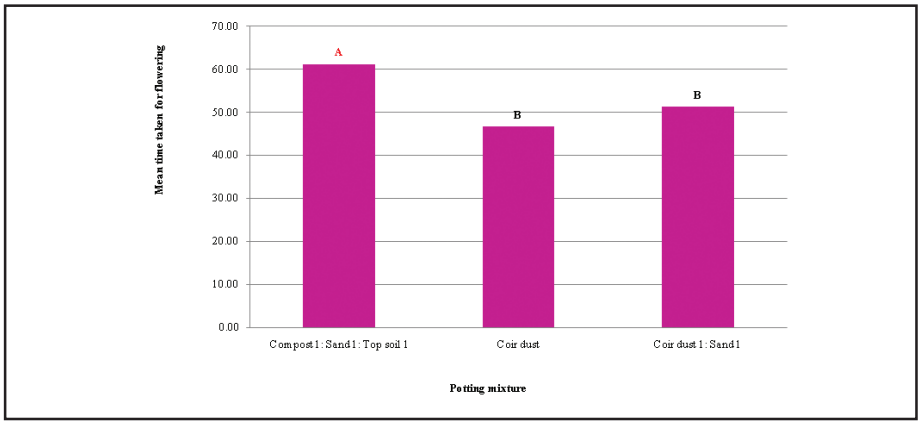

Fig. 10: Effect of potting mixtures on mean time taken for flowering of *M. dioicia* during 4 months of field planting.

Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level.

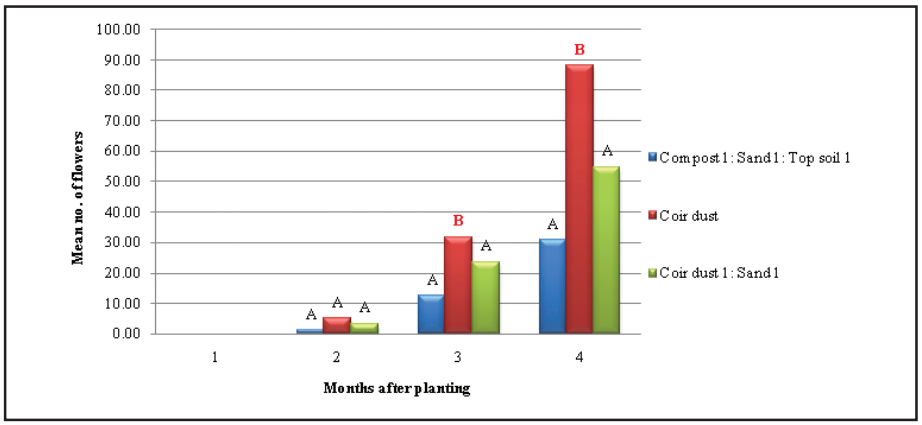

Fig. 11: Effect of potting mixtures on mean cumulative number of flowers per vine of *M. dioicia* during 4 months of field planting.

Means on the bars represent the same letters are not significantly different at P≤ 0.05 probability level.

Number of roots

The significantly highest number of roots per cutting was recorded in semi hard wood cuttings compared to the hard wood cuttings at nursery stage. The significantly highest number of roots per cuttings was observed in coir dust medium compared to all the other mixtures at P≤ 0.05 (Figure 5). It was evident that the coir dusts significantly increase rooting of the stem cuttings and the texture of the medium also appears to have an impact on rooting.

Root length

Semi hard wood cuttings showed the highest root length compared to the hard wood cutting type (Figure 6). There was no significant effect found among the potting medium on length of the roots per cutting.

Field Evaluation

The length of main vine

Vine length of male plants was significantly increased in rooted cuttings taken from coir dust potting medium for the field establishment, compare to all the other treatments during 4-months period of observation (Figure 7). When vine length was consider in M. dioicia male plants, the best results obtained from the cuttings planted in coir dust medium at the nursery stage also. These plants were more vigorous than the others. They showed good adaptation to the field condition also than the other plants, especially in the early stage of field establishment.

The present results confirmed those reported by Nazari *et al*. (2011), who mentioned the

superiority of coco peat only and coco peat/sand (1:1) over the other combinations in their study. This may be due to coco peat characteristics including higher total pore space and the water holding capacity. In that study, they also discussed about the possible reasons for the result by using coco peat as a good moisture-retentive material. Khayyat *et al*. (2007) also indicated the superiority of coir dust over other pot mixtures.

The cumulative number of new branches per vine

Cuttings planted in coir dust medium recorded the significantly highest number of branches per vine than other two potting mixtures during 4 months of the study period (Figure 8). Results clearly showed that coir dust based rooted cuttings planted in the field performed better compared to the other two potting mixture based rooted cutting planted in the field. In the 4th month, coir dust based rooted cuttings planted in the field produced two times higher number of new branches as compared to rooted cuttings taken from other two potting mixtures.

Cumulative number of leaf per vine

The significantly highest cumulative leaf number per vine was observed in coir dust based rooted cuttings planted in the field as compare to sand 1: coir dust 1 and compost 1: sand 1: top soil 1medium based rooted cuttings planted in the field (Figure 9).

Time taken for flowering

The significantly lowest time taken for flowering on vine was observed in rooted cuttings taken from the coir dust potting medium and coir dust1: sand1 potting medium compared to compost 1: sand 1: top soil 1 mixture-based cuttings taken for the field establishment. If male plants of M. dioicia showed late flowering as compared to female flowering then pollination to female flowers will be affected. Because of that M. dioicia plants are mostly practiced with artificial pollination (manual). It was revealed that, the rooted cuttings taken from the coir dust potting medium and coir dust1: sand1 medium, the mean time taken for flowering can be reduced by 14.58 days. It is about two weeks earlier than the other treatment (Figure 10).

Cumulative number of flowers per vine

No significant difference was found among the treatments at the end of the 2nd month of field planting. But, at the end of 3rd and 4th months, cumulative number of flowers per vine was significantly increased in field plants, which was taken from rooted cuttings from the coir dust based potting media as compared to the other two potting mixtures at $P \leq 0.05$ (Figure 11).

There was a wide gap between rooted cuttings taken from coir dust media with other two potting mixtures on cumulative number of flowers. One of the major objectives of the experiment was to induce more number of flowers per vine. From the present study, it was clearly shown that the number of flowers was increased by about three times in the rooted cuttings taken from coir dust-based medium as compared to the rooted cuttings taken from other two potting mixtures.

CONCLUSION

Semi hardwood cuttings planted in coir dust medium showed the best impact for the rooting ability and growth of cuttings of M. dioicia. Roxb male plants in the nursery stage. The cuttings from the coir dust medium when planted in the field also showed best impact for field establishment and adaptation to the environmental condition as found from the growth and the reproductive performance of M. dioicia. Roxb (Thumba karawila) male plants as compared to the cuttings taken from other two potting mixture medium.

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