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Effect of rooting media on success rate and establishment of different ornamental cuttings

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Abstract
The investigation entitled "Effect of rooting media on success rate and establishment of different ornamental cuttings in Allahabad at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom Institute of Agriculture, Technology and Sciences (SHUATS), Allahabad durung the year 2018. The experiment was laid out in Factorial complete randomized design (FRBD) with 27treatment and 3 replication. All 27 possible combinations of 9 plants (Ixora, Hibiscus, Crape jasmine, Croton, Java Fig tree, Acalypha, Bougainvillea, Golden shower, Clerodendron) and 3 rooting media (soil, sand, soil + sand). On the basis of the results obtained from the present investigation, it is concluded that most suitable rooting medium for ornamental stem cuttings was M_2 (sand), suitable ornamental cutting was P_6 (Acalypha) and interaction of rooting media and ornamental cutting was P_6M_2 (Acalypha + Sand) among all rooting medium combination.

Keywords: ornamental cutting, rooting media

Introduction
In the present world, ornamentals plants have become important not only for its aesthetic and social values but also for its economic contribution. Production and trade with these crops are now very much specialized in the developed countries with a significant contribution to their national economy. Ornamental plants are plants that are grown for decorative purpose in gardens and landscape design projects, as house plants and specimen display. Ornamental plants are mostly grown for their exquisite blooms and are a source of major attraction for many gardens.

Ornamental plants are mainly used to enhance the beauty of a garden or home. Flowering and non- flowering ornamental plants can be used in creating parks, different themed gardens, lawn borders etc. Raising and selling of ornamental plants are a good business. The cut flowers from ornamental plants can fetch you economic benefits as they are used in various floral arrangements. Apart from increasing the aesthetic value of the property, these also improve the quality of the space by acting as wind barriers, providing shade, cleaning up the pollutants in the air, reducing soil erosion and providing the habitat for animals and birds. The ornamental plants placed indoors provide a good and pleasant ambience and also purifies the air. Attractive looking ornamental plants can influence you psychologically and keeps you happy. You can achieve a calm mind and healthy body by indulging in ornamental plants gardening.

Ixora coccinea (Ixora) is a genus of flowering plants in the Rubiaceae family. Although there are around 500 species in the genus Ixora. Ixora is used in warm climate for hedges, and screens, foundation plantings, massed in flowering beds or grown as a specimen shrub or small tree. This tight, compact shrub is much branched and tolerates hard pruning, making it ideal for formal hedges. In cooled climates, it is grown in a green house plant requiring bright light. The flowers, leaves, roots and the stem are used to treat various ailments in the Indian traditional system of medicine.

Hibiscus rosasinensis (Hibiscus) is a genus of flowering plants in the family, Malvaceae. The genus includes both annual and perennial herbaceous plants, as well as woody shrubs and small trees. The leaves are alternate, the flowers are large, conspicuous, trumpet-shaped, with five or more petals, colour from white to pink, red, orange, peach, yellow or purple. Many Hibiscus are grown for their showy flowers or used as landscape shrubs. Hibiscus is a perennial plant and commonly grown as hedges plant and is very important in Hindu devotion.

Tabermontana divaricate (Apocynaceae), commonly called pinwheel flower, crape jasmine, East India rosebay and Nero's crown is an evergreen shrub. Both single and double flowered

forms are cultivated, the flowers of both forms being white. The flowers of the single form are unscented but the double-flowered form has a pleasing fragrance. The large shiny leaves are deep green and are 6 or more inches in length. Flowers are commonly used in pooja in South India. It is commonly cultivated in gardens for its showy, sweet gradient flowers, glossy green foliage and shapes and also as a fragment hedge.

Codiaeum variegatum (Croton) is extensive flowering plants, Euphorbiaceae family. Codiaeum is a genus of lovely ornamental plants known for their attractive and colourful foliage. Croton plants stiff, leathery leaves in bold colors of yellow, pink, red, orange and green make it beautiful and popular house plant. Croton plants used as ornamental shrubs and house plants.

Ficus benjamina, commonly known as weeping fig, benjaminfig or Ficus tree, is a species of flowering plant in the family Moraceae, *Ficus* is an evergreen tree with a dense, wide crown, being widely cultivated in the tropical and subtropical and used as an avenue and shade providing tree. It has been an extremely popular indoor house plant because of its attractive shape and tolerance for a variety of growing conditions.

Acalypha wilkesiana (Acalypha) is a genus of flowering plants in the family Euphorbiaceae. The genus includes annuals or perennial herbs, shrubs, and small trees. Most are monoecious, and some are dioecious. The leaves are alternately arranged, undivided. Acalyphais an erect or spreading, evergreen, that can grow 2-4meters tall. It is widely cultivated as an ornamental plant, being especially valued for its wide range variegated cultivars, and is also often grown as a hedge.

*Bougainvillea glabra (*Bougainvillea) are among the most floriferous shrubby climbing plant, producing beautiful color effects which can hardly be excelled by any other plant. In recent years, these have become one of the most popular garden plants all over the world. It is a member of the family Nyctaginaceae, Flowers are usually inconspicuous and surrounded by brilliantly colored papery bracts that persist on the plants for a long time. Bougainville is also often used as a formal hedge or ground cover.

Clerodendrum splendens (Hill Glory Bower) is a genus of flowering plants in the family Verbenaceae. Clerodendrum is weak- stemmed evergreen shrubs and herbaceous perennials with a more or less climbing habit. It is widely grown as an ornamental, valued especially for its floral display. Flowers which are produced on wiry flowers stalks stems end during the spring and autumn.

Pyrostegia venusta (Gloden shower)also commonly known as flame vine. cascading like a waterfall of orange trumpets. Vigorous, it flowers for many months, from soon after Christmas until winter. The plants from dense masses, growing up trees, on walls or over rocks and flowers in the cool, dry season.

Ornamental plants can be propagate either sexually (by seed) or asexually (by vegetative means). A number of horticultural plants especially ornamental plants are propagated commercially by vegetative means. Many ornamental plants do not normally produce any viable seed. On the other hand, this unique characteristic may be deteriorated due to cross pollination when it is propagated through seed. Among the vegetative means, stem cutting is one of the easiest, cheapest and least time consuming methods of plant propagation.

Cutting technique is the widely utilized vegetative method for propagating different plant species. Commercial propagators have developed techniques that successfully manipulate environmental conditions to maximize rooting of cuttings. The success of rooting of cuttings is affected by many factors, such as the plant part's age and its location on the plant, nutritional levels of the stock plants, seasonal timing, cuttings type used, rooting medium and environmental manipulation and treatments of cuttings. Some plants root better at a particular stage of growth, at a specific time of the year, or using a particular technique. Seasonal timing or the period of the year in which cuttings are taken, could play an important role in rooting of plant species especially woody plants (Harrison-Murray 1991) [10]. With many plant species there is an optimal period of the year for taking cutting materials and consequently rooting (Anand and Haberlein 1975) [5]. In woody perennials, types of cutting materials to use range from softwood terminal shoot of current growth to dormant hardwood cuttings. There is no universal or ideal rooting medium for cuttings. An appropriate rooting medium depends on the species, cutting type, season, propagation system, and the cost and availability of the medium components (Hartmann *et. al* 1997) [11].

Rooting medium is any type of substrate that encourages root growth. This substrate normally comprises of different organic components and minerals. The best type of rooting medium depends on a grower's available materials and plant species. A rooting medium is any grow media used to start (propagate) new plants, whether they be seeds or cuttings. Often, once a new plant develops roots in the rooting medium, they are transferred to either a larger home that contains more of the same medium, or a new medium altogether. Rooting mediums are often used together with synthetic or organic rooting hormones, which have been known to act as a catalyst for root growth while protecting the root cuttings from various types of ailments and fungi.

Light and sandy soils are well suited as rooting or germinating media while loamy silt or clayey soils are unsuitable on account of poor aeration and stickiness. These soils in combination with sand, some organic matter, moss, shredded bark and peat are useful as media. The sand used should be fine enough to retain some moisture around the cutting and coarse enough to allow free draining. Sand consists of small rock grains of 0.05 to 2.0 mm in diameter. Quart sand is most useful as it is suitable for sterilization of fumigation. It has no mineral nutrients.

Materials and Methods

The research study was conducted in Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh during the period of February, 2018 to May, 2018. Different ornamental cuttings were collected from the department of Horticulture, Allahabad.

Plots of 27 were thoroughly filled with media according to treatment combination i.e., M1 (soil), M2 (sand) and M3 (soil + sand) and ornamental plants are P1 (Irora), P2 (Hibiscus), P3 (Chandini), P4 (Croton), P5 (Ficus), P6 (Acalypha), P7 (Bougainvellea), P8 (Gloden shower), P9 (Clerodendrum).

The different treatment combinations are as follows; T1 (P1M1), T2 (P1M2), T3 (P1M3), T4 (P2M1), T5 (P2M2), T6 (P2M3), T7 (P3M1), T8 (P3M2), T9 (P3M3), T10 (P4M1), T11 (P4M2), T12 (P4M3), T13 (P5M1), T14 (P5M2), T15 (P5M3), T16 (P6M1), T17 (P6M2). T18 (P6M3), T19 (P7M1). T20 (P7M2), T21 (P7M3). T22 (P8M1), T23 (P8M2), T24 (P8M3), T25 (P9M1). T26 (P9M2), and T27

(P9M3). The growth parameters including Days taken to 1st sprouts, No of sprout/cutting, Sprouting percentage.

Result and Discussion

Among various ornamental cuttings, minimum days taken to 1st sprouting (16.387) was observed in P_3 (Crape jasmine) followed by P_2 (16.757) (Hibiscus) and maximum days (41.033) was on served in P_4 (Croton). Among various rooting media, minimum days taken 1st sprouting (17.2) was observed in R_2 (sand) followed by M_3 (20.5) (soil + sand) and maximum days (25.5) was observed in M_1 (soil). The difference days taken to 1st sprout is due different rooting media and vigour of the plant. Sand will provide good aeration, good water holding capacity and moisture to cuttings So the medium which helps to sprout early. Among the various ornamental cuttings, maximum number of sprouts per cuttings (7.037) was observed in P_6 (Acalypha) followed by (4.947) in P_1 (Ixora) and minimum sprouts (1.443) was recored in P_5 (Ficus). Among various rooting media the maximum number of sprouts per cuttings (3.41) was observed in M_2 (sand) followed by M_3 (3.01) (soil+sand) and minimum sprouts (2.62) was observed in M_1 (soil). The difference in number of sprouts per cutting is due different rooting media and vigour of the plant. Sand will provide good aeration, good water holding capacity and moisture to cuttings. So the medium which helps to more sprouts per cutting. Among various ornamental cuttings, maximum percentage of sprouting (77.776) was observed P_3 (Crape jasmine followed by (77.775) in P_2 (Hibiscus) and minimum percentage of sprouting ((55.550) was observed in P_9 (Clerodendron). Among various rooting media, maximum percentage of sprouting (79.01) was observed in M_2 (sand) followed by (64.19) in M_3 (soil + sand) and minimum percentage sprouting (55.85) was observed in M_1 (soil). The difference percentage of sprouting is due different rooting media and vigour of the plant. Sand will provide good aeration, good water holding capacity and moisture to cuttings so the medium which helps to more sprouting percentage.

Table 1: Effect of rooting media on Days taken to 1st sprouts of different ornamental cuttings.

Levels of Plants (P)	Media (M)			
	M1(Soil)	M2(Sand)	M3(Soil+Sand)	Mean (P)
P1(Ixora)	20.00	15.7	19.17	17.957
P2(Hibiscus)	23.55	14.22	18.5	16.757
P3(Crape jasmine)	20.22	14.16	17.78	16.387
P4(Croton)	24.33	19.44	21.33	41.033
P5(Java Fig tree)	21.39	18.39	21.67	20.483
P6(Acalypha)	17.39	14.83	18.67	16.963
P7(Bougainvillea)	22.33	17.11	19.33	18.257
P8(Golden shower)	23.67	17.33	22.67	19.89
P9(Clerodendron)	25.5	23.17	25.00	24.557
Mean (M)	22.0	17.2	20.5	21.4
	F-test	S. Em. (±)	C.D. at 5%	
Plants (P)	S	0.370	0.755	
Media (M)	S	0.214	0.436	
Int. (P x M)	S	0.641	1.308	

Table 2: Effect of rooting media on no. of sprouts/ cutting of different ornamental cuttings.

Levels of Plants (P)	Media (M)			
	M1(Soil)	M2(Sand)	M3(Soil+Sand)	Mean (P)
P1(Ixora)	3.17	6.50	5.17	4.947
P2(Hibiscus)	3.17	3.72	2.78	3.223
P3(Crape jasmine)	2.39	2.33	2.44	2.387
P4(Croton)	1.33	1.66	1.67	1.553
P5(Java Fig tree)	1.33	1.78	1.22	1.443
P6(Acalypha)	6.33	7.50	7.28	7.037
P7(Bougainvillea)	3.17	2.94	2.67	2.927
P8(Golden shower)	1.33	2.33	2.50	2.053
P9(Clerodendron)	1.33	2.17	1.17	1.557
Mean (M)	2.62	3.41	3.01	
	F-test	S. Em. (±)	C.D. at 5%	
Plants (P)	S	0.475	0.970	
Media (M)	S	0.274	0.560	
Int. (P x M)	NS	0.823	1.681	

Table 3: Effect of rooting media on sprouting % of different ornamental cuttings.

Levels of Plants (P)	Media (M)			
	M1(Soil)	M2(Sand)	M3(Soil+Sand)	Mean (P)
P1(Ixora)	55.55	77.77	55.55	62.958
P2(Hibiscus)	66.66	88.89	77.77	77.775
P3(Crape jasmine)	66.66	88.89	77.78	77.776
P4(Croton)	33.33	77.78	44.44	51.849
P5(Java Fig tree)	55.55	77.77	77.77	70.366
P6(Acalypha)	55.55	88.89	77.77	74.070
P7(Bougainvillea)	55.55	77.77	44.44	59.254
P8(Golden shower)	33.33	66.66	66.66	55.550
P9(Clerodendron)	44.44	66.66	55.55	55.550
Mean (M)	51.85	79.01	64.19	
	F-test	S. Em. (±)	C.D. at 5%	
Plants (P)	S	0.597	1.219	
Media (M)	S	0.345	0.704	
Int. (P x M)	S	1.034	2.111	

On the basis of the results obtained from the present investigation, it is concluded that most suitable rooting medium for ornamental stem cuttings was M_2(sand), suitable ornamental cutting was P_6 (Acalypha) and interaction of rooting media and ornamental cutting was P_6M_2 (Acalypha + Sand) among all rooting medium combination.

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