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INFLUENCE OF DIFFERENT MEDIA ON PROPAGATION OF MARIGOLD THROUGH SHOOT CUTTING

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ABSTRACT

Marigold is one of most commercial and popular loose flower crops. It is prized for their vivid hues and unique fragrance. They can be found in many colors, such as yellow, orange, and red, and are frequently utilized in gardens for both aesthetic purposes and pest deterrence. They have symbolic implications connected to love, passion, and even loss in some civilizations. The most of the marigold cultivars are propagated through seeds but due to their highly cross-pollinated nature, we cannot obtain true to type flowers naturally. Also, the viability of the seed is very poor. Therefore, an alternative method of propagation i.e. shoot cuttings may be applied to overcome this problem. Considering the aforementioned information and the dearth of previous research, the present study was held to investigate the impact of different rooting media on rooting of the marigold cutting, to investigate the impact of different media on shoot growth of marigold cutting, and to find out the best rooting media for propagation of marigold through shoot cutting. The treatments involved in the study were twelve in numbers viz. T_1 (Soil 100%), T_2 (Sand 100%), T_3 (Soil 50% + Sand 50%), T_4 (Soil 50% +FYM 50%), T_5 (Soil 50% + Vermicompost 50%), T_6(Soil 50% + Cocopeat 50%), T_7 (Sand 50% + FYM 50%), T_8 (Sand 50% + Vermicompost 50%), T_9 (Sand 50% + Cocopeat 50%), T_{10} (Soil 33.3% + Sand 33.3% +FYM33.3%), T_{11} (Soil 33.3%+ Sand 33.3%+ Vermicompost33.3%), T_{12} (Soil 33.3% + Sand33.3% + Cocopeat33.3%) replicated thrice in Completely Randomized Design (CRD). It was observed that all the parameters were significantly influenced by various combinations of rooting media. The results revealed that number of leaves per cutting (9.67), number of branches per cutting (7.00), average length of shoot per cutting (30.43cm), final survival percentage (75.44%) were recorded maximum under the treatment T_{12} (Soil 33.33% + Sand 33.33% + Cocopeat 33.33%) as compared to other treatments.
***Keywords*:** Marigold, shoot cutting, sand, soil, Farm yard manure, Cocopeat and Vermicompost.

Introduction

Marigold (*Tagetes erecta* L.) is one of most popular loose flower crop grown commercially for various purposes. It belongs to the family Asteraceae and the chromosome number (2n) of African marigold is 24. Marigold flowers are prized for their vivid hues and unique fragrance. They can be found in many colors, such as yellow, orange, and red, and are frequently utilized in gardens for both aesthetic purposes and pest deterrence. They have symbolic implications connected to love, passion, and even loss in some civilizations. Marigold is native to South and Central America especially Mexico and belong to the family Composite. The genus Tagetes commonly cultivated species are *Tagetes erecta* (African Marigold), *Tagetes patula* (French Marigold) and *Tagetes minuta*. Amongst these *Tagetes erecta* and *Tagetes patula* are more commonly grown for their ornamental values while *Tagetes minuta* is valued for its high content of essential oil. Marigold is a long upright and quick growing habit. The height of plants ranges from 30 to 90 cm (about 2.95 ft). They can be grown almost throughout the year under tropical and subtropical conditions, but it requires mild climate for proper plant growth and profuse flowering. It requires

well drained and moist soil rich in organic matter. The soil pH should be 7.0- 7.5 but it can also be grown under slightly acidic soil with pH 5.8 -6.2. The flowers of these varieties are deep orange, light orange, golden yellow, bright yellow and lemon yellow in color. The size of flower may vary from 4 to 6 cm (diameter). The uses of marigold are many folds, often referred to as, "Versatile crop with golden harvest". Flowers are traditionally used as offerings in temples and churches and are also used in festivals, beautification and landscape architecture. It is highly suitable for pot culture, bedding purpose and windows boxes (Kumar *et al.,* 2015). Besides, marigold is a good source of carotenoid pigment for poultry feed to intensify the yellow color of egg yolks. Marigold also finds industrial applications like preparation of natural dyes and essential oils. It is used as mosquito and nematode repellents. The marigold plants are highly useful for suppressing the population of nematodes in the field also. Marigolds produce thiopenes, which are toxic to nematodes and used as trap crop in tomato, brinjal, tobacco etc. In India, major flower growing states are West Bengal, Karnataka, Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Chhattisgarh Uttar Pradesh etc. About 304-thousand-hectare area is under floriculture with production estimated to 2301 thousand MT of loose flower and 762 thousand MT of cut flower. Among all these flowers, marigold is one of the leading loose flowers (Anonymous, 2019).

Most of the marigold cultivars are propagated through seeds but due to their highly cross-pollinated nature, we cannot obtain true to type flowers naturally. Also, the viability of the seed is very poor. Therefore, an alternative method of propagation i.e. shoot cuttings may be applied to overcome this problem, survival of cuttings usually depends upon several factors which includes physiological conditions of parent plant, cutting type, time of preparation of cuttings, medium type and rooting hormones. Growing medium is also an important factor, because it not only supports the plant but also provides moisture and essential mineral nutrients to it (Kumar *et al.,* 2015).

Growing media are the substrates in which plant grows. They provide anchorage for the plant’s roots, air spaces to allow respiration, and retain sufficient available water to enable plant growth. When selecting media, the grower needs to find the optimum balance between their requirements and those of the plants to be grown.

Soil is the basic material ingredient of the media. It forms the major portion in the combination of different media. Soil is cheaply available, economic and easy to handle. Most soils on average are composed of 46-49% mineral particles (often called separates), 1-6% organic matter and 50% air and water. The mineral particles of soil are sand, silt and clay.

Cocopeat coir-pith, cocopeat, and coir-dust are other names for cocopeat. The flexible natural fiber known as coir is taken from the coconut fruit's husk, or mesocarp tissue. There is 20% to 30% varying-length fiber in the husk. The husk is ground, and the fibers are taken out and used to make coco-pith, which is frequently used as a medium. The coconut palm seed's protective fibrous coating is known as cocopeat.

Sand is a naturally occurring granular material composed of finely divided rock and mineral particles. Its diameter ranges from 1⁄16 mm (about 0.63 in) to 2 mm (about 0.08 in). Most common constituent of sand is silica (silicon dioxide, SiO_2), usually in the form of quartz. This may result in prohibitive transportation costs. Sand is a valuable amendment for both potting and propagation media. Fine sands (0.05mm (about 0 in)-0.25mm) do little to improve the physical properties of a growing media and may result in reduced drainage and aeration.

FYM is used to describe the degraded combination of farm animal faeces and urine, litter, and leftover materials from roughages or cattle feed. Neem cake is employed in the management of soil-born organisms, including nematodes. It's really beneficial organic manure that either directly or indirectly aids in boosting crop productivity.

Vermicompost is also known as worm castings, worm humus or worm manure. Vermicompost is defined as the end-product of the breakdown of organic matter by the earthworm. The process of producing vermicompost by earthworms is called vermin composting. This compost is an odorless, clean, organic material containing adequate quantities of N, P, K and several micronutrients essential for plant growth. (Kaushal *et al.,* 2020).

Among the different factors which govern the root development, media plays a very important role it holds the cuttings in position, providing them with the required moisture and aeration. The type of rooting medium determines the nature of roots produced in the cutting to some extent (Renuka *et al.,* 2015). Considering the aforementioned information and dearth of earlier research the present study was undertakenwith the objective to investigate the impact of different rooting media and to find out the best rooting media for propagation of Marigold through shoot cutting.

Material and Methods

The experiment was carried out at the farm of Centre of Agricultural Education, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh, India during the year 2023-24. The Experimental farm is located at 188.66 meters above mean sea level and is located at latitudes 27.88 N and longitudes 78.20 E. Aligarh is situated in the middle portion of *Doab* or the land between the Ganga and Yamuna rivers. Aligarh experiences a hot, semi-arid climate which is marginally too dry to be classified as a humid subtropical climate influenced by the monsoon. The scorching summer months begin in April and last in May. The typical temperature range is between 28 and 38 °C (82 and 100 °F). High humidity is brought about by the monsoon season, which begins in late June and lasts until early October. During these months, Aligarh receives the majority of its 800 millimeters of yearly rainfall. Then, as the temperature drops, winter arrives in December and lasts through February. The range of temperatures is 2–11 °C (36–52 °F).

The experiment was laid out in a Completely Randomized Design with three replications under Experimental field. Each replication consisted of 12 treatments. Two months old plants were used to provide the 8 cm terminal shoot cuttings used in the experiment. The distal end of each cutting was cut smoothly, and the lower end, Just below the lower node, was cut slantingly. The various components of Soil, Sand, FYM, Vermicompost, and Cocopeat were thoroughly mixed to create the media in various ratios. Cuttings were placed in polythene bags and surrounded by a solid layer of medium. In a single polythene bag, a single cutting was planted. We used a net to keep peacocks and parrot-like birds away from the cuttings, and we regularly watered them every two to three days with the use of a rose can. Thirty-five days after planting, the number of leaves (counting each leaf of a single compound leaf) from three randomly chosen cuttings were recorded, and an average was then computed. At 35 days following sowing, the total number of sprouts in each of the three randomly chosen cuttings was counted, and an average was then determined. The data recorded during the course of investigation were statistically analyzed by using Panse and Sukhatme's (1985) methodology, an independent analysis of variance was conducted for every character.

Results and Discussion

The perusal of data clearly reveals that the different shoot parameters viz. number of leaves per cutting, number of branches per cutting, average length of shoot per cutting(cm), final survival percentage (%) were significantly influenced by various combinations of rooting media. Among all the treatments maximum number of leaves (9.67) was recorded under the treatment T_{12} (Soil33.33%+ Sand 33.33%+ Cocopeat 33.33%) followed by (6.00 and 5.03 under the treatments) T_{11}(Soil 33 .33%+ Sand 33.33% +Vermicompost 33.33%) and T_{10} (Soil 33.33%+ Sand 33.33% + FYM 33.33%) respectively whereas the minimum number of leaves per cutting (2.00) was recorded under control T_1 (Soil100%). Chauhan *et al.,* (2005) noted the similar trend for numbers of leaves per plant noted and they recorded highest number of leaves per plant with the application of normal soil + rice husk + Cocopeat+ caster cake + vermicompost. The poorest response was observed in normal soil. The same findings were noted by Barreto and Jagtap (2002) in gerbera cv. Sangaria.

Table 1 : Effect of different treatments on Number of leaves per cutting, Number of branches per cutting, Length of shoot per cutting and Final survival percentage

Treatments	Treatment details	Number of leaves per cutting	Number of branches per cutting	Length of shoot per cutting (cm)	Final survival percentage (%)
T_1	Soil 100%	2.00	2.67	16.43	51.61
T_2	Sand 100%	3.10	3.80	21.00	54.00
T_3	Soil 50% + Sand 50%	3.83	4.00	21.87	55.43
T_4	Soil 50% + FYM 50%	4.67	5.00	25.03	54.03
T_5	Soil 50% + Vermicompost 50%	5.00	4.27	21.57	58.25
T_6	Soil 50% + Cocopeat 50%	4.97	4.00	23.67	56.40
T_7	Sand 50% + FYM 50%	4.67	3.40	22.67	58.63
T_8	Sand 50% + Vermicompost 50%	4.00	4.67	24.53	66.61
T_9	Sand 50% + Cocopeat 50%	5.00	4.00	24.90	56.57
T_{10}	Soil 33.33% + Sand 33.33% + FYM 33.33%	5.03	5.13	26.50	53.36
T_{11}	Soil 33.33% + Sand 33.33% + Vermicompost 33.33%	6.00	5.27	27.80	73.00
T_{12}	Soil 33.33%+ Sand 33.33% + Cocopeat 33.33%	9.67	7.00	30.43	75.44
	SEm ±	**0.50**	**0.59**	**0.77**	**0.41**
	CD (P=0.05)	**1.44**	**1.72**	**2.25**	**1.17**

The maximum number of branches per cutting (7.00) was recorded under the treatment T_{12} (Soil33.33%+ Sand 33.33% + Cocopeat 33.33%) followed by (5.27 and 5.13 under the treatments) T_{11} (Soil 33 .33%+ Sand 33.33% +Vermicompost 33.33%) and T_{10} (Soil 33.33%+ Sand 33.33% +FYM 33.33%) respectively, whereas the minimum number of branches per cutting (2.67) was under control T_1 (Soil100%).These results are consistent with those of Deogade*et al*. (2020) who also recorded the greatest number of branches (23.82) at 120 DAT. T_2 (Cocopeat + Vermicompost) and T_3 (Sand + Vermicompost) reported values of 23.05 and 21.15, respectively, which were closely followed by these two groups. The T_5 (Sand + Cocopeat) reported the fewest branches (12.33). This might be because the potting mixture's vermicompost and soil combination retains moisture, nutrients, and a better water-soil relationship all of which are important for plant growth. This is likely because the growing medium's optimal bulk density may allow for proper water absorption.

The maximum length of shoot per cutting (30.43 cm.) was recorded under the treatment T_{12} (Soil 33.33% + Sand 33.33%+ Cocopeat 33.33%) followed by (27.80 cm. and 26.50 cm.) under the treatments T_{11} (Soil 33 .33%+ Sand 33.33% + Vermicompost 33.33%) and T10 (Soil 33.33%+ Sand 33.33% +FYM 33.33%) respectively. WhereasT_1 (Soil100%) produced the minimum Shoot length per cutting (21.00). Peyvast *et al*. (2008) also found similar findings with the development of parsley *(Petroselinumcrispum*) and LA hybrid lilies, respectively.

The maximum survival percentage (75.44 %) was noted under T_{12}(Soil 33.33% + Sand 33.33% + Cocopeat 33.33%) followed by (73.00 %and 66.61 % under the treatments) T_{11} (Soil 33.33% + Sand 33.33% + Vermicompost 33.33%) and T_8 (Sand 50% + Vermicompost 50%). On the other hand the minimum survival percentage (51.61) was found under control (Soil 100%).The cuttings placed in mixtures of Cocopeat media had the best survival rate, which may have been caused by the medium's commensurate ability to support root and shoot growth and nutrition over time. The benefits of using Cocopeat may stem from the addition of coarser material, which would enhance the medium's aeration status (Awang et al., 2009). According to Jeyaseeli and Paul (2010), aeration is essential for the gaseous exchange between the soil and atmosphere, which transfers carbon dioxide from the soil's microorganisms and roots to the outside atmosphere and oxygen from the outside atmosphere to the roots' growth, improving plant respiration and survival.

Conclusion

Based on the findings of the study of "Influence of different media on propagation of marigold through shoot cutting" the Treatment T_{12} (Soil 33.33% + Sand 33.33% + Cocopeat 33.33%) yielded the best results among the growing media treatments in terms of all parameters, including survival percentage (%), number of branches per cutting, length of shoot per cutting (cm), number of leaves per cutting, fresh weight of shoot per cutting (g), dry weight of shoot per cutting (g), number of roots per cutting, average length of roots per cutting (cm), fresh weight of roots per cutting (g), and dry weight of roots per cutting (g) under Marigold.

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