



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(4): 1980-1982
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www.thepharmajournal.com

Received: 05-02-2022

Accepted: 18-03-2022

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Effect of varying combination of livestock waste and crop residues as growing media on rooting of terminal cuttings of marigold

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Abstract

The present investigation entitled “Effect of varying combination of livestock waste and crop residues as growing media on rooting of marigold cutting” was conducted at Poly house of Tissue Culture Lab at College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C. G.) during 2020-21. The experiment was laid out in completely randomized design with 7 treatments viz. T₁ - Sand + FYM + Chickpea straw (1:1:1), T₂ - Sand + FYM + Rice husk (1:1:1), T₃ - Sand + FYM + Wheat straw (1:1:1), T₄ - Sand + Poultry manure + Chickpea straw (1:1:1), T₅ - Sand + Poultry manure + Rice husk (1:1:1), T₆ - Sand + Poultry manure + Wheat straw (1:1:1), T₇ - Sand (Control) replicated thrice. All treatments had significant effect on marigold cuttings, superior effect was observed in T₆ (Sand + Poultry manure + Wheat straw) having highest rooting percentage (82.22%), fresh weight of root (0.25g), dry weight of root (0.09 g), longest shoot length (11.73 cm) and root length (6.01 cm) as compare to all other treatment. Therefore, it can be concluded that among the different agricultural waste used as component of growing media, the combination of Sand + Poultry manure + Wheat straw (1:1:1) was found best for propagation of marigold and proved to be sustainable solution for agro waste management.

Keywords: Agro waste, cutting, growing media, marigold, rooting

Introduction

The African marigold (*Tagetes erecta* L.) is one of the most commonly grown traditional flower in India, belonging to family Asteraceae. Flower is preferably used as loose and enjoys high demand in Indian market for its aesthetic and industrial value. Thus, commercial cultivation of marigold has a huge potential to generate handsome income to farmers round the year. It is easy to care hardy annual, highly adaptable to different environmental conditions, tolerant to heat, drought and pest, generally propagated by seed and vegetative cuttings. Propagation through cuttings is cheap, rapid and convenient method, some varieties of African marigold do not set seed for which cutting is only alternative for its multiplication. Terminal cuttings are most preferred because of its superiority in all aspects of rooting compare to middle and basal cuttings (Padsumbiya, 1991) [9]. Selection of ideal growing medium is a basic requirement for successful development of marigold cuttings. Media must serve as a reservoir of plant nutrients, porous enough to provide space for exchange of gases, prevent water logging etc. enabling root and shoot development. Use of cheap and locally available agricultural by-product like rice husk, chickpea straw, wheat straw, cow dung, poultry manures as rooting media can supplement the earning of grower by reducing the cost of plant production. Inclusion of crop residues in a growing media improves physical condition of soil as it enriches the minerals and nutrients content and improves the water holding capacity. Animal manure are also understood to be a rich source of fertilizer elements which enhance the physical and biological properties of soil (Sorathiya *et al.* 2014) [13]. Therefore, studying the feasibility of agricultural waste as a substitute of commercial growing media for early and successful rooting of marigold cuttings is important as it offers a better economic return to the farmers and a sustainable solution to agro waste management.

Materials and Methods

The experiment was conducted at Poly house of Tissue Culture Lab at College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C. G.) during 2020-21. The experiment was laid out in a Completely Randomized Design replicated 3 times having 7 treatment viz. T₁ - Sand Sand + FYM + Chickpea straw (1:1:1), T₂ - Sand + FYM + Rice husk (1:1:1), T₃ - Sand

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+ FYM + Wheat straw (1:1:1), T₄ - Sand + Poultry manure + Chickpea straw (1:1:1), T₅ - Sand + Poultry manure + Rice husk (1:1:1), T₆ - Sand + Poultry manure + Wheat straw (1:1:1) and T₇ - Sand (Control). Terminal cuttings of 5-7 cm length were prepared from 3 months old marigold plant with the help of secateur. Bottom end of cuttings were treated with 200 ppm IBA solution using quick dip method and were eventually planted in plug trays containing 7 different growing media. After 30 days of planting, growth parameters of cuttings were analysed by taking average of six randomly picked cuttings.

Results and Discussion

1. Length of shoots per cutting

Data in Table disclosed that T₆ (Sand + Poultry manure + Wheat straw) had better effect on shoot length (11.73 cm) and the least effect in T₁ (Sand + FYM + Chickpea straw). The best result in T₆ can be attributed to the harmonious effect of media component. Physiochemical reaction among the media component might have led to formation of nutrient rich media that aided in better root and shoot growth of cuttings. The addition of wheat straw to poultry manure optimize the substrate properties such as air space, moisture content, C/N ratio, particle density, pH and mechanical structure affecting the decomposition rate positively (Petric *et al.* 2009) ^[10]. Besides, Poultry manure are also reported to have some of the growth promoting hormones which stimulates the uptake of nutrient (Brown, 1958) ^[4]. Hence, must have contributed to the greater plant height. The finding is in close conformity with the result of Chander *et al.* (2015) ^[5] and Swathi *et al.* (2018) ^[14] in marigold.

2. Longest root length

The longest root length (6.0 cm) was reported in cuttings planted in T₆ (Sand + Poultry manure + Wheat straw) while the shortest length (3.0 cm) in T₇ (Sand) as evident in Table. High water holding capacity and porosity in wheat straw (Petric *et al.* 2009) ^[10] might have improved the drainage and aeration of plant rhizosphere facilitating better root growth. Further, inclusion of poultry manure must have stimulated better root elongation by providing readily available nutrient to the plant. Easy availability of nitrogen in poultry manure leads to balanced C:N ratio, enhancing the vegetative growth and resulting in higher photosynthetic activity (Abusaleha and Shanmugavelu 1992) ^[11] thereby inducing better root growth. The result is in agreement with finding of Riaz *et al.* (2015) ^[11] in gerbera.

3. Fresh weight of root per cutting

The maximum fresh weight of root (0.247) was reported in

T₆ (Sand + Poultry manure + Wheat straw) while the minimum was observe in T₁ (Sand + FYM + Chickpea straw) and T₄ (Sand + Poultry manure + Chickpea straw) as evident in Table. The high concentration of nutrient elements (especially N, K and P) and reduction of carbon/nitrogen (C/N) in composted wheat straw might have resulted in greater plant growth. High C/N ratio of the media may cause N-immobilization and thus N-deficiency (Allaire *et al.* 2004) ^[2]. Addition of poultry manure must have increased the organic matter content of the soil which in turn improved the soil physical properties resulting into enhanced supply of macro and micro nutrients to plants, ultimately augmenting the overall plant growth. Similar Outcome was observed by Ghoreishy *et al.* (2018) ^[8] in tomato.

4. Dry weight of root per cutting

The dry weight of root ranges from 0.031 to 0.087 g as presented in Table. The most significant effect was reported in T₆ (Sand + Poultry manure + Wheat straw) while the lowest was observed in T₁ (Sand + FYM + Chickpea straw) and T₄ (Sand + Poultry manure + Chickpea straw). The best result in favor of T₆ can be correlated to the root growth influenced by role of media in holding moisture, maintaining sufficient pore spaces to permit optimal air circulation, drainage of the excessive water and high concentration of nutrient elements. Schachtschable, (1979) ^[12] described composts obtain from plant residues and animals waste as one type of humus which contributes to the soil fertility. The result is in consistent with previous result of Anwar *et al.* (2013) ^[3] in marigold and El- Zawawy *et al.* (2021) ^[7] in calendula.

5. Rooting percentage

Table revealed that T₆ (Sand + Poultry manure + Wheat straw) had most noteworthy effect on rooting percentage (82.2%) while least was reported in T₁ (Sand + FYM + Chickpea straw) and T₄ (Sand + Poultry manure + Chickpea straw). The media mixture which might have provided congenial environment for root formation. Ghoreishy *et al.* (2018) ^[8] revealed that Composted wheat residue compared with coco peat + soil reported the high water holding capacity and porosity that caused an improvement in drainage. Zhang *et al.* 2016) ^[15] also reported that wheat straw biochar hastens organic matter degradation and produces nutrient rich compost. Thus the combination of Sand + Poultry manure + Wheat straw might have resulted into a suitable media having ability to supply nutrients in available form such as nitrate nitrogen and soluble phosphorus which are necessary for rooting. Result is in close conformity with finding of Dawa *et al.* (2013) ^[6] in rose.

Table 1: Effect of varying combination of growing media on rooting of terminal cuttings marigold*

Treatment	Shoot length (cm)	Longest root length(cm)	Fresh weight of root(g)	Dry weight of root (g)	Rooting percentage (%)
T ₁ (Sand + FYM + CS)	8.067	3.600	0.098	0.031	53.330
T ₂ (Sand + FYM + RH)	10.600	5.000	0.170	0.061	71.107
T ₃ (Sand + FYM + WS)	11.033	5.233	0.190	0.063	71.107
T ₄ (Sand + PM + CS)	8.500	3.800	0.098	0.031	53.330
T ₅ (Sand + PM + RH)	11.167	5.167	0.183	0.058	71.107
T ₆ (Sand + PM + WS)	11.733	6.000	0.247	0.087	82.233
T ₇ (Sand)	9.100	3.000	0.105	0.041	59.997
SE(m)	0.238	0.106	0.006	0.002	2.224
CD (5%)	0.730	0.325	0.017	0.007	6.811

FYM: Farm yard manure, PM: Poultry manure, CS: Chickpea straw, RH: Rice husk, WS: Wheat straw

Conclusion

it was observed that T₆ (Sand + Poultry manure + Wheat straw) had better effect on rooting percentage (82.2%), fresh weight of root (0.247g), dry weight of root (0.087 g), longest shoot length (11.73 cm) and root length (6.0 cm) compare to all other treatments. Therefore, it can be concluded that Sand + Poultry manure + Wheat straw found to be best for propagation of marigold through terminal cuttings.

Acknowledgement

we extend our heartiest thanks to all the professors and members of Department of Floriculture and Landscape architecture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) for their persistent support and assistance throughout the research period.

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