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Performance of Lemon Balm (*Melissa officinalis*) Cutting under Different Growing Media

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ABSTRACT

This study was carried out to explore the performance of lemon balm (*Melissa officinalis*) cuttings under different growing media at CIMAP, Research Centre Purara (Uttrakhand). Results indicate that vermicompost + soil + FYM in ratio 1:1:1 had recorded highest survival of cutting (85 %), number of branches (6), plant height (36 cm), number of leaves/plant (38), fresh weight/plant (1.95 g), dry weight/plant (0.98 g), number of root/plant (6) and root length (11.2 cm). Finally concluded that growing media significantly influenced the survival rate of cutting, growth and development parameter of lemon balm sapling in which media vermicompost + soil + FYM was best media since the survival of cutting and development parameters were higher than those on other media, therefore this result suggested that vermicompost + soil + FYM should be used as a growing media for production of lemon balm sapling.

1. Introduction

Lemon balm (*Melissa officinalis* L.) belongs to the mint family and it is indigenous of Southern Europe, Mediterranean region, Western Asia, and North Africa. Lemon balm is now cultivated worldwide. Currently in India lemon balm is cultivated in Kashmir, Uttrakhand and some part of South India. There are two subspecies, *Melissa officinalis* subspecies *Melissa officinalis*, the common cultivated lemon balm; and *Melissa officinalis* sub species altissima, naturalized in New Zealand and known as bush balm. Although *Melissa officinalis* sub species officinalis is known for its lemon fragrance (Tucker and Baggio 2000). Melissa refers to honey or the honeybee because the plant is attractive to bees, and officinalis means a plant that is officially used in medicine. The Greeks called it "melisophyllon" with "meliso" meaning "bee" and "phyllon", denoting "leaf." The Romans referred to the plant as "apiastrum" from "apias", to mean simply "bee". Sixteenth-century gardeners rubbed the leaves on beehives in order to promote the production of honey.

Lemon balm is a perennial bushy plant and is upright, reaching a height of about 1 m. The soft, hairy leaves are 2 to 8 cm long and either heart-shaped (Zargari 1991). Melissa officinalis is used in herbal medicine (Meftahizade et al., 2010). Dried or fresh leaves and top aerial section of the plant which are consumed as a medicine, perfume, cosmetic and herbal tea industries. Lemon balm is a versatile culinary herb which can be used to flavor for different types of dishes, from beverages, to appetizers, desserts. It can be added to salads, sandwiches, soups, stews, butters, cheeses, fish, stuffings for poultry, egg dishes, vegetables, fruit cups, jams, jellies, sauces, herb vinegar, wine, fruits punch, cakes, custards, ice cream, cookies, and cheesecakes (Janina 2003). Lemon balm has medicinal properties like carminative, digestive, diaphoretic antioxidant, antiviral, antidepressant and stimulant activity. (Belsinger 2007) Externally, it is used to treat herpes, sores, gout, insect bites and other skin disease. Lemon balm is also used as an insect repellent (Belsinger 2002). It is a prominent antimicrobial agent against food-borne pathogens and spoilage bacteria. In vitro testing has identified its anti-HIV activity against HIV-1 reverse transcriptase and antitumor activity (Bown 2006).

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Lemon balm is also used for treatment depression and sleeping disorder. Lemon balm has been used to treat irritability and nervousness in young girls and women, boost a lack of interest and energy. Typically, 20–50 g of the dried leaves are infused in 1.0 L of boiled water for 5–15 minutes, and three to four cups of this tea are taken daily (Araujo 2003). Essential oil of lemon balm which is used in aromatherapy, oil of lemon balm is considered the therapeutic principle mainly responsible for most of the activities mentioned, but plant phenolics, especially rosmarinic acid, are also considered to contribute to the therapeutic potential of *M. officinalis*. The essential oil content in lemon balm ranged from 0.02% to 0.30%, which is quite low compared with other members of the Lamiaceae family. Because of this, the production cost and price of the essential oil is very high in the market (Brickell and Judith 1997). Lemon balm oil has contain potentially active components primarily include monoterpenoids and sesquiterpenes, in particular geranial, neral, citronellal, geranyl acetate, β-caryophyllene, caryophyllene oxide and 1, 8-cineole (Davis 1997). However, propagation by seed is not in practice in lemon balm because seed so, vegetative propagation is best way of multiplication for production of lemon balm sapling. Some basic work on performance of lemon balm cuttings under different growing media regarding use of saw dust, vermicompost, sand and FYM in different combination to survival of cutting, sapling growth and development parameters of lemon balm have been carried out.

2. Material and Methods

Performance of lemon balm (*Melissa officinalis*) cutting under different growing media was carried out at CIMAP Research centre Purara, Bageshwar (Uttrakhand) during March to May 2015. The Experimental site is situated at an elevation of 1500-1560 m between the coordinate's 79° 51' 38°- East and 29° 38' 45° North in Katyur valley of Uttrakhand hills. The valley remains hot during summer and cold during winter. The monsoon usually breaks in June and continues up to September. Experimental treatments comprised of following combina tions of different growing media i.e. T_0 - control (soil), T_1 - soil + saw dust (1:1), T_2 - Soil + vermicompost (1:1), T_3 - soil + sand (1:1), T_4 - soil + FYM (1:1), T_5 - vermicompost+ soil+ FYM (1:1:1). Transplanting of cutting was done in first week of March, 2015 in different media filled in polybags, prepared as per treatments. The polybags were irrigated immediately after transplanting of the cutting and repeated every day till final development of seedlings.

For survival of cutting and sapling growth experiment, treatments of the experiment were conducted in CRD with three replications. Each treatment was composed of 100 polybags saplings. All the observation on survival of cutting were recorded at the time of root initiation and growth parameter at the time of transplanting from 100 cuttings for survival percentage and randomly selected 10 saplings for growth parameters. The data on survival percentage of cuttings was recorded according to mortality percentage in cuttings. The survival percentage was calculated as the per cent of mortality, starting from the first mortality to no further mortality in cutting. Survival percentage was calculated by number of established sapling devised by the total number of cuttings transplanted in polybags and multiplied by 100. Recorded plant height was measured from polybags top soil surface up to the highest leaf tip by straightening all leaves. Number of root, root length was measured by destructive method of uprooting the plants and taking measurement by standard method. Plant fresh weight and number of leaves were recorded at the time of transplanting. Dry weight of the plant was recorded after reduction of moisture from the plant. All data was subjected to analysis of variance (ANOVA) to determine significant differences and comparison of mean at significant level of 5%.

Plate 1

Plate 2

(A) Soil **(B)** Soil + saw dust (1:1) (C) Soil+ vermicompost (1:1) **(D)** Soil + sand (1:1) **(E)** Soil + FYM (1:1) **(F)** vermicompost + soil + FYM (1:1:1)

3. Results and Discussion

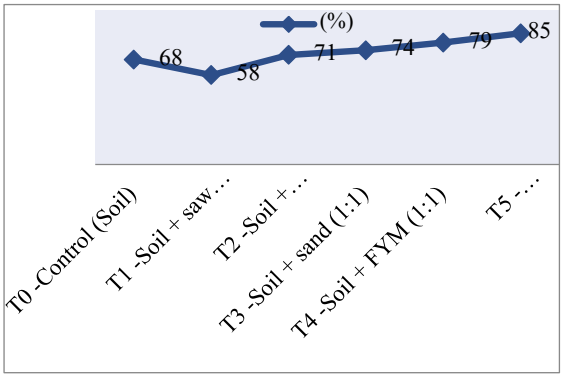
Results of present study have been presented in Table 1. It is evident that the treatment T_5 was found to best followed by T_4. Highest survival percentage of cutting (85 %) was obtained in T_5. The reason for the best performance of vermicompost with the FYM and soil are high organic matter content, which increases the water and nutrient holding capacity of the medium, which improve water utilization capacity of the plant. The higher available well decomposed organic matter (Vermicompost) may preserve soil humidity, increase nutrient content and improve soil structure which increase water absorption and maintain the cell turgidity, cell elongation and increase respiration at optimum level, leading to favorable root initiation in cuttings. Vermicompost + soil + FYM (1:1:1) affects the properties of soil physics, chemistry and biology, since organic matter acts glue for soil aggregate and source of soil nutrient (Prasad 1997). Vermicompost granules may develop soil aggregate and its granulating. Soil aggregation will improve permeability and air flow in the polybags. Vermicompost may decrease fluctuation of soil temperature further root initiation and root growth become easier to the particular depth, so that plant grows well and may absorb more water and nutrients (Jo 1990). Organic matter may also improve nutrient availability and improve phosphorus absorption (Karama and Manwan 1990). All these factors are favorable for root initiation in cutting and ultimate by increase survival percentage, application of vermicompost+ soil+ FYM (1:1:1) in the treatment T_5 showed significant effect on the survival percentage probably due to the synergetic combination of both factor in improving physical condition of the medium and nutritional factors (Sahni et al., 2008). This treatment combination is also helpful in reducing fungus disease in lemon balm sapling due to proper aeration in root zone of sapling and produced highest survival percentage (85 %) in treatment T_5, because of the better physical properties and enhanced nutrient level. Growth of the sapling was also fast and minimum days required for gaining transplanting stage was recorded in this treatment. The improvement of soil porosity, water content, drainage, soil permeability and water availability, with decrease in soil and water availability with decrease in soil density, due to presence of vermicompost and FYM in growth media have provided support for fast growth cutting due to availability of better nutrition with water and air in root zone. Therefore, good physical and biological condition in vermicompost + soil + FYM (1:1:1) had positive effect on root development, which was also helpful in increased survival percentage of sapling in main field after transplanting. Significant differences were also observed among the different treatments with regard to sapling growth characters. Maximum number of leaves (38) and maximum number of branches (6) was observed in T_5 followed by T_4. Vermicompost provide adequate nutrients and enhances both the physical properties and the water holding capacity (Zaller 2007). Similar result was also reported by Supriyant et al. (1990) working on an orange seedling where media contenting manure produced growth and root better than those containing sawdust and sand. Combined application of vermicompost and FYM in the T_5 showed significant effect on sapling growth parameter and plant biomass probably due to the synergistic combination of both factors in improving the physical condition of media and nutrient factor (Sahni et al., 2008) This result is akin to the findings of compos Mota et al. (2009) who suggested that since cure dust is low in nutrients when mix with vermicompost provides better growth medium for plant establishment. However, the air filled porosity (AFP), easily available water (EAW) and aeration of vermicompost and FYM were not at the recommended level, which in turn limit the root growth and

Table 1. Survival and growth performance of lemon balm (*Melissa officinalis*) cutting under different growing media.

Treatment	Survival (%)	Number of branches	Height of the plant(cm)	Number of leaves per plant	Fresh weight of the plant (g)	Dry weight of the plant(g)	Number of root per plant	Root Length(cm)
T0 -Control (Soil)	68	2	15	15	0.73	0.4	2	3.4
T1 -Soil + saw dust (1:1)	58	3	19	28	0.82	0.53	2	4.9
T2 -Soil + vermicompost (1:1)	71	3	23	30	1.05	0.56	3	5.4
T3 -Soil + sand (1:1)	74	4	29	32	1.55	0.73	5	6.2
T4 -Soil + FYM (1:1)	79	5	30	35	1.81	0.86	5	9.7
T5 -Vermicompost+ soil+ FYM (1:1:1)	**85**	**6**	**36**	**38**	**1.95**	**0.98**	**6**	**11.2**
SEM ±	0.606	0.624	0.596	0.198	0.005	0.516	0.606	0.624
CD at 5%	1.908	1.965	1.879	0.623	0.016	1.627	1.908	1.965

lowered the water holding capacity therefore, the medium with vermicompost and FYM is more suitable because of the better physical properties and enhance nutrient level (Bhardwaj, 2014). Significant differences are also observed among the different treatments with regard to sapling growth characters. Maximum height of the plant (36 cm) was recorded in T_5 followed by T_4, maximum fresh weight of the plant (1.95 g) was recorded in T_5 followed by T_4, maximum dry weight (0.98 g) was recorded in T_5 followed by T_4, maximum number of root/plant (6) was recorded in T_5 followed by T_4 and maximum number of root length (11.2 cm) was recorded in T_5 followed by T_4 treatment. T_5 treatment was significantly superior as compare with other treatments.

Graph 1. Survival of lemon balm (Melissa officinalis) cutting under different growing media.



Conclusion

Conclusively, it emerges that growing media significantly influenced the survival rate, growth and development parameters of lemon balm saplings. Vermicompost + soil + FYM (1:1:1) was best media since survival of cutting, sapling growth and development were better in this media than other. Thus, vermicompost + soil + FYM (1:1:1) is recommended as growing media for successful production of lemon balm sapling.

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