Journal of Medicinal and Aromatic Plant Sciences 44(3-4), 2022, 115-119

ORIGINAL RESEARCH ARTICLE

A new agrotechnology for the quality production of menthol-mint shoots and suckers

UPADHYAY RK[1*] • PANDEY P[1] • KHOLIYA S[1] • PADALIA RC[1] • VENKATESHA KT[1] • KUMAR D[1] CHAUHAN A[1] • TIWARI AK[1] • SINGH S[1] • VERMA RK[2]

Article History

Received: December 02, 2022
Revised: December 04, 2022
Accepted: December 18, 2022

Key Words

Mentha arvensis
Menthol-mint
Productivity
Shoots
Sprout
Suckers

ABSTRACT

Menthol-mint (Mentha arvensis L.), cultivated worldwide in tropical and subtropical countries, is a major source of natural menthol and dementholized oil. A field experiment was conducted at CSIR-Central Institute of Medicinal and Aromatic Plants, Research Centre, Pantnagar, Uttarakhand, India, to study the effect of different aerial parts of menthol-mint on its shoot/sprout and suckers production during Kharif season 2021 & 2022. The results clearly showed that the top aerial plant cutting (10-15 cm length) from the main crop of menthol-mint i.e., taken at the time of harvest and used for the raising of shoot/sprouts (T_4), provided maximum quality menthol-mint shoot/sprout yield (32.22 q/ha) and menthol-mint suckers yield (204.42 q/ha) as compared to other treatments. The treatment T_4 proved maximum productivity in terms of menthol-mint shoot/sprout yield and menthol-mint suckers. The results showed that it was due to having maximum regenerative quality compared to other treatments.

INTRODUCTION

Menthol mint (*Mentha arvensis* L.), commonly known as "mints" and belongs to the Lamiaceae family, is a prime source of natural menthol and dementholized oil and is cultivated worldwide in tropical and subtropical countries. India is a leading producer of menthol-mint oil globally, and menthol-mint oil is mainly exported from India to the USA and European countries (Upadhyay *et al*. 2014; Bajeli *et al.* 2016). The total area under-menthol-mint cultivation is estimated to be 3.0 lakh hectares in India, with an annual production of 40,000 tons of menthol-mint essential oil. The crop is commercially cultivated as a spring season crop (January-February to May-June) in Tarai and the central part of Uttar Pradesh and Uttarakhand, Haryana, Punjab, and Bihar etc. (Singh et al., 1998; Izhar et al., 2015). Farmers cultivate mentha crops as cash crops to strengthen their economy. CSIR-CIMAP is a premier institute with expertise in the development of agro-technologies for medicinal and aromatic crops, especially menthol mint, rose-scented geranium, Ocimum, satawar, mucuna, lemongrass, citronella, palmarosa, vetiver, etc. (Kumar & Janesha, 2017)

The menthol-mint crop is cultivated through direct sowing or transplanted by the raising of a nursery through suckers. The production of suckers

*Corresponding Author, E-mail: rkupadhyayfzd@yahoo.com, rk.upadhyay@cimap.res.in
Institutional Communication No.: CIMAP/PUB/2023/16
[1]*CSIR-Central Institute of Medicinal and Aromatic Plants, Research Center, Pantnagar, PO Dairy Farm Nagla, Udham Singh Nagar, Uttarakhand-263149,India*
[2] *CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, Uttar Pradesh-226015,India*
Doi: https://doi.org/10.62029/jmaps.v44i4.Upadhyay

menthol-mint is very tedious, as the process involves transplanting menthol-mint sprouts. Menthol-mint sprout, is the shoot that emerge from ratoon crop after harvesting the main crop during May-June. The production of menthol-mint sprouts is a tedious process because it consumes more time, requires 3-4 nos. of weeding or intercultural operation for raising crops, and requires 45-60 days. Hence, farmers are reluctant to produce menthol-mint sprouts by themselves and depend on others for menthol-mint sprouts. The present method discussed in this communication produceing these sprouts by 20-25 quintals/hectare, costing approximately Rs. 75000-80000/- per hectare as estimated.

METHODOLOGY

Experimental site

A field experiment was conducted at CSIR-Central Institute of Medicinal and Aromatic Plants, Research Centre, Pantnagar, Uttarakhand, India, to study the different parts of menthol-mint for the production of menthol-mint shoot/sprout as well as suckers during Kharif season 2021 & 2022. The experimental field is between 29° N latitude and 79.38° E longitude and 243 meters above mean sea level. The experiment's main objective was to ascertain and find out the best methods for the Menthol-mint shoot/sprout production, which play a key role in quality planting material production of menthol-mint suckers. The experimental soil at Pantnagar was mollisol with neutral in reaction (pH 7.27), medium in organic carbon (0.1.32%), low in available nitrogen (320 kg ha^{-1}), and medium in available phosphorus (18 kg ha^{-1}) as well as in potassium (115 kg ha^{-1}) at pre-experiment stage (Page et al., 1982; Walkley and Black, 1934).

Experimental field design and treatments details

The field experiment trial was laid out in Randomized Block Design with five treatments (Table 1) in three replicates. The pooled data for two-years (2021 & 2022) of all the components were subjected to complete analysis of variance (ANOVA) using a randomized block design. The data were analyzed following standard procedures (Snedecor and Cochran, 1967) to calculate the critical difference (CD).

Table 1: Treatment details

T_1	Whole aerial plant part of the menthol mint 2-4 cm long pieces in tinny furrow, row-to-row spacing 15 cm.
T_2	1/3rd aerial part 2-4 cm long pieces sown in tinny furrow row to row spacing 15 cm.
T_3	Menthol-mint 2/3rd aerial plant chopped 2-4 cm in length sown in tinny furrow row to row spacing 15 cm.
T_4	Cutting from top aerial plant part of menthol-mint 10-15 cm in length and transplanted at 15×10 cm (row to row and plant to plant)
T_5	Menthol-mint sprouts after harvesting of main crops

Raising of menthol-mint shoot/sprouts

The well-leveled and pulverized field was used to raise Menthol-mint shoot/sprouts and suckers variety CIM-Unnati as per treatments. The fresh herbs of menthol mint crop collected during the harvesting of main crop was treated as shown in Table-1. The whole mint herb (T_1), 1/3rd areal parts of the plant (T_2) and 2/3rd top areal parts of the plant (T_3) chopped into 2-4 cms long pieces were sown at 2-3 cm alongwith row-to-row spacing 15 cm in well-prepared bed size of 3×1 m^2 in June during both the years (2021 and 2022). Cutting (10-15 cm long) from the top aerial plant part of menthol-mint transplanted at 15×10 cm at a row-to-row and plant-to-plant (T_4) in June during 2021 and 2022 (Fig. 1). After harvesting the main crops, the ratoon crops were maintained for menthol-mint sprout production, through conventional methods (T_5). Light irrigation was made at the experimental field after transplanting menthol-mint chopped plant, cutting, etc., as per treatment. Further irrigations and intercultural operations were provided as and when required maintaining optimum moisture for the raising menthol-mint sprouts. One weeding was done at 10-15 days after transplanting (DAT) in T_1; two weeding done at 10-15 & 25-30 DAT in T_2, T_3, T_4, and three handing done at starting of ratoon crops, 10-15 days after the ratoon crops, and 25-30 days after ratoon crops in T_5 treatment to keep the experimental field free from weed as per requirement. The top dressing of 30 kg nitrogen per ha was given at 15-20 days after transplanting of menthol-mint cutting, chopping, etc.

Figure 1: Preparation of menthol-mint shoot cutting & transplanting

Transplanting of the menthol-mint shoots/sprouts for suckers' production

The healthy menthol shoots were transplanted in the main field as and when they attained the height of 20-25 cm irrespective of treatment in the experimental field of 45×30 cm inter-row and intra-row spacing during July-August in 2021 and 2022 for menthol-mint suckers production. The most critical good agricultural practices, i.e., one weeding and hoeing, were done 25 and 45 days after transplanting, for proper growth and development of menthol-mint suckers production crops. The menthol-mint suckers production was fertilized with Nitrogen, Phosphorous, and Potash at the rate of 120:80:40 kg/ha respectively. 1/3rd Nitrogen and a full dose of Phosphorous and Potash were applied in the experimental field before the last ploughing. Two other dosees of Nitrogen were applied in two equal splits as top dressing 30th & 70th day after transplanting. The field was irrigated as and when required during the experiment.

Growth and yield characters

The parameters of about days taken to attain 20-25 cm height, nos. of braches per shoot, nos. shoots/sprout per m^2, nos. of shoot per ha., fresh weight of 100 nos. shoot, the fresh yield of shoots/sprout per ha were taken as per treatment at the time of menthol-mint shoot/sprouts attaining 20-25 cm height. The observations of menthol-mint suckers production crops pertaining to sucker yield per plant and sucker yield (kg/m^2), (q/ha) were observed and recorded at the time of digging of menthol-mint suckers during December in 2021 and 2022.

RESULTS AND DISCUSSION

Yield attributes of menthol-mint shoot/sprout production

The data pertaining to yield attributes are presented in Table 2. The detailed scrutiny of results obtained and presented in Table 2, revealed that the

Table 2: Growth and yield attributes observed for the menthol mint shoot/sprout production under various treatments.

Treatment	Days took to attain 20-25 cm height	Nos. of branches per sprout	Nos. of sprouts per meter square	Nos. of sprouts per hectare	Weight of 100 shoots (g)	Yield of sprout (quintal/ hectare)
T_1	42	4	48	480000	490.50	23.54
T_2	47	5	50	500000	492.60	24.63
T_3	45	3	55	550000	483.40	26.59
T_4	33	3	65	650000	495.80	32.22
T_5	55	5	40	400000	550.00	22.00
SEm	1.29	0.01	1.39	NA*	6.85	0.79
$CD_{(0.05)}$	3.85	0.03	4.18	NA*	20.59	2.34

*NA: Not Applicable (as estimated value)

significantly lower number of days were taken (33 days) to attain ideal length and height (20-25 cm) of shoots under T_4 as compared to other treatments, while the maximum number of days (55 days) were taken to attain 20-25 cm height under T_5 (Menthol-mint sprouts after harvesting of main crops). The results presented in Table 2 clearly showed that the maximum nos. of shoots/sprouts per m^2 (65 nos.), maximum numbers of sprouts per hectare (650000 nos.), and maximum yield of sprouts (32.22 q/ha) were recorded in T_4 (Cutting from top aerial plant part of menthol-mint 10-15 cm in length and transplanted at 15×10 cm at a row to row and plant-to-plant). In comparison, the lowest numbers of shoots/sprouts per m^2 (40 nos.), lowest numbers of sprouts per hectare (400000 nos.), and lowest yield of sprouts (22.00 q/ha) were observed in T_5. The results suggest that the cutting from the top aerial plant part of menthol-mint 10-15 cm in length and transplanted at 15×10 cm at a row to row and plant to plant (T_5) provide the highest yield of menthol-mint shoot/sprouts in both qualitative and quantitative as compared to other treatments.

Yield attributes of menthol-mint suckers production

The data pertaining to menthol-mint suckers production is presented in Table 3. The detailed comparative study and scrutiny of results obtained, i.e., presented in Table 3, showed that the maximum fresh weight of menthol-mint suckers per plant (510.85 g.), maximum suckers yield per m^2 (2.04 kg). Maximum yield of suckers (204.42 q/ha) were recorded in T_4 (Cutting from top aerial plant part of menthol-mint 10-15 cm in length and transplanted at 15×10 cm at a row to row and plant to plant),

Table 3: Effect of different treatments on sucker's production of *Mentha arvensis* L.

Treatment	Weight of suckers per plant (g/plant)	Yield of suckers per meter^2 (kg/m^2)	Yield of suckers (q/ha)
T_1	450.65	1.80	180.40
T_2	466.85	1.88	187.95
T_3	472.71	1.90	189.85
T_4	510.85	2.04	204.42
T_5	380.00	1.52	152.23
SEm	8.54	0.50	4.70
$CD_{(0.05)}$	25.62	0.14	14.28

Fig 2: Menthol-mint shoot production

Fig 3: Menthol-mint suckers production

followed by T_3, T_2, T_1 the lowest fresh weight of menthol-mint suckers per plant (380.00 g.), lowest suckers yield per m^2 (1.52 kg) and the lowest yield of suckers (152.23 q/ha) was observed in T_5(Menthol-mint sprouts after harvesting of main crops) It clearly showed that the cutting from the top aerial plant part of menthol-mint 10-15 cm in length and transplanted at 15×10 cm at a row to row and plant to plant (T_5) provided the highest yield of menthol-mint suckers in both qualitative and quantitative as compared to others treatments. The results clearly showed that the top aerial plant cutting (10-15 cm length) from the main crop of menthol-mint i.e., taken at the time of harvest and used for the raising of menthol-mint shoot/sprouts (T_4), provided maximum menthol-mint shoot/sprout yield (32.22 q/ha) and menthol-mint suckers yield (204.42 q/ha) Figure 2 & 3 as compared to other treatments. The treatment T_4 proved the maximum productivity of menthol-mint shoot/sprout yield and menthol-mint

suckers due to its maximum regenerative quality compared to other treatments.

CONCLUSION

Based on a trial on a study to standardize and develop the best as well as affordable menthol-mint sprout production technology for quality production of menthol-mint sprouts and suckers in a sustainable manner, cuttings (10-15 cm length) taken from top aerial plants of menthol-mint at the time of harvest of main crops in the month of May-June and used as planting material production for menthol-mint suckers provided maximum quality menthol-mint shoot/sprout yield (32.22 q/ha) and menthol-mint suckers (204.42 q/ha) as compared to other treatments.. Therefore, it is recommended to use the top aerial plants cutting (10-15 cm length) from main menthol-mint crop at the time of harvest of main crops for qualitative and quantitative production of menthol-mint shoot/sprouts and suckers both in a sustainable manner.

ACKNOWLEDGEMENTS

The authors are very thankful to CSIR Aroma Mission Phase-II (HCP-0007) for financial support to make this research successful and thankful to the Director, CSIR-CIMAP, Lucknow for continuous support & encouragement.

REFERENCES

Bajeli J, Shailesh T, Kumar A, Tripathi A, Upadhyay RK. 2016. Organic manures a convincing source for quality production of Japanese mint (*Mentha arvensis* L.). *Ind Crops & Prod* **83**: 603-606.

Izhar M, Khan M, Yasmin T, Zahid NY. 2015. Differential Effect of Fertilizers on Menthol Contents in Mint (*Mentha arvensis*). *Am Res J of Agr* **1:** 55-60.

Kumar A & Janesha AC. 2017. Medicinal and aromatic plants agro technologies developed by CSIR-central institute of medicinal and aromatic plants. *J Pharmacognosy and Phytochem* **6**: 173-175.

Page AL, Miller RH, Keeney DR. 1982. Methods of soil analysis Part 2 Chemical and microbiological properties. *American Society of Agronomy, Madison.*

Singh A, Singh M, Singh K, Tajuddin. 1998. Intercropping menthol mint (*Mentha arvensis* L.) for higher returns. *J Med and Arom Pl Sci* **20**: 757–758.

Snedecor GM, Cochran WG. 1967. Statistical Methods. *Iowa State College Press, Ames, IA.*

Upadhyay RK, Bahl JR, Verma RS, Padalia RC, Chauhan A, Patra DD. 2014. New source of planting material for quality cultivation of Menthol-mint (*Mentha arvensis* L.). *Ind Crops & Prod* **59**: 184-188.

Walkely AJ, Black IA. 1934. Estimation of soil organic carbon by chromic acid titration method. *Soil Sci* **37**: 29-38.