Priyanka Suryavanshi*,
Dipender Kumar and
Abdul Mazeed

Menthol mint cultivation – Step towards Atmanirbhar Bharat

Improving farmer's income through technological intervention is the urgent need in rural areas for making Indian farmers self-dependent and achieving Atmanirbhar Bharat dream for better India. Adoption of improved package of practice developed for menthol mint cultivation is needed to get higher returns and crop diversification. Menthol mint is grown for menthol used in pharmaceutical and flavour industry. India is a leading supplier of menthol mint oil to the world, and a large number of farmers in India are being benefitted by its cultivation. Menthol mint is today a major industrial crop, thanks to research scientists for providing farmers with high oil-yielding superior varieties of the mint plant.

AMONG different essential oils produced in India today, *Mentha arvensis* (menthol mint) oil holds prominent position in terms of acreage under the crop production and domestic consumption and export to the world market. Today India is the largest producer and exporter of natural menthol in the world. The annual turnover of the menthol industry has been in the range of ₹ 3,500–4,000 crores during the past one decade. Menthol mint is presently cultivated in more than 2.50 lakh hectares land of North India. It is believed that over 5 lakh farming families grow menthol mint crop contributing 75–80% global menthol mint oil produce. Uttar Pradesh contributes about 70–75% of the total national production of menthol mint oil. Menthol mint yields 130–150 kg mint oil/ha (single harvest) giving a net profit in the range of ₹ 60–70,000 in about 3 and a half months. Taking the lesson of success of menthol mint cultivation from the farmers of UP, the area under mint is now spreading to other states in the country including Bihar, parts of Punjab.

CSIR, in its efforts to improve the socioeconomic status of people in the country who are at the bottom of the pyramid of life, is focusing to bring S&T interventions in the areas of health, agriculture, and energy, resulting in equitable and inclusive growth. One such classic example of the proper utilization of a CSIR technology for the economic empowerment of rural India is the cultivation of superior varieties of mint, commonly called *Pudina*. India today dominates the world market contributing about 80% (30,000 tons) of menthol mint in various forms – Menthol crystals and powder, demontholised mint oil, and arvensis oil. Mint cultivation occupies 300,000 ha across the country. Over 90 % of the mint cultivated area is covered by CSIR developed varieties. Continuous development and deployment of improved high-oil yielding, short duration, location-specific varieties and related agro-technologies is a part of CSIR success stories in promoting

Overview of menthol mint field

Mint cultivation. Further value-addition has taken place through improved distillation process and products. Most importantly, CSIR, with its mint production enhancement technologies has generated employment to the extent of 648 lakh man days in the farms and 162 lakh man days in the industry.

Improved varieties

Kosi: The high-yielding variety Kosi developed through half-sib progeny selection, is tall with robust growth and wider adaptability in different parts of the country. The variety is early maturing by about 10 days, and the essential oil is containing 75–78% menthol. On an average it gives 100-125 q/acre herb yield with oil content of 0.6–0.7%. It gives the highest herb and oil yield when harvested at 150 days after planting. The per capita productivity of a superior variety *Kosi*, enabled farmers to take this crop as a bonus between *Rabi* and *Kharif.*

CIM-Saryu: Another high-yielding variety developed with large canopy and huge biomass. The leaf fall is less as compared to other varieties and is also tolerant to sudden rainfall at maturity. The variety yields 140–150 kg essential oil /ha containing 78–80% menthol.

CIM-Kranti: The improved variety 'CIM-Kranti' of menthol mint has been developed through half-sib progeny selection. The variety is cold and frost tolerant and has the potential to produce higher oil (ffi100 kg/ha oil having 80% menthol) when grown in winter compared to all popular commercial varieties. However, during winter (September to January) when all other varieties suffer senescence by the cold and frost conditions, CIM-Kranti remains green in the field. During this period, the variety CIM-Kranti growing vigorously yields two to three times higher essential oil, compared to the popular commercial varieties Kosi and CIM-Saryu. The oil yield during the main summer crop from this variety is 10–12% higher compared to the best check varieties. Hence, this variety is suitable for commercial cultivation to generate additional income without any extra input during both winter and summer seasons.

CIM-Vishisht: The variety CIM-Vishisht rich in pulegone was developed through a half-sib progeny selection in menthol mint cultivar, Shivalik. The new variety has the potential of yielding 60 kg/ha of essential oil rich in pulegone in the range of 65–68%. The pulegone has wide usage in aromatherapy, flavouring agents, perfumery, etc. and also can be chemically converted into some other important compounds like menthone, carvone or thymol and into high value commercially important menthofuran through biotransformation. Therefore, this new variety CIM-Vishisht will be helpful in opening new avenues for industry and research.

Other mint varieties

Some of the prominent varieties of mint developed by CSIR include: Sambhav, Ganga, Damroo, Neerkalka, CIM-Indus, CIM-Patra, Anant Carvomint, and CIM-Madhuras.

Neerkalka is a hybrid mint plant developed by employing sexual crossing between *Mentha arvensis* and *Mentha spicat*. It has high oil yield and shows combined characteristics typical of both parent plants. Another CSIR developed variety of mentha, CIM-Indus contains menthofuran, one of the major aromatic constituents of the essential oil extracted from the leaves of *Mentha piperita.* Another high menthofuran containing mint genotype is CIM-Patra, which is an ideal candidate for commercial utilization. Yet another CSIR developed variety of sweet smelling peppermint *(Mentha piperita)* christened CIM-Madhuras produces characteristic essential oil having medicinal, therapeutic and beverage properties.

Fully matured menthol mint crop

Cultivation

Climatic requirements: Mentha can be grown all over India, wherever assured irrigation is available. It needs a well distributed rainfall of 200-250 cm and bright sunshine for good growth.

Soil Type: Well-drained, sandy loam to loamy soil with moderate to high organic matter, is best for this crop. The soil should be free from acidity, salinity, alkalinity and water-logging.

Rotations: Mentha-Potato, Mentha–Toria, Mentha–Oats (fodder), Mentha-Basmati, Mentha–Wheat–Maize–Potato, Mentha-Maize-Potato, Mentha-DSBR-Potato

Time of planting: The best planting time is the mid-January to the end of January, however, Kosi should be planted from end of January to mid of February. The crop can also be raised by transplanting in April.

Seed rate: Mentha is propagated through suckers. About 2 q of freshly dug 5-8 cm long suckers are enough for one acre.

Method of planting: The suckers are laid end to end, 4-5 cm deep in furrows, 45 cm apart and are then covered with soil by planking lightly. For higher biomass production and water saving, planting should be done on 67.5 cm wide beds (two rows) or ridges should be made at 60 cm spacing after broadcasting the suckers. Apply 24 q of paddy straw mulch per acre and apply a light irrigation after planting.

Distillation units for extracting mentha oil

- Use two quintals of disease free sucker for planting an acre.
- Do not plant sprouted suckers, as most of such suckers die.
- Sow the crop during mid January to end January, however, Kosi variety can be sown up to mid February.
- For water saving and higher yield, sow the crop on beds/ ridges and apply paddy straw mulch @ 24 q / acre.
- For higher returns, grow mentha as an intercrop in sunflower/sugarcane or onion as an intercrop in mentha.

Intercropping

Mentha can also be grown as intercrop.

a) **Sugarcane + mentha intercropping:** Plant one row of mentha between two rows of sugarcane. Mentha and sugarcane can be planted simultaneously in the first fortnight of February. Use one quintal of mentha suckers per acre. In addition to fertilizers recommended to sugarcane, apply 18 kg N (39 kg urea) and 10 kg P_2O_5 (62 kg super phosphate) per acre. Half N and full phosphorus may be applied at planting and remaining half N about 40 days after planting. Take only one cutting of mentha.

Processed mentha oil

b) **Sunflower + mentha intercropping:**

Mentha can be successfully intercropped with sunflower. Sow two rows of mentha in end January between two lines of sunflower grown at 120 cm × 15 cm in North-South direction. Use 150 kg of mentha suckers per acre. In addition to fertilizers recommended to sunflower, apply 23 kg N (50 kg urea) and 12 kg P_2O_5 (75 kg single superphosphate) per acre. Full phosphorus and half nitrogen be applied at planting and remaining half nitrogen at 40 days after planting.

c) **Mentha + Onion intercropping:** Onion can be grown as intercrop in mentha. Both mentha and onion should be planted simultaneously from the mid-January to end January. Plant one row of onion in between the two rows of mentha planted at 45 cm, keeping plant to plant spacing of onion at 7.5 cm. Apply 13 kg N (29 kg urea), 7 kg P_2O_5 (44 kg SSP) and 7 kg K_2O (12 kg MOP) per acre in addition to recommended fertilizer of mentha. Full phosphorus and potash and half nitrogen be applied at planting and the remaining half nitrogen about 40 days after planting.

Fertilizer application: Mentha responds favourably to organic manuring. Apply 10-15 tonnes of well-rotten farmyard manure per acre before planting. The following quantities of inorganic fertilizers are recommended: Nutrients (kg/acre), Fertilizers (kg/acre) N, P_2O_5, Urea, DAP* or Single Superphosphate 60, 16, 130, 35, 100.* When 35 kg DAP is used, apply 115 kg urea per acre. Drill one-fourth of nitrogen and the full quantity of phosphorus at planting. Apply another one fourth of nitrogen about 40 days after planting. Add the remaining

half dose of nitrogen in two equal splits after the first cutting of the crop. The first split may be applied immediately and the second split 40 days afterwards.

Irrigation: Mentha requires frequent but light irrigations. Irrigate at 10 days interval till the end of March and at five or six days interval till the onset of the monsoon. During the rainy season, irrigate according to the need.

Drip irrigation and fertigation: Menthol mint should be drip irrigated at 3 days interval with a lateral pipe having dripper discharge of 2.2 litre per hour and dripper placed at 30 cm apart as per following schedule: Fertigate with first 1/10th of N and P_2O_5 with first irrigation just after planting and thereafter, remaining 9 doses of N and P_2O_5 should be fertigated in 9 equal splits at 9 days interval starting one month after planting. This will result in about 25% higher oil yield along with saving of 36% irrigation water and 20% nutrients over check basin. Use urea (46%) and mono ammonium phosphate (12-61-0 grade) for supplying N and P_2O_5 respectively.

Weed control: In the early stages of growth, a wheel-hoe may be used.

Harvesting and yield: The crop should preferably be harvested at the flower initiation stage. If the lower leaves of the plants turn yellow and start shedding, harvesting may be done earlier. Harvest the crop, leaving 6-8 cm long stumps to secure better sprouting. Two cuttings can be taken, first in June and the second in September. The yield of the crop is 100-125 quintals per acre of fresh herbs which contains 0.5 to 0.75% oil.

Harvesting of mentha by women farmers

Processing and marketing

After harvesting, allow the crop to wilt overnight in the field and subject it to simple distillation. Some private distillation units provide facilities for farmers to extract oil. The farmers are advised to plant mentha only in that area where the distillation units are available.

Plant protection

Insect pests

1. **Termite** (*Odentoterms obseus*): Termites attack the underground parts of the plants and damage the roots and the stems of mentha.
2. **Cutworm** (*Agrotis* spp.): Cutworms cut the young plants at the ground-level. They remain hidden near the base of the plants during day-time.
3. **Jassid and Whitefly:** The attack of these sucking pests adversely affects the plant growth and oil content.
4. **Hairy caterpillars:** Hairy caterpillars, if appearing in an epidemic form, cause serious damage by feeding on the leaves and the tender stems. When young, they feed gregariously. The grown up caterpillars may migrate from one field to another.

Farmers are advised to adopt the following control measures:

- Use light-traps for the destruction of moths.
- Young larvae are gregarious. They can be destroyed by plucking the infested leaves or by pulling out the infested plants and burying them underground. The grown up caterpillars can be destroyed by crushing them under feet.

Diseases

Root rot and Stem rot (*Rhizoctonia bataticola*): The infected portion shows brown lesions which turn dark and later increase in size. The leaves wither and die. Infected plants should be uprooted and destroyed. Planting stock should not be from an infected field. Mentha farming should be avoided year after year in the same field.

Conclusion

India has now attained the distinction of being the largest exporter of menthol mint and its oil. Touching the lives of rural masses through S&T interventions, the story of cultivating superior varieties of mint by Indian farmers unquestionably proves that scientific research is all set to transform rural India by bringing equitable and inclusive growth, which is reflected in enhancing the socio-economic status of the rural populace.

For further interaction please write to:
Priyanka Suryavanshi, CSIR-CIMAP, Lucknow. Corresponding author *e-mail:* priyankaagrios@gmail.com