*Journal of Spices and Aromatic Crops 11 (1) : 67-69 (2002)*

# Comparative performance of menthol mint (*Mentha arvensis* L. f. *piperascens* Malinvaud ex Holmes) cultivars in semi-arid tropical climate

Kamla Singh, B R Rajeswara Rao, C P Singh, P N Kaul, Gopal R Mallavarapu [1] & S Ramesh[1]

*Central Institute of Medicinal and Aromatic Plants*
*Field Station, Boduppal, Uppal*
*Hyderabad 500 039, Andhra Pradesh, India.*

Received 25 August 2001; Revised 17 June 2002; Accepted 26 June 2002.

**Abstract**

Biomass yield, quantity and quality of essential oil of three menthol mint (*Mentha arvensis* f. *piperascens*) cultivars namely, Kosi, Shivalik and Himalaya grown in red sandy loam (alfisol) soil in semi-arid tropical climate of South India, were compared. Cultivars Kosi (15.9 t $ha^{-1}$) and Shivalik (15.4 t $ha^{-1}$) recorded similar biomass, which were superior to that of cultivar Himalaya (14.1 t $ha^{-1}$). Cultivar Kosi produced the highest essential oil yield (140.5 kg $ha^{-1}$), which was 16.6% and 31.1% higher than the yields of cultivars Shivalik (120.4 kg $ha^{-1}$) and Himalaya (107.2 kg $ha^{-1}$), respectively. All the three cultivars yielded good quality essential oils having menthol (77.2% in cv. Kosi; 76.3% in cv. Shivalik; 75.5% in cv Himalaya) as their main constituent. Based on the result, cultivar Kosi is highly promising for commercial cultivation in red soils in the semi-arid tropical climate of South India.

**Key words:** biomass yield, essential oil composition, essential oil yield, yield, menthol mint, *Mentha arvensis*.

Corn mint or menthol mint (*Mentha arvensis* L. f. *piperascens* Malinvaud ex Holmes, Lamiaceae) is an important aromatic crop, the essential oil of which is widely used in the flavour, fragrance and pharmaceutical industries. India is the principal producer of menthol mint oil, menthol, dementholised oil, mint terpenes etc. The cultivation of menthol mint is confined largely to the sub-tropical climate of the North and North-West India, until recently. Recent studies indicated the possibility of commercially cultivating menthol mint in semi-arid tropical climate of South India (Rajeswara Rao 1999; Rajeswara Rao *et al.* 1999 c ; Rajeswara Rao & Singh 1988; Singh *et al.* 1999) and revealed that the quality of essential oil produced in South India is comparable to the North Indian oil (Rajeswara Rao *et al.* 1999 b). Two high yielding menthol mint cultivars, Himalaya and Kosi, are replacing the existing cultivar, Shivalik in the northern belt. As cultivar-environment interactions decide the success or failure of a specific cultivar in an environment, the performance of the two new cultivars, Himalaya and Kosi, in comparison with the established cultivar Shivalik has been studied in red sandy loam (alfisol) soil in the semi-arid tropical climate of South India.

A field experiment was conducted in 1997 at the Research Farm of Central Institute of Medicinal and Aromatic Plants Field Station, Hyderabad, India with a semi-arid tropical climate on a red sandy loam (alfisol) soil of poor fertility and neutral in reaction. Rhizomes of three cultivars were planted, end to end in 3-5 cm deep furrows

[1] Central Institute of Medicinal and Aromatic Plants, Field Station, GKVK (PO), Bangalore, 560 065, India

spaced at 45 cm and covered with soil in the first week of January. The crop was irrigated at weekly intervals and manually weeded twice. It was fertilised with 150 kg nitrogen (three splits) as urea, 60 kg of phosphorus as single superphosphate and 60 kg of potassium as muriate of potash per hectare, at the time of planting. The plants were harvested at flowering stage and the shoot biomass was recorded. Shoot tissue samples (800 g each) were hydrodistilled in Clevenger apparatus for 3 h for the determination of essential oil concentration in the plant samples. Essential oil (economic) yields per unit area (kg $ha^{-1}$) were computed by multiplying biomass yield with es-

**Table 1.** Chemical composition (percentage of essential oil) of three menthol mint cultivars

| Compound* | RI | | Area %** | | | Method of identification |
|---|---|---|---|---|---|---|
| | BP-1 | BP-20 | Himalaya | Kosi | Shivalik | |
| (Z)- Hex-3-enol | 832 | | 0.1 | 0.1 | 0.1 | RI, MS |
| α - Pinene | 933 | 1019 | 0.6 | 0.4 | 0.5 | RI, PE, MS |
| Sabinene | 969 | 1114 | 0.2 | 0.2 | 0.2 | RI, PE, MS |
| β- Pinene | 974 | 1100 | 0.6 | 0.5 | 0.7 | RI, PE, MS |
| Myrcene* | 984 | 1155 | 0.4 | 0.4 | 0.4 | RI, PE, MS |
| Octan-3-ol* | 984 | 1382 | 0.1 | 0.1 | 0.5 | RI, MS |
| α - Phellandrene | 998 | 1168 | tr | tr | tr | RI, MS |
| *p*- Cymene | 1014 | 1261 | - | - | tr | RI, MS |
| Limonine* | 1024 | 1185 | 2.1 | 2.0 | 1.1 | RI, PE, MS |
| 1, 8 - Cineole* | 1024 | 1195 | 0.6 | 0.3 | 0.2 | RI, PE, MS |
| (Z) -β- Ocimene | 1030 | 1257 | tr | tr | tr | RI, PE, MS |
| (E) -β- Ocimene | 1042 | 1235 | tr | tr | tr | RI, PE, MS |
| trans- Sabinene hydrate | 1059 | 1465 | 0.1 | 0.1 | 0.1 | RI, MS |
| Linalol | 1084 | 1550 | 0.1 | 0.1 | 0.1 | RI, PE, MS |
| Isopulegol | 1153 | 1574 | 0.7 | 0.8 | 0.7 | RI, MS |
| Menthone | 1140 | 1444 | 2.0 | 1.7 | 4.5 | RI, PE, MS |
| Isomenthone | 1149 | 1470 | 4.9 | 4.8 | 6.8 | RI, PE, MS |
| Menthol | 1167 | 1640 | 75.5 | 77.2 | 76.3 | RI, PE, MS |
| α - Terpineol | 1177 | 1694 | 0.1 | 0.2 | 0.1 | RI, PE, MS |
| Citronellol | 1212 | 1788 | 0.4 | 0.4 | 0.3 | RI, PE, MS |
| Pulegone | 1219 | 1660 | tr | tr | 0.1 | RI, MS |
| Piperitone | 1233 | 1740 | 0.3 | 0.3 | 0.2 | RI, PE, MS |
| Menthyl acetate | 1280 | 1540 | 7.5 | 6.8 | 4.2 | RI, PE, MS |
| Isomenthyl acetate | 1312 | - | 0.1 | 0.2 | 0.2 | RI, PE, MS |
| β- Caryophyllene | 1422 | 1588 | 0.5 | 0.4 | 0.3 | RI, PE, MS |
| Germacrene | 1480 | 1715 | 0.4 | 0.4 | 0.3 | RI, MS |
| Caryophyllene oxide | 1577 | 1990 | 0.1 | tr | tr | RI, PE, MS |

*In order of elution from BP-1 column

* Area percentage on BP-20 column

tr =<0.05%; RI = retention index; PE = peak enrichment; MS = mass spectra

sential oil recovery from Clevenger apparatus and bulk density of the oil.

Cultivar Himalaya produced the least biomass (14.1 t $ha^{-1}$) and essential oil (107.2 kg $ha^{-1}$), while cultivars Kosi (15.9 t $ha^{-1}$) and Shivalik (15.4 t $ha^{-1}$) gave identical biomass yields. The essential oil yield was highest in Kosi (140.5 kg $ha^{-1}$), which outyielded Shivalik and Himalaya by 16.6% and 31.1%, respectively. The higher essential oil yield of Kosi is attributed to its higher leaf : stem ratio (1.1) compared to Shivalik (1.0) and Himalaya (0.8) and better retention of lower leaves at harvest (Kothari *et al.* 2000). In menthol mint, leaves yield more oil than stems (Rajeswara Rao *et al.* 1999 a; 2000) and a higher leaf : stem ratio along with more number of leaves on the stems lead to greater essential oil yield. The superiority of Kosi over Himalaya and Shivalik has been observed in North India also (Kothari *et al.* 2000).

GC and GC-MS analyses of essential oil samples were carried out as described previously (Rajeswara Rao *et al.* 1999a). Compounds were identified by comparing the relative retention indices (RRI)) of the peaks (computed from gas chromatograms by logarithmic interpolation between bracketing η-alkanes. The homologous series of η-alkanes C8 - C22, Poly Science Inc, Niles, USA, were used as standards) with those reported in literature (Davies 1990), comparing the mass spectra of the peaks with literature values (Adams 1989; Jennings & Shibamoto 1980) and by peak enrichment on co-injection with authentic chemicals, wherever possible. All the three cultivars produced essential oils of similar composition with marginal variations in some constituents (Table 1). The oil of Shivalik was marginally rich in menthone and isomenthone, but was poor in menthyl acetate in comparison with the oils of Kosi and Himalaya. Menthol was the main component of all the oils with Kosi recording the maximum percentage (77.2 %) in its oil followed by Shivalik and Himalaya. The quality of the oils was considered as good and was readily accepted in the market.

This investigation has revealed that Kosi produced the highest essential oil yield of good quali-ty in the semi-arid tropical climate of South India.

## Acknowledgement

The authors are grateful to the Director, CIMAP, Lucknow for facilities and encouragement.

## References

Adams RP 1989 Identification of Essential Oils by Ion Trap Mass Spectrometry. Academic Press, New York.

Davies NW 1990 Gas chromatographic retention indices of monoterpenes and sesquiterpenes on methyl silicone and carbowax 20 M phases. J. Chromatogr. 503 : 1- 24.

Jennings W & Shibamoto T 1980 Quantitative Analysis of Flavour and Fragrance Volatiles by Glass Capillary Gas Chromatography. Academic Press, New York.

Kothari S K, Singh C P, Singh K & Kumar S 2000 Critical analysis of menthol mint (*Mentha arvensis* L.) cultivar differences in oil yield. Indian Perfum. 44 : 129–134.

Rajeswara Rao B R 1999 Biomass and essential oil yields of cornmint (*Mentha arvensis* L.f. *piperascens* Malinvaud ex Holmes) planted in different months in semi-arid tropical climate. Ind. Crops Prod. 10 : 107-113.

Rajeswara Rao B R, Bhattacharya A K, Mallavarapu G R & Ramesh S 1999a Volatile constituents of different parts of cornmint ( *Mentha arvensis* L.). Flavour Fragr. J. 14 : 262 – 264.

Rajeswara Rao B R, Bhattacharya A K, Singh K, Kaul P N & Mallavarapu G R 1999b Comparative composition of cornmint oils produced in North and South India. J. Essent. Oil Res. 11 : 54 – 56.

Rajeswara Rao B R, Kaul P N, Bhattacharya A K, Singh C P, & Naqvi A A 1999c Cultivation of cornmint (*Mentha arvensis* L.f. *piperascens* Malinv. ex Holmes) in Tamil Nadu : Yield and quality of the essential oil. J. Essent. Oil Bearing Plants 2 : 127 – 131.

Rajeswara Rao B R, Kaul P N, Mallavarapu G R & Ramesh S 2000 Comparative composition of whole herb, flowers, leaves and stem oils of cornmint (*Mentha arvensis* L. f. *piperascens* Malinvaud ex Holmes). J. Essent. Oil Res. 12 : 357 – 359.

Rajeswara Rao B R & Singh K 1988 Production potential of improved genotypes of Japanese mint in Andhra Pradesh. Pafai J. 10 (4) : 37 – 39.

Singh K, Kaul P N, Bhattacharya A K & Singh C P 1999 Effect of planting dates and spacing on performance of *Mentha arvensis* L. in semi-arid tropical climate of Hyderbad. Indian Perfum. 43 : 29 – 34.