I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS)
Rating : 3.03

Effect of primary and secondary nutrient in conjunction with Zinc on yield contributing character and oil yield of Menthol mint (*Mentha arvensis* L.)

R. K. Upadhyay[a,] & V. R. Singh[b]*

Abstract: *A field experiment were conducted at the research farm of Central Institute of Medicinal and Aromatic Plant, Research Centre, Pantnagar (Udham Singh Nagar) Uttarakhand, India, during 2013 to ascertain the response of primary and secondary nutrient in conjunction with Zinc on yield contributing character, oil yield and quality of Menthol mint (*Mentha arvensis *L.). The results revealed that, application of Application of NPK @ 100:60:40 kg ha^{-1} + Ca- 0.8 kg ha^{-1} foliar spray at 25 & 45 DAT + Mg- 0.8 kg ha^{-1} 25 & 45 DAT + S- 2.0 kg ha^{-1} 25 & 45 DAT + Zn- 2.0 kg ha^{-1} 25 & 45 DAT recorded highest plant height (92.5 cm), fresh herb yield (232.7 q ha^{-1}), oil content (1.05%), and oil yield (244.34 kg ha^{-1}) of mint as compared to other treatments.*

INTRODUCTION

Menthol mint (*Mentha arvensis* L.) is a potential source of natural menthol and dementholized oil and is cultivated in the tropics and subtropical countries worldwide. The area under menthol mint cultivation in India is estimated to be 0.15 million hectares with annual production of 20,000 metric tons of essential oil. The crop is commercially cultivated in tarai and central part of Uttar Pradesh (Barabanki, Raebareli, Rampur, Bareli, Badaun, Moradabad, Amroha, Rudrapur Bilaspur), Punjab, Bihar and Haryana (Singh *et al.*, 1998). The plant on hydro distillation yields essential oil containing about 70-80% menthol, which is used in various pharmaceutical, food and cosmetic preparations. Besides China and USA, India is a major producer of mint oil mostly exported to USA and European countries. Due to huge amount application of N, P, K soil facing problem of nutrient imbalance, because less number of farmers apply best nutrient management practices in their field. Therefore, soil productivity declining nowadays. The present investigation was undertaken to develop appropriate agro technology for mint crop which may be improve nutrient balance as well and provide higher return with minimum risk to environment, soil health, quality and quantity of the produce.

MATERIALS AND METHODS

A field experiment was conducted at the research farm of CSIR-Central Institute of Medicinal and Aromatic Plant, Research Centre, Pantnagar (Udham Singh Nagar) Uttarakhand, India during summer season 2013 with an object to ascertain the response of primary and secondary nutrient in conjunction with Zinc on yield contributing character, oil yield and quality of Menthol mint (*Mentha arvensis* L.). The experimental site is located between 29° N latitude and 79.38° E longitude and

[a] CSIR-Central Institute of Medicinal and Aromatic Plants, Research Centre, Pantnagar P.O. Dairy Farm Nagla, Udham Singh Nagar, Uttarakhand-263149, India.

[b] CSIR-Central Institute of Medicinal and Aromatic Plants, Kukrail Picnic Spot Road, Lucknow, (U.P.) 226015, India

* *Corresponding author: rkupadhyayfzd@yahoo.com, rk.upadhyay@cimap.res.in*

at an altitude of 243 m above mean sea level. The maximum temperature ranges between 35 to 45°C, and minimum between 2 to 5°C. At proper tilth, field was ploughed once with soil turning plough by tractor followed by cross-harrowing with the help of disk harrow. After harrowing, planking was done to level the field and obtain fine tilth which is necessary for proper plant growth. The experimental soil in field up to furrow slice level (15 cm depth) was sandy-loam in texture, neutral in reaction (7.3 pH), medium in organic carbon (0.56%), low in available nitrogen (134 kg ha-1), and medium in available phosphorus (13 kg ha-1) as well as in potassium (140 kg ha-1). The field experiment was laid out in a Randomized Block Design with three replication keeping 17 treatments as T_{-1}- Control (no fertilizer); $T-_2$- Recommended dose (RD) NPK 100:60:40 kg NPK ha^{-1}; $T-_3$- RD + Ca @ 0.8 kg ha^{-1} foliar spray at 25 & 45 DAT; $T-_4$- RD + Mg @ 0.8 kg ha^{-1} foliar spray at 25 & 45 DAT; $T-_5$- RD + Sulphur (S) @ 2.0 kg ha^{-1} foliar spray at 25 & 45 DAT; $T-_6$- RD + Zn @ 2.0 kg ha^{-1} foliar spray at 25 & 45 DAT; $T-_7$- RD + Ca + Mg; T_8- RD + Ca + S; T_9- RD + Ca + Zn; T_{10}- RD + Mg + S; T_{11}- RD + Mg + Zn; T_{12}- RD + S + Zn; T_{13}- RD + Ca + Mg + S; T_{14}- RD + Mg + S + Zn; T_{15}- RD + S + Zn + Ca; T_{16}- RD + Zn + Ca + Mg; T_{17}- RD + Ca + Mg + S + Zn.

Transplanting of menthol-mint (cv. CIM-Saryu) was done at 50x50 cm spacing on March 23, 2013 through nursery raised seedling. The full dose P & K were applied as basal, and N was applied in three equal doses as 1/3 basal, 1/3 at 25 days after transplanting (DAT), and 1/3 at 45 DAT. Secondary nutrient and zinc were sprayed with the help of a manual operated knapsack sprayer fitted with flatfan nozzle using 600 litres water per hectare before transplanting of mint (*Mentha arvensis*). The observation on different parameters viz. plant height (cm), fresh herb yield (q ha^{-1}), oil content (%) by Clevenger apparatus (Clevenger, J.F. 1928) , and oil yield (kg ha^{-1}) were observed. Statistical analysis of data was done following standard procedures (Snedecor & Cochran, 1967).

RESULTS AND DISCUSSIONS

The data pertaining to plant height (cm), fresh herb yield (q ha^{-1}), oil content (%), and oil yield (kg ha^{-1}) is presented in Table 1. The scrutiny of table & data indicates that significantly highest plant height (92.5 cm), fresh herb yield (232.7 q ha^{-1}), oil content (1.05%), and oil yield (244.34 kg ha^{-1}) of mint was recorded in $T---_{17}$ (Recommended dose (RD) NPK @ 100:60:40 kg ha^{-1} + Ca- 0.8 kg ha^{-1} foliar spray at 25 & 45 DAT + Mg- 0.8 kg ha^{-1} 25 & 45 DAT + S- 2.0 kg ha^{-1} 25 & 45 DAT + Zn- 2.0 kg ha^{-1} 25 & 45 DAT)in T_5 (40:20:20 kg NPK ha^{-1}+ FYM @ 5 t ha^{-1} + VC @ 2 t ha^{-1}) as compared to other treatments; and lowest plant height (45.0 cm), fresh herb yield (60.5 q ha^{-1}), oil content (0.75%), and oil yield (45.38 kg ha^{-1}) was

Table 1
Effect of primary and secondary nutrient in conjunction with Zinc on yield contributing character & oil yield of Menthol mint (*Mentha arvensis* L.).

Treatment	*Plant height (cm)*	*Fresh herb yield (quintal ha^{-1})*	*Oil content (%)*	*Oil yield (kg ha^{-1})*
T_1	45.0	60.5	0.75	45.38
T_2	70.5	205.4	0.95	195.13
T_3	72.5	206.4	0.96	198.14
T_4	74.6	205.8	0.95	195.51
T_5	75.6	206.9	0.96	198.62
T_6	76.5	207.8	0.95	197.41
T_7	76.8	215.5	0.96	206.88
T_8	77.8	216.8	0.97	210.30
T_9	78.5	218.4	0.96	209.66
T_{10}	79.2	217.9	0.98	213.54
T_{11}	79.5	216.5	0.98	212.17
T_{12}	79.9	218.4	0.98	214.03
T_{13}	82.5	220.5	1.00	220.50
T_{14}	84.5	221.1	0.99	218.89
T_{15}	85.4	222.8	1.00	222.80
T_{16}	87.6	224.4	1.01	226.64
T_{17}	92.5	232.7	1.05	244.34
$SEm_{\pm}$	1.25	2.21	0.01	2.57
$LSD_{(P=0.05)}$	3.72	6.58	0.03	7.61

T_{-1}- Control (no fertilizer); $T-_2$- Recommended dose (RD) NPK 100:60:40 kg NPK ha^{-1}; $T-_3$- RD + Ca @ 0.8 kg ha^{-1} foliar spray at 25 & 45 DAT; $T-_4$- RD + Mg @ 0.8 kg ha^{-1} foliar spray at 25 & 45 DAT; $T-_5$- RD + Sulphur (S) @ 2.0 kg ha^{-1} foliar spray at 25 & 45 DAT; $T-_6$- RD + Zn @ 2.0 kg ha^{-1} foliar spray at 25 & 45 DAT; $T-_7$- RD + Ca + Mg; T_8- RD + Ca + S; T_9- RD + Ca + Zn; T_{10}- RD + Mg + S; T_{11}- RD + Mg + Zn; T_{12}- RD + S + Zn; T_{13}- RD + Ca + Mg + S; T_{14}- RD + Mg + S + Zn; T_{15}- RD + S + Zn + Ca; T_{16}- RD + Zn + Ca + Mg; T_{17}- RD + Ca + Mg + S + Zn.

recorded in T_1- control. Similar observations were also made by Patra et al. (1998), Patra et al. (2000) and Singh *et al*. (1989) who worked on fertilizer requirement of menthol mint on the basis of soil-test-crop response and under integrated nutrient management system.

CONCLUSION

Application of NPK @ 100:60:40 kg ha^{-1} + Ca- 0.8 kg ha^{-1} foliar spray at 25 & 45 DAT + Mg- 0.8 kg ha^{-1} 25 & 45 DAT + S- 2.0 kg ha^{-1} 25 & 45 DAT + Zn- 2.0 kg ha^{-1} 25 & 45 DAT recommended as a good agricultural practices for the commercial scale cultivation of menthol-mint i.e. recorded the highest plant height (92.5 cm), fresh herb yield (232.7 q ha^{-1}), oil content (1.05%), and oil yield (244.34 kg ha^{-1}) of mint.

References

Clevenger J.F. (1928), Apparatus for determination of essential oil. J. Am. Pharm. Assoc. 17:346–349.

Patra, D.D., Anwar, M., Chand, S., (2000), Integrated nutrient management and waste recycling for restoring soil fertility and productivity in Japanese mint (Mentha arvensis) and mustard (Brassica juncea) sequence in Uttar Pradesh, India. Agric. Ecosyst. Environ. 80, 260–275.

Patra, D.D., Anwar, M., Chattopadhyay, A., Chauhan, H.S., Kumar, N., Rajput, D.K., Singh, D.V., (1998), Fertilizer requirement of Japanese mint (Mentha arvensis) on the basis of soil test crop response following fertility gradient approach. J. Med. Arom. Plant Sci. 20, 364–367.

Singh, V.P., B.N. Chatterjee, and D.V. Singh. (1989), Response of mint species to nitrogen fertilization. J. Agric. Sci. 113:267–271.

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

Snedecor, G.M. and W.G. Cochran, (1967), *Statistical Methods*. Iowa State College Press, Amer., Iowa, USA.