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SHORT COMMUNICATION

Response of nutrient application on growth, herbage and oil yield of mint (*Mentha arvensis* L.) in western Uttar Pradesh

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Introduction

Among aromatic crops, mint (*Mentha arvensis* L.) is more popular in the country, as it is very economical crop and can be grown on variety of soils and climatic conditions, though it prefers well drained soils and humid conditions. At present, India is major producer of mint oil and menthol in the world. In Uttar Pradesh, mint is grown commercially in the Indogangatic plains of Rampur, Moradabad, Badaun,Bareilly and Barabanki districts. The menthol is major constituents of mint oil and has various uses in pharmaceuticals, cosmetics, flavours and confectionery industries. As a herbal drug, it is considered stimulant, stomachic and carminative.

However, not much work has been done on varietal improvement, screening of germplasm for various purpose including oil content, mint based crop diversification etc. Sporadic information are available on nutrient management with special reference to increase in oil yield (Chandra *et al*., 1983; Singh *et al*., 1973 ; Bhardwaj *et al*., 1983). Some workers tried agronomical aspects coupled with application of NPK fertilizers for improvement of growth and yield of mint. However, no information is available about nutrient application in mint crop under western Uttar Pradesh conditions, where it is gaining popularity in recent years. Besides above, the role of sulphur deficiency causes reduction in dry matter production and zinc has been found to increase menthol content in mint. In general, these nutrients are applied individually to improve growth and oil yield of mint. Therefore, the present study was planned to find out the response of basic nutrients (NPK) either alone on in combination with sulphur and zinc on growth, herbage and oil yield of mint under western Uttar Pradesh conditions.

The field experiment was conducted at Horticulture Research Centre, Sardar Vallabh Bhai Patel University of Agriculture and Technology, Meerut (UP) during summer 2005 and 2006 on well drained sandy soils. The soil fertility status was medium having 7.8 pH. The agroclimatic region is broadly categorized as subtropical with 780 mm annual rainfall. The average temperature during summer ranges between 26-34 0C while in winter 15-20 0C. Occasional frost is also experienced.

The treatment comprised of three levels of NPK (i) 120+40+25 Kg N, P, K ; (ii) 160+60+40 Kg N, P, K and (iii) 200+80+55 Kg N, P, K as well as 20 Kg sulphur and 5 Kg zinc either alone or in combination were applied. Thus total 13 treatments were made including control plot (unfertilized). The experiment was laid out in randomized block design having three replications in a plot size of 2 x 2 m. The cuttings of mint cultivar Kosi were spaced at 30 cm row to row. The complete dose of phosphorus, potash, sulphur, zinc and 1/3rd of nitrogen were applied as basal dose during field preparation while remaining two doses of nitrogen were top dressed after 50 and 80 days of transplanting. All the plots under different treatment were managed uniformly with respect to irrigation, weed management, plant protection measures etc. The crop was harvested 110 days after transplanting for recording observations on plant heght, plant spread, number of branches, leaf area index, number of leaves/ 25 cm² area, herbage yield and oil content. The distillation for oil content was done in the laboratory after conditioning the herbage under various treatments. The pooled data of two harvests were analyzed statistically for interpretation of results.

Growth and herbage yield

The data presented in table 1 indicate that all the growth parameters including plant height, plant spread, number of branches per plant, number of leaves per 25 cm² and leaf area index were significantly higher in T_{12} (200+80+55+20+5 Kg N, P, K, S, Zn) and minimum under T_{13}-control plot. This is also apparent that with the increasing N, P, K either alone or in combination with sulphur and zinc the growth parameters of mint were increased correspondingly. The observations of this investigation indicated that application of nutrients are essentially required for better vegetative growth of mint crop. Almost similar observations were made by Bhardwaj and Awasthi (1989); Singh *et al*. (1992) and Zheljazkov *et al*.(1996) under different agroclimatic situations.

Based on pooled data analysis of two harvests, all the treatments show significant difference with respect

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Table 1. Effect of nitrogen, phosphorus, potash, sulphur and zinc on growth and herbage yield of mint.

Treatment	Growth parameters					Herbage yield (q ha-1)*
	Plant height (cm)	Plant spread (cm)	Number of branches plant-1	Number of leaves/ 25 cm²)	Leaf Area Index	
T_1 (120+40+25 Kg N,P,K)	65.54	40.44	35.52	447.83	4.025	427.82
T_2 (T_1+20 Kg S)	68.35	42.42	37.26	456.83	4.803	478.55
T_3 (T_1+5 Kg Zn)	68.04	41.60	36.43	450.46	4.829	472.24
T_4 (T_1+20+5 Kg S, Zn)	70.17	44.04	40.45	505.20	5.017	502.56
T_5 (160+60+40 Kg N,P,K)	72.80	45.08	42.45	573.86	5.300	507.29
T_6 (T_5+20 Kg S)	76.76	46.62	43.94	584.80	5.503	524.88
T_7 (T_5+5 Kg Zn)	75.19	46.17	43.16	579.80	5.545	518.46
T_8 (T_5+20+5 Kg S, Zn)	81.44	48.37	45.21	598.66	5.720	542.63
T_9 (200+80+55 Kg N,P,K)	81.25	48.19	45.66	596.26	5.702	530.53
T_{10} (T_9+20 Kg S)	81.34	51.18	46.61	613.06	5.890	538.41
T_{11} (T_9+5 Kg Zn)	81.28	50.43	46.50	604.86	5.810	543.90
T_{12} (T_9+20+5 Kg S, Zn)	83.31	52.46	48.28	619.60	6.106	554.70
T_{13} (Control)	49.82	35.60	25.53	385.53	2.271	321.72
SEm±	1.02	0.66	0.80	2.26	0.042	1.05
CD (p=0.05)	2.99	1.95	2.36	6.64	0.123	3.07

* Based on two consecutive harvests

to herbage yield. The herbage yield which is ultimately attributed by different growth parameters was also highest (554.70 q ha-1) in the same treatment (T_{12}) followed by T_{11} (543.90 q ha-1), T_{10} (538.41 q ha-1) and minimum in T_{13}-control (321.72 q ha-1).

Oil yield

The oil content of a particular variety is genetic character but the synthesis in plant system may largely be influenced by the growing conditions, stage of harvesting, exogenous application of desired nutrients, conditioning of herbage and distillation system etc. Therefore, variations between the treatments with respect to per cent oil content was meager, though all the treatments varied significantly if compared with control. It is also obvious that the application of N, P, K in combination with sulphur and zinc have added advantage in oil content of mint than N, P, K alone. However, the higher dose of N, P, K (T_9, T_{10}, T_{11}, T_{12}) either alone or in combination with sulphur and zinc did not beneficial in improving oil content. Similar results were made by Samra *et al.* (1978).

Among various treatments, highest oil yield was recorded in T_8 (431.63 l ha-1) followed by T_{12} (425.30 l ha-1) and minimum in T_{13}-control (196.18 l ha-1), though the herbage yield was maximum in T_{12}. This indicated that luxuriant vegetative growth was detrimental for oil yield of mint. The results are in close proximity with Singh *et al.* (1979), Sharma *et al.* (1980) and Chandra *et al.* (1983).Thus, for better oil yield of mint, application of 160+60+40+20+5 Kg N, P, K S, Zn is recommended under western Uttar Pradesh conditions. By the said dose of nutrients, the oil yield of mint can be doubled in comparison to control.

Table 2. Effect of nitrogen, phosphorus, potash, sulphur and zinc on oil yield of mint.

Treatment	Oil content (%)	Essential oil yield (l ha-1)
T_1 (120+40+25 Kg N,P,K)	0.779	329.95
T_2 (T_1+20 Kg S)	0.816	364.92
T_3 (T_1+5 Kg Zn)	0.818	372.00
T_4 (T_1+20+5 Kg S, Zn)	0.820	384.24
T_5 (160+60+40 Kg N,P,K)	0.822	371.70
T_6 (T_5+20 Kg S)	0.825	411.23
T_7 (T_5+5 Kg Zn)	0.825	422.96
T_8 (T_5+20+5 Kg S, Zn)	0.836	431.63
T_9 (200+80+55 Kg N,P,K)	0.781	374.12
T_{10} (T_9+20 Kg S)	0.782	401.08
T_{11} (T_9+5 Kg Zn)	0.790	416.89
T_{12} (T_9+20+5 Kg S, Zn)	0.784	425.30
T_{13} (Control)	0.609	196.18
SEm±	0.001	0.44
CD (p=0.05)	0.003	1.29

* Based on two consecutive harvests

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