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Effect of transplanting time, spacing and fertilizers on herbage and oil yield of *Mentha piperita* L

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ABSTRACT

A field experiment was conducted in the department of Forest Products, College of Forestry, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan to study the effect of transplanting time, spacings and fertilizers on herbage and oil yield of *Mentha piperita*. The study revealed that the crop transplanted on 15 February gave highest plant height (36.54 cm), herb yield (135.16 q/ha), oil content (0.26%) and oil yield (39.63 kg/ha). Similarly at 30x45 cm spacing, maximum plant height (36.52 cm), herb yield (143.46 q/ha), oil content (0.24%) and oil yield (36.05 kg/ha) were recorded. These coupled with the use of NPK (120:50:40 kg/ha) fertilizer gave maximum values for all the parameters like plant height (43.22 cm), herb yield (204.42 q/ha), oil content (0.36%) and oil yield (62.57 kg/ha) in *M. piperita* followed by application of vermicompost. When vermicompost (10 t/ha) was applied for organic cultivation of *M piperita*, the respective values for these parameters were 39.45 cm, 190,11 q/ha, 0.34 per cent and 57.29 kg/ha for plant height, herb yield, oil content and oil yield.

Keywords: Transplanting, spacing, oil, *Mentha piperita*

INTRODUCTION

Mentha commonly known as mint, is an important oil bearing herb. It is world's third most valuable flavouring agent (Fenarolics 1971). The oil and aroma chemicals in pure form command a massive demand especially in food and allied industries. *Mentha piperita* L is a native of Mediterranean countries. It spreads by a system of branching, underground rootstock and grows to height of 45 to 90 cm. The square branching stems are deep purple in colour and bear opposite, lanceolate, slightly toothed leaves of deep green colour, 2.5 to 5 cm long. Small purplish flowers are borne in terminal spikes on the main stems and branches from June to September. Peppermint oil bears a comparatively lesser amount of menthol content (50-60%) and delicate flavour. Some of the important constituents are á-pinene, â-pinene, sabinene, myrcene, 1-8 cinneole, limonene, g-terpinene, isovallerate, octanol, cis-hexenyl, methyl acetate, iso-methyl, linalool, menthone menthofuran and caryophyllene oxide (Guenther 1974). Peppermint oil is one of

the most popular and widely used essential oils which is used in the flavouring of pharmaceuticals and oral preparations like toothpastes, dental creams, mouth washes, cough syrups, chewing gum, confectionary and alcoholic liquours. Medicinally, it is an excellent carminative and gastric stimulant. When applied externally, it acts as a mild analgesic (Husain et al 1988, Farooqi and Sreeramu 2001).

Keeping in view the demand and multifarious uses of mint in flavouring and pharmaceuticals industries, although, some work on cultivation under inorganic farming have been done, yet no systemic information is available on its cultivation under organic farming, especially in mid hill conditions of Himachal Pradesh. Hence, the present study was conducted.

MATERIAL AND METHODS

The experiment was carried out at Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP situated at 1200 m above mean sea level under the sub temperate zone of Himachal Pradesh. The soil of experimental area was sandy loam in texture having pH 7.71, EC 0.43 m mhos/cm, available nitrogen, phosphorus potassium 318, 12.60 and 285.97 kg/ha, respectively. The treatment consisted of three dates of planting (15 January, 15 February, and 15 March), three row spacings (30x30, 30x45 and 45x45 cm) and three organic fertilisers viz FYM (10 t/ha), vermicompost (10 t/ha), *Azotobacter* (10 kg/ha) and one standard dose of NPK (120:50:40 kg/ha). The experiment was laid out in split-plot design with three replications. Fresh, healthy and disease free suckers were transplanted in furrows at a depth of 4-5 cm as per the treatments. A light irrigation was given soon after planting to ensure better establishment. The crop was harvested from mid May to last of June (first cutting), and mid August to mid September (second cutting) depending on the planting dates. The data on fresh herb and oil yield were recorded at the time of each harvest.

RESULTS AND DISCUSSION

Effect of transplanting time

The studies revealed that the15 February was the best transplanting time for *M piperita* as compared to 15 January and 15 March, thereby, giving higher values for plant height (36.54 cm), herb yield (135.16 q/ha), oil content (0.26%) and oil yield (39.63 kg/ha) (Tables 1-4).The low yield in the crop transplanted on 15 January might be due to low temperature in the initial stages and higher temperature during 15 March. Moreover, under delayed plantings, as a consequence of higher temperature, plant height remained less due to less diversion of photosynthates for stem formation than leaves as is reported by Singh et al (1998). However, the crop transplanted during February got all the favourable conditions for the growth of

Table 1. Effect of transplanting time, spacings, organic maures and fertilizers on plant height (cm) of *Mentha piperita* L

Treatments	S_1						S_2						S_3						Overall Mean
	F_1	F_2	F_3	F_4	F_5	Mean	F_1	F_2	F_3	F_4	F_5	Mean	F_1	F_2	F_3	F_4	F_5	Mean	
T_1	31.18	32.14	36.38	34.21	38.41	34.46	31.28	32.44	39.17	35.45	39.44	35.56	27.34	31.41	35.20	33.39	37.21	32.91	34.31
T_2	32.21	35.45	39.41	37.34	41.31	37.14	34.39	36.18	39.48	38.40	43.22	38.33	29.38	31.45	36.47	34.20	39.37	34.17	36.54
T_3	29.83	32.29	35.41	33.27	37.35	32.29	32.29	34.30	37.14	35.31	39.32	35.67	29.25	31.16	35.29	33.22	35.20	32.82	33.59
Mean	31.07	33.29	37.07	34.94	39.02	34.85	32.65	34.31	38.60	36.39	40.66	36.52	28.66	31.34	35.65	33.60	37.26	33.30	-

$CD_{0.05}$

Transplanting time (T)	5.28	4.61	4.87
Fertilizer (F)	2.08	3.58	3.26
TxF	3.28	4.66	3.80

		Time of transplanting	**Spacings**	**Fertilizers**
Transplanting time (T)	3.74	T_1 = 15 January	S_1 = 30x30 cm	F_1 = No fertilizer
Spacing (S)	3.82	T_{2-} = 15 February	S_2 = 30x45 cm	F_2 = FYM 10 t/ha
Fertilizer (F)	3.46	T_3- = 15 March	S_3 = 45x45 cm	F_3 = Vermicompost 10 t/ha
TxFxS	3.18			F_4 = Azotobacter 10 kg/ha
				F_5 = NPK (120:50:40 kg/ha)

Table 2. Effect of transplanting time, spacings, organic manures and fertilizers on herb yield (q/ha) of *Mentha piperita* L.

Treatment	S_1						S_2						S_3						Overall
	F_1	F_2	F_3	F_4	F_5	Mean	F_1	F_2	F_3	F_4	F_5	Mean	F_1	F_2	F_3	F_4	F_5	Mean	Mean
T_1	83.32	102.50	137.60	112.51	160.66	119.30	91.60	103.22	153.34	119.55	188.54	131.22	72.43	99.35	132.40	101.31	137.42	108.58	119.70
T_2	93.30	103.31	148.42	113.22	165.34	124.70	94.25	145.32	190.11	185.63	204.42	163.93	91.22	100.35	137.22	114.34	141.32	116.86	135.16
T_3	79.80	90.20	133.34	91.54	154.22	109.81	92.43	107.55	152.34	143.66	180.35	135.23	78.53	86.21	102.44	91.48	105.32	92.78	112.60
Mean	85.47	98.67	139.77	105.75	160.03	117.93	92.76	118.67	165.23	149.57	191.07	143.46	80.73	95.29	124.00	102.36	128.00	106.07	-

$CD_{0.05}$

Transplanting time (T)	8.33	7.61	22.48
Fertilizer (F)	16.79	19.92	13.95
TxF	13.46	20.43	17.62

$CD_{0.05}$

		Time of transplanting	**Spacings**	**Fertilizers**
Transplanting time (T)	5.24	T_1 = 15 January	S_1 = 30x30 cm	F_1 = No fertilizer
Spacing (S)	18.63	T_{2-} = 15 February	S_2 = 30x45 cm	F_2 = FYM 10 t/ha
Fertilizer (F)	11.36	T_3- = 15 March	S_3 = 45x45 cm	F_3 = Vermicompost 10 t/ha
TxFxS	21.05			F_4 = Azotobacter 10 kg/ha
				F_5 = NPK (120:50:40 kg/ha)

Table 3. Effect of transplanting time, spacings, organic manures and fertilizers on oil content (%) of *Mentha piperita* L.

Treatment	S_1						S_2						S_3						Overall
	F_1	F_2	F_3	F_4	F_5	Mean	F_1	F_2	F_3	F_4	F_5	Mean	F_1	F_2	F_3	F_4	F_5	Mean	Mean
T_1	0.18	0.19	0.22	0.21	0.24	0.21	0.19	0.21	0.23	0.22	0.26	0.22	0.15	0.16	0.21	0.19	0.22	0.19	0.21
	(0.42)	(0.43)	(0.46)	(0.45)	(0.48)		(0.43)	(0.45)	(0.47)	(0.46)	(0.50)		(0.38)	(0.39)	(0.45)	(0.43)	(0.46)		
T_2	0.19	0.22	0.29	0.25	0.34	0.26	0.22	0.25	0.34	0.27	0.36	0.29	0.18	0.21	0.27	0.23	0.29	0.24	0.26
	(0.44)	(0.45)	(0.53)	(0.49)	(0.58)		(0.46)	(0.47)	(0.58)	(0.51)	(0.60)		(0.42)	(0.45)	(0.51)	(0.47)	(0.53)		
T_3	0.16	0.18	0.22	0.20	0.24	0.20	0.16	0.19	0.26	0.21	0.28	0.22	0.14	0.16	0.20	0.18	0.21	0.18	0.20
	(0.39)	(0.42)	(0.46)	(0.44)	(0.48)		(0.39)	(0.43)	(0.50)	(0.45)	(0.52)		(0.37)	(0.39)	(0.44)	(0.42)	(0.45)		
Mean	0.17	0.19	0.24	0.22	0.27	0.22	0.19	0.21	0.27	0.23	0.30	0.24	0.15	0.17	0.22	0.20	0.24	0.20	-

$CD_{0.05}$

Transplanting time (T)	0.03	0.02	0.02
Fertilizer (F)	0.02	0.03	0.03
TxF	0.03	0.03	0.03

$CD_{0.05}$

		Time of transplanting	**Spacings**	**Fertilizers**
Transplanting time (T)	0.04	T_1 = 15 January	S_1 = 30x30 cm	F_1 = No fertilizer
Spacing (S)	0.03	T_{2-} = 15 February	S_2 = 30x45 cm	F_2 = FYM 10 t/ha
Fertilizer (F)	0.02	T_3- = 15 March	S_3 = 45x45 cm	F_3 = Vermicompost 10 t/ha
TxFxS	0.03			F_4 = Azotobacter 10 kg/ha
				F_5 = NPK (120:50:40 kg/ha)

plants which might have contributed towards higher growth and yield parameters.

Effect of spacings

The studies on the effect of plant spacings on plant height, herb yield, oil content and oil yield in *M piperita* revealed that spacing of 30x45 cm resulted in significant increase in all the growth and yield parameters. At this spacing, maximum plant height (36.52 cm), herb yield (143.46 q/ha), oil content (0.24%) and oil yield (36.05 kg/ha) were recorded. Higher yield in this case might be due to more number of plants per unit area and less competition among plants for nutrients, light, water etc which contributed more towards increased herb yield and oil content. Such a phenomenon of higher yield at closer spacing has also been reported by Saini et al (2002).

Effect of organic manures and fertilizers

Application of vermicompost resulted in enhanced plant height, herb yield, oil content and oil yield 39.48 cm, 190.11 q/ha, 0.34% and 57.29 kg/ha, respectively which was higher than application of FYM, Azotobacter and PSB in the present study. All these values were compared with the standard dose of NPK fertilizer (120:50:40 kg/ha). The values of all the parameters like plant height (43.22 cm), herb yield (204.42 q/ha), oil content (0.36%) and oil yield (62.57 kg/ha) were higher as compared to other treatments. Since, nitrogen has well marked effect on the yield of herbage and essential oil and *Mentha* being a leafy crop, responds favourably more to the higher doses of nitrogen (Bhardwaj et al 1978, Singh et al 1983, Bhardwaj and Kaushal 1990). Duhan et al (1975) also reported that more leaf area, size of epidermal cells and number of oil glands per unit area are the important factors which are responsible for higher essential oil content and herbage yield.The beneficial effect of phosphorus in influencing herbage yield is due to its role in various metabolic activities of plant which might have resulted in increased herbage yield. The results obtained in the present studies are in agreement with those of Munsi and Mukherjee (1982) who reported a significant increase in the yield of *Mentha* oil by application of 60 kg P_2O_5/ha. The use of vermicompost served as the best substitute for the cultivation of *M piperita* under organic conditions.

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