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Optimum planting time and row spacing for bergamot mint (*Mentha citrata* Ehrh.) var. 'Kiran' under sub tropical plains of central Uttar Pradesh

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Abstract

A field experiment was conducted at CIMAP farm, Lucknow during 1997-98 to find out the optimum planting time and row spacing for newly developed variety 'Kiran' of bergamot mint (*Mentha citrata* Ehrh.). The crop planted on 15 and 30 December produced higher total herb yield (356 and 349 q ha^{-1}) but maximum oil yield (167 kg ha^{-1})was obtained from 30 January planting. Planting at a closer row spacing of 45 or 60 cm produced higher herb and oil yield than wider row spacing of 75 cm. Planting of bergamot mint in the end of January at a row spacing of 60 cm is suggested for maximum oil production from crop grown for two harvests. However, for a single harvest, planting in mid February is suggested to enable the farmers to grow bergamot mint in rotation with winter season crops such as potato, mustard and vegetables and also rainy season crops after the harvest of bergamot mint.

Key words: *Mentha citrata*, planting date, row spacing

Introduction

The essential oil of bergamot mint (*Mentha citrata* Ehrh.) is a rich source of linalool and linalyl acetate which have wide application in cosmetic, food, flavour and perfumery industries, world over. In India it is cultivated in an area of 150-200 ha with an annual production of about 20 tonnes of oil. Among the various agronomic aspects that affect the productivity of mint, planting time and row spacing are considered to be most important. Earlier studies revealed that the optimum planting time was mid January for *tarai* regions of U.P. and Uttranchal (Singh & Nand 1979) and Gangetic plains of West Bengal (Ghosh & Chatterjee 1978), and first week of March for the temperate climate of Himachal Pradesh (Katoch *et al.* 1978). However, precise information on above aspects in sub tropical plains of central Uttar Pradesh is meagre. The present investigation was therefore, undertaken to find out the optimum planting time and row spacing for newly developed variety 'Kiran' of bergamot mint.

Materials and methods

A field experiment was conducted at CIMAP farm, Lucknow during 1997-98 to study the effect of planting time and row spacing on herb and oil yield of bergamot mint var. 'Kiran'. The treatments consisting of seven planting dates (Dec.15, Dec.30, Jan. 15, Jan. 30, Feb. 15, March 2 and March 17) and three row spacings (45, 60 and 75 cm), replicated thrice, were tested in factorial R.B.D. with an individual plot size of 9.0 m x 4.0 m. The soil (pH 7.8) of the experimental plot was sandy loam in texture, low in nitrogen (available N, 150 kg ha^{-1}), medium in phosphorus (available P, 12.5 kg ha^{-1}),) and

potassium (available K, 142 kg ha^{-1}). Fresh stolons /runners of bergamot mint were planted end to end 2-3 cm deep in furrows for Dec. 15 to March 2 plantings, whereas for March 17 planting 25 days old rooted plantlets were used. Irrigation was applied immediately after planting to ensure better establishment. Crop received 40 kg N, 60 kg each of P_2O_5 and K_2O ha^{-1} as basal dose placed in furrows 3-4 cm below the stolons/plantlets at the time of planting. N (40 kg) was top dressed at 45 days after planting and another 40 kg N at 15 days after first harvest. Two harvests of crop were taken (Table 1). The oil content in fresh herb was estimated in Clavenger type apparatus at each harvest. Oil yield was estimated by multiplying the herb yield with oil content and a constant factor 0.9 (the approximate specific gravity of oil).The mean weekly weather parameters recorded during the period of experimentation (15 December 1997 to 23 September 1998) are presented in Fig.1.

Table 1. Harvesting schedules for different planting dates

Planting time	First harvest (DAP)	Second harvest (DAFH)
December 15	150	80
December 30	135	80
January 15	120	75
January 30	120	70
February 15	115	65
March 2	110	65
March 17	110	65

DAP-days after planting, DAFH-days after first harvest

Results and discussion

In the first harvest the maximum fresh herb yield was obtained from Dec. 15 and Dec. 30 planting. The delay in planting resulted in continuous decline in herb yield while reverse was true for oil content in herb. Lowest oil content of 0.35% was recorded in Dec. 15 and 30 planted crop which increased to 0.40% in Jan. 15, 0.55% in Jan. 30 and 0.65% in later plantings (Feb. 15 to March 17). Thus, the maximum oil yield (96.0 kg ha^{-1}) was recorded from Feb. 15 planting and the lowest 63-65 kg ha^{-1} from Dec. 15 to Jan. 15 plantings. In second harvest, however, oil yield was lower with plantings after Jan. 30. The total oil yield (first + second harvest) was maximum (167.0 kg ha^{-1}) with Jan. 30 planted crop. A reduction of 10.5, 11.4, 12.0, 27.6, 33.0 and 41.9 % in total oil yield was noted from Dec. 15, Dec. 30, Jan. 15, Feb. 15, March 2 and March 17 plantings, respectively, compared

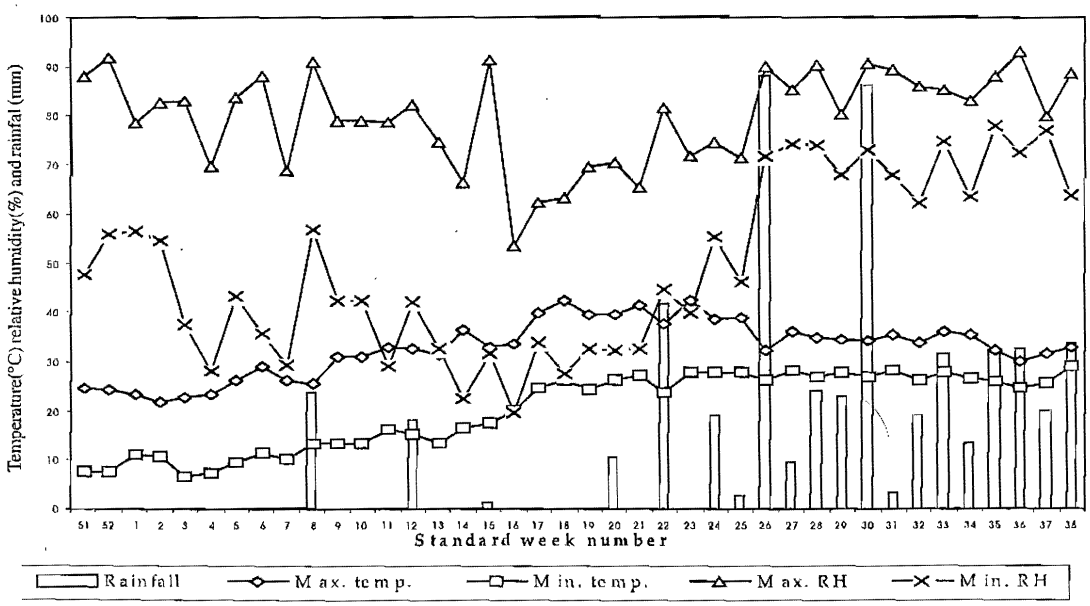

Fig. 1. Mean weekly weather parameters during the period of experimentation (Dec.15, 1997-Sept., 1998)

to Jan. 30 planted crop. The higher biomass yield in the early planting was attributed to favourable climatic conditions for growth of bergamot plant as mint planted in December and January witnessed a low day temperature (<25 °C) for 3-5 weeks time after planting (Fig. 1). Because of low temperature in the initial stages, mint planted in December and January got fully established and when exposed to higher temperature, picked up growth without any limitation. Whereas mint planted in March was exposed to higher day temperature soon after planting, hence could not efficiently utilize growth resources in the absence of well developed root system, because low temperatures have often been found to favour more of root than the shoot growth (Farrav & Williams 1991). Due to comparatively higher temperature, late planted mint took less time to reach the maturity than mint planted earlier (December and January). Thus, period between planting and the first harvest of the late planted crop was considerably reduced (Table 1), resulting in poor herb yield. The reduction in oil yield under early planting was due to lower oil content in fresh biomass, as oil yield is a function of biomass yield and oil content. The lower oil content in early planting was due to low temperature prevailed during active growth stage. This observation is in agreement with that of Guenther (1961), Duriyaprapan *et al.* (1986), Prasad & Saxena (1979) and Singh *et al.* (1995) who noted that the oil content in leaves of *Mentha* species was a direct function of mean temperature prevailing during the growth period. The drastic reduction in herb yield in second harvest under late (15 Feb – 17 Mar) planting was due to poor regrowth of the crop as a consequence of less carbohydrate reserve in the stolon at the time of first harvest because of the higher temperature experienced during the active growth period. These findings are in conformity to those reported by Prasad & Saxena (1980) and Singh *et al.* (1995) in *Mentha* spp .

The crop planted at a closer row spacing of 45 cm out yielded 60 and 75 cm row spacing with respect to fresh herb produced in first harvest. However, the oil yields were at par as the oil content in herb was significantly increased under wider row spacing. The herb and oil produced in second harvest and the total oil yield was similar in 45 and 60 cm row spacings. Wider spacing of 75 cm resulted about 9.0 and 5.5% reduction in oil yield in second harvest and total of both (I + II) the harvests, respec-

Table 2. Fresh herb yield, oil content and oil yield of bergamot mint as influenced by planting time and row spacing

Treatment	Fresh herb yield (q ha^{-1})			Oil content (%)		Oil yield (kg ha^{-1})		
	I harv.	II harv.	Total	I harv.	II harv.	I harv.	II harv.	Total
Planting time								
Dec. 15	207.0	149.0	356.0	0.35	0.63	65.0	84.5	149.5
Dec. 30	200.0	149.0	349.0	0.35	0.64	63.0	85.0	148.0
Jan. 15	178.0	146.0	324.0	0.40	0.63	64.0	83.0	147.0
Jan. 30	163.0	151.0	314.0	0.55	0.64	80.0	87.0	167.0
Feb. 15	165.0	43.5	208.5	0.65	0.63	96.0	24.9	120.9
Mar. 2	153.0	37.7	190.7	0.65	0.63	90.0	21.8	111.8
Mar. 17	135.0	32.9	167.9	0.65	0.64	79.0	18.7	97.7
SEm±	6.6	5.2	6.3	0.01	0.02	4.5	3.0	4.3
LSD (P=0.05)	18.7	14.8	17.9	0.03	NS	12.8	8.4	12.2
Row spacing (cm)								
45	188.0	104.8	292.8	0.49	0.63	83.2	59.3	142.5
60	167.0	104.4	271.4	0.53	0.64	80.0	60.2	140.2
75	160.0	94.4	254.4	0.54	0.65	78.0	54.2	132.2
SEm±	4.3	3.2	4.9	0.01	0.01	2.9	1.8	2.8
LSD (P=0.05)	12.0	8.9	14.5	0.03	NS	NS	5.0	7.8

NS-Non Significant

tively, as compared to 60 cm row spacing. Katoch *et al.* (1978) and Singh & Nand (1979) also recorded higher oil yield under closer row spacing.

Planting of bergamot mint in the end of January at a row spacing of 60 cm is suggested for the maximum oil production from crop grown for two harvests. However, for a single harvest, planting in mid of February is recommended. The mid February planting is of great significance to the farmers as they may grow bergamot mint in rotation with major winter crops such as potato, mustard and vegetable crops and also rainy season crops after the harvest of bergamot mint.

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