Plant Archives Vol. 19 No. 1, 2019 pp. 319-322 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF PLANTING AND HARVESTING DATES ON THE GROWTH AND ESSENTIAL OIL CONTENT OF PEPPERMINT (*MENTHA PIPERITA* L.)

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Abstract

A pot experiment was conducted in the Experimental Researches Station (2), College of Agriculture - Al-Muthanna to study the effect of two dates of cultivation (15 February and 15 March) and five dates of harvesting (60, 80, 100, 120 and 140 day after transplanting) on growth and essential oil content of peppermint *Mentha piperita* L.). Complete Randomized Design was used with three replicates. The study revealed that the peppermint plants planted at 15 February significantly supervised in plant height, shoot fresh weight, shoot dry weight, leaves dry weight, root dry weight, number of stolon's and essential oil content (38.1 cm, 11.12 gm., 3.03 gm., 2.04 gm., 2.85 gm., 7.0 stolon.plant^{-1} and 0.78%) respectively. Harvesting of plants at 120 day after transplanting gave highest shoot dry weight (2.48gm.), leaves dry weight (1.83 gm.), root dry weight (2.35 gm.) and number of stolon's (8.6 stolon.plant^{-1}). While harvested plants at 140day after transplanting gave highest plant height (36.7 cm). Highest shoot Fresh weight (9.22 gm.) was obtained on harvested plants at 100 day after transplanting. The maximum essential oil content of peppermint was recorded on harvesting peppermint at 80 day after transplant in greached (0.84%).

Key words : *Menthap iperita* L., Planting date, Harvesting date, Essential oil, Peppermint

Introduction

Mentha piperita L. (commonly known as peppermint) belongs to Lamiaceae family is one of the important species of mint in Iraq. It is herbaceous and perennial considered as a medical and aromatic plant and were produced extensively for the medicinal and food product industries (Yazdani *et al.* 2002, Grieve 1999). Peppermint oil is one of the most popular and widely used essential oils mostly because of its main components menthol and menthone (Gul 1994). It is widely used for its medicinal properties such as digestive, carminative, chloretic, antispasmodic, diuretic, antimetic, mild sedative, diaphoretic, antiseptic, antiviral, used in many mixtures of indigestion and colic and cough and cold remedies (Khare 2007). It is used for flavoring pharmaceuticals and oral preparations, such as mouth washes, toothpastes and dental creams, and it is also used as a flavoring agent in chewing gums, confectionery, cough drops and alcoholic liqueurs. As wellit is usedin medicines for internal use. Its pleasant taste makes it an excellent gastric stimulant (Budavari *et al.* 1989, Gupta 1991).

Although, secondary metabolites in the medicinal and aromatic plants were fundamentally produced by genetic processing but, their biosynthesis is strongly influenced by environmental factors (Yazdani *et al.* 2002). Singh *et al.* (1995) mentioned that the herb yield an essential oil biosynthesis in *Mentha* sp. is strongly influenced by several intrinsic and extrinsic factors including fertilizer, planting time, harvesting time and other agro-climatic factor. Because oil biosynthesis occurs in the leaves, their growth and photosynthetic capacityare important factors for oil production (Srivastava & Luthra 1994). The rate of biosynthesis is the chief process that determines monoterpene accumulation in peppermint. Shah and Gupta (1989) mentioned that is harvesting a crop early or late result to a lower in yield of leaves and essential oil content because at an earlier or later stage of harvesting, the crop was immature or over mature resulting in a poor yield of herb and oil content. Thus, the aim of this investigation was to study the effect of planting date and harvesting date on the growth parameters and essential

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oil content of *Mentha piperita* L.

Materials and Methods

A pot experiment was conducted inthe Experimental Researches Station (2), College of Agriculture - Al-Muthanna University from 15/2-10/8/2018. The peppermint plants were initiated from underground stolons (3 cm long) were transplanted into plastic pots, three of which were planted in one pot. Each pot was filled with 6 kg of air-dried soil. The soil was silty loam (silt 76%, clay 18% and sand 6%) with 0.95% organic matter, 8.1 pH and 1.2dsm EC. A uniform amounts of (150 Kg of N.ha^{-1}, 100 Kg of P_2O_5.ha^{-1} and 100 Kg of K_2O) were applied to each pot. The experiment included 10 treatments which is the interaction treatments between two dates of planting (15 February and 15 March) and fife dates of harvesting (60, 80, 100, 120 and 140 day after transplanting). These treatments were arranged in factorial experiment laid out in completely randomized design (CRD) with three replications. All the plants within each pot were harvested for the study of their plant height, shoot fresh weight, shoot dry weight, leaves dry weight, root dry weight, number of stolons. Essential oil content was determined by hydro distillation method. The mint leaves (30 g) were air dried at 40^{0}C and then mixed with 500 ml of water, which was subsequently hydro distilled in modified Clevenger apparatus for 2.30 h at 120°C. The essential oil ratio was measured by using dry yield (biomass yield) of peppermint (Aflatuni 2005).

Data on all observation were subjected to analysis of variance (ANOVA) and least significant difference (LSD) at probability of 0.05.

Results and Discussion

Effect of planting date

Data presented in Tables (1-7) showed that the 15 February was the best planting date for peppermint as compared to 15 March, thereby, gave highest values of plant height (38.1 cm), shoot fresh weight (11.12 gm.), shoot dry weight (3.03 gm.), leaves dry weight (2.04 gm.), root dry weight (2.85 gm.), number of stolon's (7.0 stolon.plant^{-1}) and essential oil content (0.78%). The significant superiority to first planting date (15 February) may be due to the plants planted during February got all the favorable conditions for the growth of plants (represented by temperature and light) which might have contributed towards higher growth and yield for those plants.

Table 1: Effect of planting and harvesting dates and their interaction on plant height (cm.plant-1)

Planting date	Harvesting date					
	60 DAT	80 DAT	100 DAT	120 DAT	140 DAT	Mean
15 February	27.73	4.64	1.14	2.54	4.53	8.1
15 March	16.82	2.72	6.92	8.32	9.02	8.7
Mean	22.32	8.63	3.43	5.43	6.7	
L.S.D 0.05	Planting d		Harvesting d.		Planting d × Harvesting d.	
	2.08		3.28		4.64	

*DAT: Days after transplanting

Table 2: Effect of planting and harvesting dates and their interaction on shoot fresh weight (gm.plant^{-1})

Planting date	Harvesting date					
	60 DAT	80 DAT	100 DAT	120 DAT	140 DAT	Mean
15 February	7.56	10.69	12.14	13.17	12.06	11.12
15 March	4.02	5.44	6.30	4.86	3.98	4.92
Mean	5.79	8.06 9.	22 9.0	1 8.02		
L.S.D 0.05	Planting d		Harvesting d.		Planting d × Harvesting d.	
	0.72		1.14		1.61	

Table 3: Effect of planting and harvesting dates and their interaction on shoot dry weight (gm.plant^{-1})

Planting date	Harvesting date					
	60 DAT	80 DAT	100 DAT	120 DAT	140 DAT	Mean
15 February	1.66	2.97	3.46	3.56	3.51	3.03
15 March	0.90	1.25	1.42	1.41	1.42	1.28
Mean	1.28	2.11	2.44	2.48	2.46	
L.S.D 0.05	Planting d		Harvesting d.		Planting d × Harvesting d.	
	0.2 1		0.33		0.46	

Table 4: Effect of planting and harvesting dates and their interaction on leaves dry weight (gm.plant^{-1})

Planting date	Harvesting date					
	60 DAT	80 DAT	100 DAT	120 DAT	140 DAT	Mean
15 February	1.12	2.10	2.30	2.35	2.32	2.04
15 March	0.65	0.96	1.30	1.31	1.28	1.10
Mean	0.88	1.53	1.80	1.83	1.80	
L.S.D 0.05	Planting d		Harvesting d.		Planting d × Harvesting d.	
	0.13		0.20		0.29	

Effect of harvesting date

The results showed that harvesting dates significantly

Table 5: Effect of planting and harvesting dates and their interaction onroot dry weight (gm.plant^{-1})

Planting date	Harvesting date					
	60 DAT	80 DAT	100 DAT	120 DAT	140 DAT	Mean
15 February	1.37	2.76	3.28	3.47	3.35	2.85
15 March	0.79	1.08	1.21	1.22	1.20	1.10
Mean	1.08	1.93	2.25	2.35	2.28	
L.S.D 0.05	Planting d		Harvesting d.		Planting d × Harvesting d.	
	0.20		0.31		0.44	

Table 6: Effect of planting and harvesting dates and their interaction on number of stolons (stolon.plant^{-1})

Planting date	Harvesting date					
	60 DAT	80 DAT	100 DAT	120 DAT	140 DAT	Mean
15 February	2.5	4.0	7.16	11.31	0.0	7.0
15 March	1.77	4.8	5.67	6.01	6.23	4.9
Mean	2.14	4.4	6.42	8.67	8.12	
L.S.D 0.05	Planting d		Harvesting d.		Planting d × Harvesting d.	
	1.0		1.58		2.24	

Table 7: Effect of planting and harvesting dates and their interaction on essential oil content (%)

Planting date	Harvesting date					
	60 DAT	80 DAT	100 DAT	120 DAT	140 DAT	Mean
15 February	0.73	1.0	0.93	0.66	0.57	0.78
15 March	0.84	0.67	0.59	0.39	0.37	0.57
Mean	0.78	0.84	0.76	0.53	0.47	
L.S.D 0.05	Planting d		Harvesting d.		Planting d × Harvesting d.	
	0.07		0.11		0.16	

affected growth parameter and essential oil content of *M. piperita* . Significantly higher values of shoot dry weight (2.48gm.), leaves dry weight (1.83 gm.), root dry weight (2.35 gm.) and number of stolon's (8.6 stolon. plant^{-1}) were observed at 120 DAT which did not differ significantly with harvesting at 100 DAT and 140 DAT in shoot dry weight, leaves dry weight and root dry weight, and with 140 DAT in number of stolon's (Tables 3-6). The results also showed that harvested plants at 140 DAT were much superior in plant height (36.7 cm) compared with other dates, which did not differ significantly with harvesting at 120 DAT (Table 1). Results of Table (2) showed that harvesting date (100 DAT) gave higher value in shoot fresh weight (9.22 gm.) which did not differ significantly with harvesting at 120 DAT. Data presented in Table (7) showed that the essential oil content was significantly affected with the different of harvesting dates. Harvest of peppermint at 80 DAT recorded the highest value of the essential oil percent (0.84%) compared with other dates, but did not differ significantly with the percentages achieved at 60 DAT and 100 DTA. Quality and quantity of essential oil is strongly dependent on developmental stage of the plant (Aflatuni 2005), and therefore harvesting of peppermint in stage (80 day after transplanting) is the optimal developmental stage of the plant to obtaining of highest content of essential oil.

Effect of interaction

Results of Tables (1-7) concluded that the interaction between planting dates and harvesting dates was a significant in all studied growth characteristics and in the peppermint content of the essential oil. The highest fresh and dry weights of shoot, leaves dry weight, root dry weight and number of stolon's were recorded from the interaction between planting date (15 February) and harvesting date (120 DAT). The interaction between planting date (15 February) with harvesting date (140 DAT) gave the highest value in plant height . While, The maximum essential oil content of peppermint was recorded from the interaction between planting date (15 February) with harvesting date (100 DAT).

Conclusion

In this study, and under the conditions of Iraq (Al-Muthanna city), it was found that the planting date at 15 February was the most appropriate and best for growth vegetative of *Mentha peperita* and as well as its content of essential oil. Essential oil content of peppermint was significantly increased when the harvesting was made at 80 day after transplanting.

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