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EFFECT OF PLANTING DATES ON GROWTH AND OIL YIELD OF WILD MINT *(Mentha longifolia,* L.) PLANTS

Matter, F. M. A.* and Farouk M. Gadallah**
***Dept. of Horticulture, Fac. of Agric. Fayoum, University. Egypt.**
****Dept. of Botany, Fac. of Agric. Fayoum, University. Egypt.**

ABSTRACT

This investigation was carried out in the two successive seasons of 2005/2006 and 2006/2007 to study the favorable months for planting wild mint. The results indicated that plant height, number of tillers plant^{-1}, number of branches tillers^{-1}and fresh and dry weights of herb increased during Oct., Nov and Dec months compared with the other planting months. Also, chemical constituent i.e. chlorophyll a, b and total, carotenoids, total soluble carbohydrates concentration and oil yield were increased. On the other hand, delaying the flowering date was recorded in these months. Hence, it may be recommended to cultivate wild mint plants in Oct., Nov. and Dec. months under conditions of Fayoum governorate to obtain economical yield of herb and oil.
Keywords: Wild mint, planting date, yield and essential oil

INTRODUCTION

Wild mint or horse mint, *(Mentha longifolia,* L.) Huds. var. *longifolia* is one of the most popular medicinal plants which grown wild on River Nile and Canal banks in Egypt. It produces essential oil which is used in medicine as stimulant, tonic and analgesic, antiseptic and spasmolytic agent, (Souleles and Argyriadou, 1988).

It is well known that event the plant is used as additive flavoring either as fresh material or dry form, in rural regions, the plant is added to water of a hot bath and it is useful for skin diseases. An infusion of leaves and flowers summits is usually used as carminative (Mohamed, 1999). The available quantities of wild mint plants are quite sufficient enough to fulfill their requirements. For this reason great efforts are made to cultivate wild mint as a domestic plant to increase it's their production. Planting date play an important role on the growth, herbage and essential oil production of such aromatic species (Singh *et al*., 1997, Galambosi *et al*., 1998; Matelic and Jevdonic, 1998; Mitchell and Yong, 1998).

Because, very little information was reported on the effect of planting date on growth, flowering and chemical composition of wild mint. The aim of this work embodied in this paper is to investigate the effect of planting date on vegetative growth, flowering and oil yield and its constituents of wild mint to determine the favorable date for planting wild mint as a domestic plant under the environmental conditions preventing at Fayoum.

MATERIALS AND METHODS

A pot experiment was conducted during two successive seasons 2005/2006 and 2006/2007 in the experimental area of the Faculty of Agric. Fayoum Univ., Egypt. The monthly air temperatures (^{o}C) and relative humidity **(%)** in Fayoum during the two seasons are shown in Table (1).

Table (1): Average of monthly temperatures (ºC) and relative humidity (%) in Fayoum governorate during the period of experiment

Date of planting	2005/2006 season		2006/2007 season	
	Temperature	RH	Temperature	RH
١ Oct.	23.3	55	24.1	53
1 Nov.	17.8	57	17.4	58
1 Dec.	15.1	59	13.7	59
١ Jan.	13.0	58	12.6	58
1 Feb.	15.3	54	14.6	55
1 Mar.	18.0	52	17.4	52
1 Apr.	21.2	50	20.6	49
1 May	21.8	50	26.5	47
1 June	28.3	51	30.0	50
1 July	29.4	51	30.4	50
1 Aug.	28.1	52	29.7	52
1 Sep.	27.5	52	27.4	54

*** Weather station, Agriculture Department, Fayoum, Egypt**

The uniform cuttings of rhizome of wild mint (10 cm length) were obtained from the farm of Faculty of Agric., Fayoum Univ. and collected at monthly intervals started on 1st October to the first of September in the two seasons. The cuttings were planted on 1st of each month for both seasons in 30 cm diameter clay pots filled with sandy loam soil (8 kg pot^{-1}). The physical and chemical characteristics of the selected soil (Table, 2) were estimated according to Wilde *et al*. (1985).

The pots were arranged in a complete block design with three replicates, each replicate comprised 10 pots (one plant pot^{-1}). All agricultural practices necessary for growth of wild mint plants were applied.

Table (2): Physical and chemical properties of the tested soil during the two seasons

Years	Physical properties								
	Clay%		Silt%		Sand%		Texture class		
2005/2006	17.60		16.80		65.6		Sandy loam		
2006/2007	15.10		17.40		67.50		Sandy loam		
	Chemical properties								
	pH	ECe (dsm^{-1})	O.M (%)	Soluble anions ($meq\ l^{-1}$)			Soluble cations ($meq\ l^{-1}$)		
				Ca^{2+}	K^{+}	Na^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}
2005/2006	7.3	1.57	0.51	16.3	0.78	32.2	1.12	24.1	32.06
2006/2007	7.6	1.99	0.44	14.6	0.89	35.4	1.38	28.3	36.30

Data recorded:

In both seasons, the plants were grown to flowering stage, were cut plants when reached the full flowering stage within each planting date. After cutting, the vegetative and chemical data were recorded.

1-Vegetative parameters:

Plant height (cm), number of tillers $plant^{-1}$, number of branches $tillers^{-1}$, fresh and dry weights of $tillers^{-1}$ (g) and flowering date (the number of days from rhizome plant to beginning of flowering was estimated).

2- Chemical parameters:

Chlorophylls (a, b and total) and carotenoids concentration (mg g^{-1} fresh weight of leaf) were determined using colorimetric method as described by Arnon (1949). Total carbohydrates (%) were colorimetrically determined in dry matter of herb using phenol–sulphuric acid reagent method as outlined by Dubois *et al.* (1956).

Oil content (percentage) was determined in 100g. of fresh herb by steam distillation method according to Guenther (1961). The obtained oil was performed by GLC technique under the following conditions:

Gas chromatography apparatus: Girdal 300, column was a stainless steel. 2m. length×4mm. column temperatures was programmed from 80 to 180^{o} C at 4^{o} C min^{-1}, temperature of injector and detector were 150 and 220^{o} C, respectively.

The carrier gas of hydrogen was at rate of 15 ml min^{-1}. The identification of the different compounds was achieved by comparing their retention dates with those of the authentic. Samples injected the same conditions. The relative percentage of each individual compound was calculated on the basis of peak area corresponding of each compound.

Statistical analysis.

All data recorded were subjected analysis of variance (Snedecor and Cochran, 1980). Differences between means were tested using the LSD at probability level of 5%.

RESULTS AND DISCUSSION

The results of one season were discussed because no significant differences were observed between results of the two studied seasons.

1- Effect of planting date on vegetative traits:

1.1- Plant height:

The results in Table (3) revealed that plant height of wild mint was highly significantly influenced by planting date. Whereas, the data showed that Nov. and Feb. planting led to a highly significant increase in plant height compared with other planting months. In addition, it may be noticed that plant height significantly declined from Feb. to July.

1.2- Number of tillers plant^{-1}:

Data presented in Table (3) show that the number of tillers plant^{-1} was affected significantly by planting dates. The highest number of tillers plant^{-1} were get from wild mint planted in October, November and December. These results may be due to the weather which became progressively colder with shorter days, where, suitable mean air temperatures during Oct., Nov. and Dec. ranged from 13.7 to 24.1^{o}C and suitable relative humidity (53 to 59 in that dates). These conditions appear to the suitable for growth of this plant.

1.3- Number of branches tiller^{-1}:

Concerning, the number of branches tiller^{-1} in data Table (3) revealed that planting the wild mint plants at 1st Oct., Nov., Dec. and March significantly increased the number of branches tiller^{-1} compared with the other planting dates. It is apparent that number of branches tiller^{-1} decreased with delaying

planting date from Dec. The reduction in number of branches tiller^{-1} as a result to delay planting may be attributed to low temperature prevailing during the vegetative growth. The present results are in harmony with those obtained by Ali *et al.* (1987) on fenugreek.

1.4- Fresh and dry tiller^{-1} weights:

Data presented in Table (3) recorded that the fresh and dry weights tiller^{-1} were significantly higher than Oct., Nov. and Dec. plantings. This result may be discussed on the finding that planting date affected the formation and the development of number of tillers and number of branches. All of the mentioned results may be discussed on the findings of Riebau *et al*. (1997) who concluded that environmental factors affected mint plant growth. In addition, Dellacecca (1996) concluded that plating date affected mint yield. Matelic and Jevdonic, (1998), Singh *et al*. (1997) and Zheljazkov and Topalov (1996), came to the same conclusion, as they mentioned that planting period affected the growth and yield of mint plant. Also, Smesrud and Selker (1998) reported that the significantly differences between planting dates may be related to the variance of solar radiation.

1.5- Flowering periods:

As regarding the number of days taken from planting date to flowering stage, data presented in Table (3) indicated that the plants sown on Oct., Nov. and Dec. Plantings delayed in flowering time compared with the other planting dates. These planting dates prolonged the vegetative period and the plants showed a vigorous growth. The numbers of days taken to flowering date were 220, 173 and 157 for Oct., Nov. and Dec. planting, respectively. This effect might be due to the higher temperature and longer photoperiod during the other planting dates that can help in faster vegetative growing of plants and consequently accelerated flowering than the cold conditions. Delaying the planting date after Oct. month planting naturally reduced the average number of days from planting to flowering and might be useful in shorting the long period of vegetative growth.

Table (3): Effect of planting date on vegetative traits in wild mint plants

Planting date	Plant height (cm)	No. of tillers plant^{-1}	No. of branches tillers^{-1}	Fresh wt. of tillers (g)	Dry wt. of tillers (g)	Flowering date (days)
Oct. ١	73.50	55.00	31.67	٣٠,٦٥	٨,٤٦	٢٢٠,٠٠
1 Nov.	84.50	47.67	٣٢,٦٧	٣٣,٢٧	١٠,٧٦	١٧٣,٠٠
1 Dec.	80.50	42.00	٣٤,٣٣	٢٥,١١	٧,٢٤	١٥٧,٠٠
Jan.١	78.00	21.67	٢٩,٠٠	٢٣,٣٧	٦,٨٨	١٢٩,٠٠
1 Feb.	85.50	15.00	٢٤,٠٠	١٧,٥٨	٥,٣٨	٩٩,٠٠
1 Mar.	75.00	12.33	٣٢,٠٠	١٥,٦٠	٤,١٥	٧٧,٠٠
1 Apr.	64.17	9.00	٢٦,٠٠	١١,١٤	٣,٦٨	٥٨,٠٠
1 May	47.50	6.00	١٨,٠٠	١٤,٤٥	٤,٦٣	٥٢,٠٠
1 June	35.50	7.33	١٥,٠٠	٥,٦٦	١,٩٧	٢٨,٠٠
1 July	28.00	6.00	٨,٠٠	٥,٤٧	١,٧٨	٣١,٠٠
1 Aug.	45.50	5.33	١٨,٠٠	٦,٤١	١,٥٩	٤٢,٦٧
1 Sep.	53.50	3.33	٢٧,٠٠	7.64	١,٨٩	٥١,٠٠
LSD (0.05)	**5.90**	**3.69**	**3.31**	**5.84**	**2.00**	**7.89**

2- Effect of planting date on chemical composition:

2.1- Pigments concentration:

Data presented in Table (4) showed that the concentration of pigments gradually decreased until June and then increased again. The highest concentration of leaf pigments; Chl. a, b, total and carotenoids were recorded by wild mint plants which cultivated in Nov.

2.2-Total carbohydrates concentration:

Regarding the effect of planting date on total carbohydrates percentage in wild mint herb, the data in Table (4) indicated that the plants cultivated on Oct. and Nov. months were higher in total carbohydrates content compared with the other planting dates. This result may be due to that plants accumulated more carbohydrates in their tissues during winter months whereas the carbohydrates decreased during summer months and this may be due to more consumption of carbohydrates due to increasing in plant respiration.

Table (4): Effect of planting date on leaf pigments and total soluble carbohydrates in wild mint plants

Planting date	Leaf pigments (mg g^{-1} fresh wt of leaves)				Total carbohydrates (%)
	Chlorophyll (a)	Chlorophyll (b)	Total chlorophyll	Carotenoids	
1 Oct.	1.99	1.33	3.38	0.38	١٨,٨٨
1 Nov.	2.02	1.65	٣,٦٤	0.41	١٨,٧٨
1 Dec.	1.99	1.48	٣,٥٣	0.36	١٤,٩٢
1 Jan.	1.68	1.34	٣,٥٥	0.33	١٤,٨١
1 Feb.	1.81	1.36	٣,٢٢	0.32	١٤,٦٠
1 Mar.	1.85	1.40	٣,٣٢	0.27	١٣,٥٦
1 Apr.	1.74	1.21	٢,٩٩	0.26	١٣,١٤
1 May	1.67	1.21	٣,١٠	0.30	١٢,٥٢
1 June	1.53	1.11	٢,٧٢	0.25	١٢,٦٢
1 July	1.77	1.20	٣,٠٥	0.30	١١,٦٨
1 Aug.	1.73	1.22	٣,٠١	0.33	١١,٩٦
1 Sep.	1.85	1.38	3.28	0.35	١٢,٧٣
LSD (0.05)	**0.16**	**0.18**	**0.22**	**0.06**	**0.97**

2.3- Essential oil (%):

Essential oil **(%)** in wild mint was affect drastically by planting date as shown in Table (5). The results indicated significant differences in oil **(%)** as a result of the planting months. The highest increase in oil **(%)** was observed in plants which cultivated in Dec.(0.69 %) , Oct. (0.67%) , Nov. (0.60%) and Jan. (0.60%) plantings. This may be discussed on the basis that the temperature and humidity affects plant growth which may have a role on the formation of aromatic oil in herb.

2.4-Essential oil components:

The relative percentage of the main components of the essential oil of different treatments of planting dates are shown in Table (5). Limonene found to be the major compound and followed by Carvone and Menthol.

Many other workers came to the same conclusion, as they mentioned that environmental factors affect the percentage of aromatic oil (Riebau *et al*., 1997; Maletic and Jevdonic, 1998 and Singh *et al*., 1997) on *Mentha*

piperata. It could be concluded that suitable and economic agricultural months, for wild mint at least in this investigation were October, November and December.

Table (5): Effect of planting date on oil yield and its components in herb of wild mint plants

Planting date	Oil (%) fresh wt.)	The relative percentage of major components of oil				
		Menthol	Carvone	Limonene	Lanalool	Comphene
1 Oct.	0.67	5.096	5.471	١,٣٣٣	٤,٢٢٩	٠,٤٨٩
1 Nov.	0.60	4.298	٥,٢٠١	٧,٧٢٧	٠,٧١٦	٠,٥٢٢
1 Dec.	0.69	5.086	٥,٣٥٥	٣,٧٠٠	١,٨٠٦	٠,١٢٨
1 Jan.	0.60	4.352	٣,٦٢٢	٥,١٢٨	٢,١٥٩	٣,١٥٩
1 Feb.	0.58	0.541	١,٢٢٠	٥,٢٦٧	١,٣٣٣	٦,٥٢٩
1 Mar.	0.53	0.804	٢,٥٠٦	١٢,٥٣٠	١,٢١٦	٠,٥٧٨
1 Apr.	0.53	1.192	١,١٧٨	٤,٢٩٣	٠,٨٢٨	٢,٣٥٩
1 May	0.52	0.711	٣,٤٠٢.	٤,٢٧٢	٠,٠٨٧	٠,٠٨٧
1 June	0.54	0.416	٣,٨٠٨	٧,٣٣١	٠,٥٥٢	٠,٦٥١
1 July	0.52	1.441	٤,٩١٩	٠,٣٣١	٠,٣٥٢	٠,٦٩٩
1 Aug.	0.42	0.730	١,٨٣٥	٢,١٢١	٥,٢٣٢	٣,٦٠١
1 Seb.	0.45	0.230	٣,١٢١	2.179	٢,٤٤١	٠,٨٩٥
LSD (0.05)	**0.04**					

REFERENCES

Ali, A.A.; A.A. Ibrahim; M.A. Mohamed; M.C. Saleh and E.A. Abdel-Aziz (1987). Effect of planting date, seedling rate and phosphorus fertilization on growth of fenugreek. Egypt J. Appl. Sci. Second Issue. June (1): 203-217.

Arnon, D.I. (1949). Copper enzymes in isolated chloroplast. Polyphenoloxidase in *Beta vulgaris* L. Plant Physiol., 24:1-5.

Dellacecca, V. (1996). Research on peppermint (*Mentha piperita* L.) Atti convegno internazionale coltivazione emiglioramento dipiante officinali, Trento Italy, 2-3 guigno, 201-212.

Dubois, M.; F. Smith; K.A. Gillers; J.K. Hamiton and P.A. Robers (1956). Colorimetric methods for determination of sugar and related substances. Anal. Chem., 28: 350.

Galambosi, B.; A. Aflatuni and K. Sorvari (1998). Effect of cultivation techniques on mint oils in northern Finland. Perfumer and flavorist. 23: 5, 27-28.

Guenther, E. (1961). "The Essential oil" Vol. I. D. van Nostrand Cam INC., New York.

Matelic, K. and R. Jevdonic (1998). Influence of locality of planting and harvesting period on the yield and quality of mint leaves (*Mentha piperita* L., Micham) and its essential oil. Review of Rcs work at the Fac. of Agric. Belgrade 43: 2,75-82.

Mitchell, A.R. and C.L. Yong (1998). Irrigation of peppermint for optimal yield. Soil Science, Society of American J. 62: 1405-1409.

Mohamed, S. Faten (1999). Botanical studies on two wild medicinal plant (damsisa and wild mint) in Fayoum. M.Sc. Thesis, Fac. Agric., Fayoum, Egypt.

Riebau, M.F.J.; B.M. Berger; O. Yegen and C. Cakir (1997). Seasonal variations in the chemical compositions of essential oils of selected aromatic plants growing wild in Turkey. J. of Agric. and Food Chemistry 45(12): 4821-4825.

Singh, V.P.; M. Singh; P.V. Singh and M. Singh (1997). Growth yield and quality of peppermint (*Mentha piperita* L.) as influenced by planting date. J. of Herbs, Species and Medicinal Plants. 5(3): 33-39.

Smesrud, J.K. and J.S. Selker (1998). Field and Sampling considerations for the stem nitrate test in peppermint. Communications in Soil Sci. and plant Analysis. 29: 19-20, 3073- 3091.

Snedecor, G.W. and W.G. Cochran (1980). Statistical Methods.7th ed., Iowa State Univ. Press, Iowa USA, pp. 128-265.

Souleles, C. and A.A. Argyriadou (1988). Constituents of the essential oil of *Menha longifolia* (L.) Huds. Plants Fitotherapia, 59(3): 239-240 (c.f. Hort. Abst., 59:6899).

Wilde, S.A.; R.B. Corey; J.G. Lyer and G.K. Voigt (1985). Soil and Plant Analysis for Tree Culture. Oxford and IBM Publishers, New Delhi, 3th ed., pp. 93-106.

Zheljazkov, V. and unTrang Web nay coi cung hay, vao coi thu di http://nhatquanglan1.0catch.com

V. Topalov (1996). Effect of planting date and density on yields from Trang Web nay coi cung hay, vao coi thu di http://nhatquanglan1.0catch.com 4(3): 15-24.

تأثير مواعيد الزراعة على نمو ومحصول زيت النعناع البرى

فيصل محمود عبد المجيد مطر* و فاروق محمد جادالله**

*** قسم البساتين- كلية الزراعة – جامعة الفيوم- مصر**

**** قسم النبات الزراعى-كلية الزراعة – جامعة الفيوم- مصر**

أجرى هذا البحث خلال موسمي ٢٠٠٦/٢٠٠٥ و٢٠٠٧/٢٠٠٦ لدراسة الوقت المناسب لزراعة النعناع البرى تحت ظروف محافظة الفيوم. أوضحت النتائج أن ارتفاع النبات وعدد الخلفات لكل ريزوم وعدد الفروع لكل خلفه والوزن الطازج والجاف للمجموع الخضرى زادت خلال ميعاد الزراعة فى أكتوبر ونوفمبر. وكما أدت الزراعة فى هذه المواعيد إلى زيادة تركيز الصبغات الورقية: الكلوروفيلات والكاروتينويدات وكذلك الكربوهيدرات الذائبة الكلية ومحصول الزيت. وعلى الجانب الأخر فقد تاخر وقت الإزهار فى النباتات التى تم زراعتها فى هذه الأشهر. ولهذا يوصى بزراعة نباتات النعناع البرى فى أكتوبر ونوفمبر و ديسمبر تحت ظروف محافظة الفيوم للحصول على محصول اقتصادي من العشب والزيت.