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The effect of drought stress on flower yield and morphology of *Matricaria chamomilla* L. in different harvests

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ABSTRACT

To study the effect of drought stress and harvest time on some morphological traits of chamomile (Matricaria chamomilla L.), this experiment was conducted as split plot in time in the form of a randomized complete block design with three replications. The main factor was irrigation after 60, 90, 120 and 150 mm evaporation from an A class pan, and the sub factor was harvest. Analysis of variance indicated that drought stress significantly affected stem height and root yield at P≤0.01. The interaction of drought stress × harvest had significant effect on dry flower yield, stem height and stem yield at P≤0.01, and on leaf yield at P≤0.05. The harvest had also a significant effect on the number of lateral branches at P≤0.01. Mean comparison showed that the highest stem height (62.84 cm) and flower yield (137.13 kg/ha) were achieved in 90 mm evaporation × the second harvest. The highest number of lateral branches (7.5 branches/plant) and the highest stem yield (362.6 kg/ha) were achieved in 90 mm × the first harvest. In 60 mm × the second harvest, leaf yield was the highest (166.29 kg/ha). All measured traits were the lowest in 150 mm × the second harvest. Regarding the results of this experiment and the importance of chamomile flower yield and essential oil yield, the mild drought stress (90 mm) is advised for chamomile production.

Keywords: chamomile, drought stress, harvest time, morphologic traits.

INTRODUCTION

Chamomile with the scientific name *Matricaria recutita* or *Matricaria chamomilla*, from the family Asteraceae is one of the most important medicinal plants which is widely consumed around the world and is used in food industries, medication industries and cosmetic-hygienic industries [1, 5, 7]. In herbal medicine science, essential oil of this plant is used to produce medications for reinforcement of digestion system, curing ulcer, insomnia, etc. The main compound in the essential of chamomile is camazolen which has antibacterial and antifungal activities [4].

Chamomile is adapted to a wide range of environmental conditions, growing from 300 to 1500 m above the sea level. It tolerates cold weather well and is a herbaceous annual plant [6, 8]. However, incidence of drought stress may reduce the number of harvests and yield [5]. Results of a study indicated a reducing trend in the essential oil content of four chamomile varieties in Iran climatic condition, from the first harvest to the third one. In all tested varieties, dry flower yield, essential oil and camazolen were the highest in the second harvest [3]. So the objective of this experiment was to evaluate the effect of drought stress on chamomile, in different harvests.

MATERIALS AND METHODS

The field experiment was conducted in 2011 at the research field of Islamic Azad University, Tabriz branch, Iran (46° 17' E, 38° 5' N and 1360 m above the sea level). Average annual precipitation is 271.3 mm and the minimum air temperature is 2.2°C. Soil texture at the test site was sand silt with the EC of 1.44 ds/m and pH of 7.7.

The experiment was conducted as split plot in time in the form of randomized complete block design with three replications. The main factor was irrigation in four levels including irrigation after 60, 90, 120 and 150 mm evaporation from an A class pan and the sub factor was harvest (two harvests at full flowering stages).

Plot size was 1.5 × 4 m and seeds were planted at early spring. Rows were 30 cm apart and the seeds were planted every 10 cm. Treatments were started after plants initial growth and at the beginning of stem growth. For the first harvest at full flowering stage, morphologic traits were recorded and samples were harvested from 15 cm above the soil surface, from the middle rows of each plot. The second harvest was also conducted when plants were again at full flowering stage, 15 cm above the soil surface. Harvested plants were dried primary in shade and complementary in an oven (60°C), and the dry weight of all plant parts was measured individually. To evaluate plant growth at each stage, 30 plants were accidentally harvested with their roots. When all data were recorded, data were analyzed using SAS and means were compared according to the Duncan's multiple range test at P≤0.05.

RESULTS AND DISCUSSION

Analysis of variance indicated that drought stress significantly affected root dry weight and stem height at P≤0.05. Harvest had a significant effect only on the number of lateral branches. The interaction of drought stress × harvest had also a significant effect on flower yield, leaf yield, stem yield, stem height and the number of lateral branches (Table 1). Mean comparison showed that the highest root dry weight was achieved in 90 mm evaporation (79.81 kg/ha) and the highest stem height was also achieved in 90 mm (61cm) (Table 2).

Table 1. Analysis of variance of the effect of treatments on the measured traits

SOV	df	Mean Squares (MS)					
		Flower yield	Leaf yield	Stem yield	Root yield	Stem height	Number of lateral branches
Block	2	ns	ns	ns	ns	ns	ns
Drought (A)	3	ns	ns	ns	**	**	ns
Error	6	9.551	3337.84	22219.30	588.60	38.198	1.554
Harvest (B)	1	ns	ns	ns	ns	ns	**
A × B	3	**	*	**	ns	**	*
Error	8	0.1002	59.562	160.03	37.184	3.1042	0.0927
CV (%)	-	2.715	5.95	4.104	9.213	3.1208	4.641

*ns, nonsignificant; *, significant at P≤0.05; **, significant at P≤0.01.*

Table 2. Mean comparison of the effect of drought stress on the measured traits

Treatments	Flower yield (kg/ha)	Leaf yield (kg/ha)	Stem yield (kg/ha)	Root yield (kg/ha)	Stem height (cm)	Number of lateral branches
60	123.33b	161.11a	345.74a	64.09b	56.7b	6.9b
90	134.16a	149.44b	362.22a	79.81a	61a	7.3a
120	113.96c	107.9c	283.88b	67.03b	56b	6.1c
150	94.76d	100.37c	240.92	53.77c	51.9c	5.8c

60, 60 mm; 90, 90 mm; 120, 120 mm; 150, 150 mm evaporation from an A class pan.
Means in a column followed by the same letter are not significantly different (P≤0.05).

Table 3. The effect of interaction of drought stress ×

Treatment	Flower yield (kg/ha)	Leaf yield (kg/ha)	Stem yield (kg/ha)	Root yield (kg/ha)	Stem height (cm)	Number of lateral branches
60 × 1st harvest	120.56cd	155.92ab	332.97b	65.55de	54.3c	6.7bc
60 × 2nd harvest	126.1bc	166.29a	358.52a	62.63cde	59.2b	7ab
90 × 1st harvest	131.2ab	143.7b	362.6a	81.48a	59.2b	7.5a
90 × 2nd harvest	137.13a	155.18ab	361.85a	78.15ab	62.8a	7.1ab
120 × 1st harvest	114.66de	110.37c	289.63c	65.92cd	56.8bc	6.4bc
120 × 2nd harvest	113.26e	105.44c	278.15c	68.14bc	55.2c	5.8d
190 × 1st harvest	101f	110.74c	271.11c	55.18de	54.6c	6.5cd
190 × 2nd harvest	88.53fe	90d	210.74d	52.37e	49.2d	5.2d

60, 60 mm; 90, 90 mm; 120, 120 mm; 150, 150 mm evaporation from an A class pan.
Means in a column followed by the same letter are not significantly different (P≤0.05).

Mean comparison of the interaction of drought stress × harvest indicated that the highest flower yield (131.1 and 137.1 kg/ha) and the highest stem highest (59.2 and 62.8 cm) were achieved in 90 mm × the first harvest and 90 mm × the second harvest, respectively (Table 3). The highest stem yield (361.8 and 362.6 kg/ha), root weight (78.1 and

81.4 kg/ha) and the number of lateral branches (7.1 and 7.5 branches/plant) were achieved in 90 mm × the second harvest and 90 mm × the first harvest, respectively. The highest leaf yield (155.9 and 166.2 kg/ha) was also achieved in 60 mm × the second harvest (Table 3).

Results of this experiment represented that drought stress increased chamomile flowering. Higher flower yield in the second harvest may be attributed to higher air temperature which increases the effect of drought stress on plant; revealing the beneficial effect of drought stress on chamomile flowering and representing that to obtain higher flower yield in chamomile cultivation, drought stress might be useful. On the other hand, chamomile was sensitive to high moisture because all measured traits, except for leaf yield, were the lowest in the control (60 mm). These results are in agreement with those of Amini Dehaghi et al. [2] on thyme. Results of flower yield of this experiment were also similar with the findings of Azizi [3]. However, results of the drought stress in this experiment were different than the other experiments which may be attributed to genetic factors of the seeds or the cool weather of the test site nights. Generally, results of out experiment showed the possibility of chamomile production with drought stress, in Azarbayejan area of Iran.

REFERENCES

[1] C Mann, EJ Staba, the chemistry, pharmacology and commercial formulations of chamomile, In: LE Pedscraker, JE Simon (eds), Herbs, Spices and Medicinal Plants: Recent Advances in Botany, Horticulture, and Pharmacology, vol.I. CRC Press, UK, **1992**; pp. 235-280.
[2] M Amini Dehaghi, K Babaei, AM Modarres Sanavi and R Jabbari, *Iranian Journal of Medicinal and Aromatic Plants Research*, **2009**, 26 (3), 239-251.
[3] M Azizi, *Iranian Journal of Medicinal and Aromatic Plants Research*, **2006**, 22 (4), 386-396.
[4] M Libster, Delmar's Integrative Herb Guide for Nurses, Oxford University Press, USA, **2008**.
[5] R Franke, H Schilcher, Chamomile: Industrial Profiles, CRC Press, New York, **2005**.
[6] R Omidbeigi, *Iranian Journal of Agricultural Science*, **1999**, 1, 45-53.
[7] R Omidbeigi, Production and Processing of Medicinal Plants, vol 3. Beh Nashr Publications, Tehran, Iran, **2006**.
[8] VE Emongor, JA Chweya, *Discovery and Innovation*. **1989**, 1 (4), 63-66.