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Effect of Water Stress and Organic matter simultaneously on some morphological characteristics of German chamomile under two mineral and biological N fertilizer treatments

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ABSTRACT

This study was performed to evaluation of Water Stress and Organic matter simultaneously on some morphological characteristics of German chamomile under two mineral and biological N fertilizer treatments. Experiment done as RCBD Experimental design in split split design with 3 factors and 3 replications. First factor included organic fertilizer (application and no application), second factor was biologic nitrogen (application and no application) and third factor included drought stress (80%FC and 50%FC). At the end of study some properties were evaluated such as: Height, Stem diameter, Branch stem number, Flower number, Dry yield of flower and Essential oil%. Using organic matter led to increasing 22, 25, 28, 18, 4 and 9 percent of Height, Stem diameter, Branch stem number, Flower number, Dry yield of flower and Essential oil% respectively. Application of biologic fertilizer had significant on all characteristics, significant reductions were observed by application of drought stress, So Height, Stem diameter, Branch stem number, Flower number, Dry yield of flower and Essential oil% were decreased 22, 23, 35, 50, 60 and 4% in compare to control.

Introduction

Chamomile (*Matricaria chamomilla* L.) is a well-known medicinal plant species from the Asteraceae family often referred to as the "star among medicinal species." Nowadays it is a highly favored and much used medicinal plant in folk and traditional medicine. Its multitherapeutic, cosmetic, and nutritional values have been established through years of traditional and scientific use and research (singh et al., 2011). In arid and semi-arid regions where water availability is a major limitation, using plants with low water consumption is one way to manage available water efficiently. Chamomile may be considered as an economical crop for fields with water scarcity due to its considerable adaptability to a wide range of climates and soils. Water availability, one of the most limiting environmental factors affecting crop productivity, is a well-known fact that, crop growth is frequently subjected to water stress during the course of its life time. Stress imposed during these periods drastically affects crop growth, ultimately leading to a massive loss in yield and quality (pirzad et al., 2011). Water deficit is very common in the production of most crops and numerous studies have indicated that they can have substantial negative impacts on plant growth and development (Bączek-Kwinta et al., 2011). Also, Organic agriculture is one of the ways that can produce high quality crops (Higa, 1994). Most of the studies, in this area have been shown that consecutive uses of chemical fertilizer causes soil erosion and lower crops quality (Kumar et al., 2000). Vermicomposting is one of the best methods of composting any kind of organic matter, which could provide a 'win-win' solution to tackle the problem of safe disposal of waste and also provide most needed plant nutrients for sustainable productivity. Vermicompost improves growth, quality and yield of different field crops, flower and fruit crops (Nagavallemma *et al*., 2004). The aim of this study was evaluation of Water Stress effect and Organic matter simultaneously on some morphological characteristics of German chamomile under two mineral and biological N fertilizer treatments.

Material and methods

Experiment was performed as RCBD Experimental design in split split design with 3 factors and 3 replications. First factor included organic fertilizer (application and no application), second factor was biologic nitrogen (application and no application) and third factor included drought stress (80%FC and 50%FC). At the end of study some properties were evaluated such as: Height, Stem diameter, Branch stem number, Flower number, Dry yield of flower and Essential oil%.

Result and discussion

Height: Analysis of variance showed significant effect of organic matter, nitrogen fertilizers and drought stress at 1, 5 and 1 percent on plant height, respectively. Also, the interaction between them was statistically at 1%. Means comparisons showed that organic matter led an increase of 22 percent the plant height in compared to control. Plant height was increased 3 % by application of biologic fertilizer in compare to mineral. Also, it was founded that drought stress reduced plant height and this reduction was 22% in compare to control. Baghalian et al., (2011) evaluated physiological and phytochemical response to drought stress of German chamomile (Matricaria recutita L.) and they reported that drought stress decreased plant height, flower yield, shoot weight and apigenin content but it had no significant effect on oil content or oil composition.

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Interaction between stress with organic matter showed that drought stress led 21% reduction of plant height in the presence of organic matter. Interaction between stresses with mineral nitrogen showed that drought stress led 24% reduction of plant height but Interaction between stress with biologic nitrogen showed that drought stress led 20% reduction of plant height.

Stem diameter: Analysis of variance showed significant effect of organic matter, nitrogen fertilizers and drought stress at 5, 5 and 1 percent on stem diameter, respectively. Also, the interaction between them was statistically at 5%. Means comparisons showed that organic matter led an increase of 25 percent the stem diameter in compared to control. Stem diameter was decreased 3 % by application of biologic fertilizer in compare to mineral. Drought stress is a major abiotic constraint responsible for heavy production losses (Waddington et al., 2010) Also, it was founded that drought stress reduced stem diameter and this reduction was 23% in compare to control. Interaction between stress with organic matter showed that drought stress led 21% reduction of stem diameter in the presence of organic matter. Interaction between stress with mineral nitrogen showed that drought stress led 36% reduction of stem diameter but Interaction between stress with biologic nitrogen showed that drought stress led 19% reduction of stem diameter.

Branch stem number: Analysis of variance showed significant effect of organic matter, nitrogen fertilizers and drought stress at 5, 1 and 5 percent on branch stem number, respectively. Means comparisons showed that organic matter led an increase of 28 percent the branch stem number in compared to control. Haghighi et al., (2010) reported that organic and inorganic fertilizers applied to the soil affect the plant physiological processes, which serve as important instruments in yield development. Branch stem number was decreased 13 % by application of biologic fertilizer in compare to mineral. Also, it was founded that drought stress reduced branch stem number and this reduction was 35% in compare to control. Interaction between stress with organic matter showed that drought stress led 30% reduction of branch stem number in the presence of organic matter. Interaction between stress with mineral nitrogen showed that drought stress led 28% reduction of branch stem number but Interaction between stress with biologic nitrogen showed that drought stress led 30% reduction of branch stem number.

Flower number: Analysis of variance showed significant effect of organic matter, nitrogen fertilizers and drought stress at 5, 1 and 1 percent on flower number, respectively. Also, the interaction between them was statistically at 5%. Means comparisons showed that organic matter led an increase of 18 percent the flower number in compared to control.

Ouda and Mahadeen (2008) reported that the application of 60 kg inorganic fertilizers with 60 tonnes organic manure per hectare produced the highest broccoli yield (40.05 t/ha).

The head number per plant, chlorophyll content and head diameter were higher when a combination of organic and inorganic fertilizers was added compared with their individual addition. Flower number was increased 2 % by application of biologic fertilizer in compare to mineral. Also, it was founded that drought stress reduced flower number and this reduction was 50% in compare to control. Interaction between stress with organic matter showed that drought stress led 48% reduction of flower number in the presence of organic matter. Interaction between stress with mineral nitrogen showed that drought stress led 52% reduction of flower number but Interaction between stress with biologic nitrogen showed that drought stress led 48% reduction of flower number.

Dry yield of flower: Analysis of variance showed significant effect of organic matter, nitrogen fertilizers and drought stress at 5, 5 and 1 percent on dry yield of flower, respectively. Also, the interaction between them was statistically at 5%. Means comparisons showed that organic matter led an increase of 4 percent the dry yield of flower in compared to control. Dry yield of flower was decreased 17 % by application of biologic fertilizer in compare to mineral. Also, it was founded that drought stress reduced dry yield of flower and this reduction was 60% in compare to control. Interaction between stress with organic matter showed that drought stress led 60% reduction of dry yield of flower in the presence of organic matter. Interaction between stress with mineral nitrogen showed that drought stress led 55% reduction of dry yield of flower but Interaction between stress with biologic nitrogen showed that drought stress led 65% reduction of dry yield of flower. Also in Iran, Majidian et al.(2006) showed that integrated chemical and biological fertilizer increase yield under drought stress. Iwaishi (2001) reported that EM inoculation increased kernel enlargement after the panicle formation stage and also increased ear number and length and kernel number. The yield of brown rice from EM inoculation was higher for the standard fertilizer rate and lower for the higher rate of organic fertilizer.

Essential oil%: Analysis of variance showed significant effect of organic matter, nitrogen fertilizers and drought stress at 5, 5 and 1 percent on essential oil%, respectively. Also, the interaction between them was statistically at 5%. Means comparisons showed that organic matter led an increase of 9 percent the essential oil% in compared to control. Essential oil% was decreased 4 % by application of biologic fertilizer in compare to mineral. Also, it was founded that drought stress reduced essential oil% and this reduction was 35% in compare to control.

Interaction between stress with organic matter showed that drought stress led 38% reduction of essential oil% in the presence of organic matter. Interaction between stress with mineral nitrogen showed that drought stress led 27% reduction of essential oil% but Interaction between stress with biologic nitrogen showed that drought stress led 42% reduction of essential oil%.

Table 1. analysis of variances for treatments.

	d.f	height	stem diameter	branch stem number	flower number	dry flower yield	Essential oil%
Replication	2	21.87	40.77	112.86	232.02	2896.4*	591.3
FactorA	1	116.64**	81.54*	125.4	464.04*	2005.2*	1182.6*
Error	2	2.43	4.53	12.54	25.78	111.4	65.7
FactorB	1	14.96*	28*	54.32*	447.26**	798.08*	300.55
AB	1	35.53*	52.5*	74.69*	223.63*	1296.88*	661.21*
Error	4	1.87	3.5	6.79	20.33	99.76	60.11
AC	1	4.72*	25.6*	39.2*	72.72*	320.96*	216.44
BC	1	1.829	28.8*	44.1*	81.81*	180.54	486.99*
ABC	1	4.1359*	25.024*	19.6	80.3556*	332.996*	497.812*
error	8	0.59	3.2	4.9	9.09	40.12	54.11

Table2. effect of treatments on studied characteristics.

	height		stem diameter		branch stem number		flower number		dry flower yield		Essential oil%	
soil without organic matter	24.25	b	0.375	b	8	b	17.75	b	2.15	b	0.485	a
soil with organic matter	29.75	a	0.47	a	10.25	a	21	a	2.2525	a	0.4425	b
Nitrogen mineral fertilizer	26.5	b	0.4275	a	9.75	a	19.25	b	2.4	a	0.4725	a
Nitrogen biologic fertilizer	27.5	a	0.4175	b	8.5	b	19.5	a	2.0025	b	0.455	b
control	30.25	a	0.475	a	11	a	25.75	a	3.125	a	0.56	a
stress	23.75	b	0.37	b	7.25	b	13	b	1.2775	b	0.3675	b

Table3. interaction of treatments on studied characterestics.

			height		stem diameter		branch stem number		flower number		dry flower yield		Essential oil%	
soil without organic matter	Nitrogen mineral fertilizer	control	26	bc	0.45	b	11	b	23	d	3.1	b	0.54	b
		stress	21	d	0.31	e	7	d	12	f	1.4	c	0.45	c
	Nitrogen biologic fertilizer	control	28	b	0.4	d	9	c	25	cd	3	b	0.61	a
		stress	22	d	0.34	de	5	e	11	f	1.1	c	0.34	d
soil with organic matter	Nitrogen mineral fertilizer	control	34	a	0.53	a	13	a	29	a	3.5	a	0.55	b
		stress	25	c	0.42	cd	8	cd	13	f	1.6	c	0.35	d
	Nitrogen biologic fertilizer	control	33	a	0.52	a	11	b	26	b	2.9	b	0.54	b
		stress	27	b	0.41	d	9	c	16	e	1.01	c	0.33	d

Totally, Using organic matter led to increasing 22, 25, 28, 18, 4 and 9 percent of Height, Stem diameter, Branch stem number, Flower number, Dry yield of flower and Essential oil% respectively. Application of biologic fertilizer had significant on all characteristics, significant reductions were observed by application of drought stress, So Height, Stem diameter, Branch stem number, Flower number, Dry yield of flower and Essential oil% were decreased 22, 23, 35, 50, 60 and 4% in compare to control.

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