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The Effect of Irrigation Intervals and Nitrogenous Fertilizer on the Quantitative and Qualitative Performance of Chamomile

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Abstract

In order to determine the best irrigation intervals and nitrogen fertilizer rate on the performance and chamomile essence an experiment was conducted in 2009 cropping season, at the Agricultural research Center and Natural Source of Yazd province. The experiment was established as a randomized complete blocks design using split-plot with 3 replications. Irrigation intervals' factor was considered at 3 levels contain (I3=18, I2=2, I1=6) day as a main factor, and nitrogen fertilizer's factor at 4 levels contain (N3=100, N2=80, N1=60, N0=0) kg net nitrogenous per ha -1 (urea) as a sub factor. Each experimental unit consisted of 6 planting line to a distance of 20 cm and 6m long, and fresh flower performance, dry flower performance, essence percentage and essence performance were studied. The results showed that the highest performance belonged to dry flower with the rate of 284/2 kg per ha -1 and 80 kg nitrogenous treatment and irrigation intervals of once every 12 days. Also fertilizing treatment of 60 kg per ha -1 nitrogenous devoted the highest percent of essence to itself, and essence performance was obtained from 0.71 l per ha -1 I3N0 up to 2.17 l per ha -1 in I2N2.

Keywords: Chamomile, Irrigation Interval, Nitrogenous Fertilizer, Qualitative Performance, Essence

Introduction

Chamomile is one of the highly valued herbal medicine which is useful in pharmaceutical, food and cosmetic industry. Some researchers believe that the content of oil essence in herbal medicine get change depending on genetic and environmental conditions. The main content of chamomile is Chamazulin and Antimic acid. Also an Alkaloid named Antemin have been separated from the plant. The used part of this plant is its capitol which is separated from its stem during May to October. Its capital contains some essence. The fresh essence is dark blue which is related to the substance called Azul on which gradually gets green and brown on the effect of air and light. This essence includes b and g Sesquiterpene and Matricarine as well (Newell and colleagues1996). The different irrigation regimes have a significant effect on the percentage of essence and flower performance and chamomile essence performance. It can be produced a high efficiency yield and highest essence if the chamomile irrigation is proper. Nitrogenous fertilizer increases the flower performance and chamomile oil essence. (Mirshekari and his colleagues 1386). Nitrogen is regarded a basic and essential element for plants and is compound with elements such as Carbon, Oxygen, Hydrogen, and even BRIMSTONE. And it produces worthwhile substances such as Amino Acids Nucleic acids, Alkaloids and Purine bases. Chlorophyll is essential as a place for light-absorbing and synthesis of the necessary materials for plants growth which depend on this element. If the available nitrogen is more or less than the plant requirement, it causes disorders in process of plant vital which may appear in different ways such as increasing or reduction of growth, procrastination or even it stops natal growth (Salisbury and Ras 1991). Lizer and Rickman 1994 realized that the rate of Zu faba essence 1/8 gr nitrogen in vase had the highest performance, but nitrogen didn't alter the rate of Bomaderon essence. Veneskotonis and his colleagues 1991 said that nitrogen fertilizer had a little effect on the percent of cumin plant essence, but cumin performance under the influence of nitrogen fertilizer was different between 984-2673. In another study nitrogen caused increasing of plant height, numbers of branches of flowers, biologic performance and black cumin performance. (Mola filabi 2009). Researches done on the valerian flower shows that the average nitrogenous rate causes an increase in root essence. In this manner the growth part of the Plant is desirable while nitrogenous causes increasing in the growth part of the plant and developing of its root. But it has no effect on essence rate. (Omid Beige 1998).

Materials and Methods

This study starts in late winter of 2009 at the Agricultural Research Center and Natural Source of Yazd province in order to land preparation. To do this research plot a piece of land with an area of 500 m2 was terraced. The land blocking was done based on the plot in February 1387. Each terrace has a size of 6 long and a 2m wide (an area of each terrace is 12m2) and the distance between each plot 60 cm and the distance between the blocks between each 2 replications is 120cm. The experiment was established as a randomized complete blocks design using split-plot with 3 replications contains at 3 levels Irrigation intervals I1=6, I2=12, I3=18 once a day as a main factor and 4 levels of nitrogen n0=0, n3=100, n2=80, n1=60 kg ha -1 (urea) as a sub factor. Also blocks were placed side by side with space randomly. Picking flowers was done (at the end of July) in 2009 and then extraction of essence was done in organic chemistry laboratory Molasadra institute depending on agriculture Jihad in Yazd province. The solid area in terms of the texture is sth that hasn't made any certain restriction for penetration of water into soil and

leaching is possible easily. Soil salinity is nearly proper and the accumulation of salt is average in it. The results of this experiment was done with use of statistical software MSTATC, Variance analysis and the comparison of medians with Danken exam.

Fresh flower Performance

There is a significant difference at 1% possibility level between different Treatments of irrigation intervals in terms of fresh flower performance. Also there is a significant difference at 1% level between treatments of nitrogen fertilizer. Effect of irrigation intervals: there is a significant difference between different levels of irrigation intervals at level of 5%. The highest performance is related to once every 6 days' treatment with average performance of 327/9 kg per ha -1 and the lowest performance is related to once every 18days irrigation treatment with average performance of 223/8 kg ha -1. The effect of nitrogen fertilizer: There is a significant difference between different levels of Fertilizing. the lowest performance of fresh flower related to 0kg treatment per ha -1 with average performance of 226/3 kg per ha -1 and the highest is to 80 kg nitrogenous treatment per ha -1 which means 316/2 kg ha -1. There is no significant difference between other fertilizing treatments of 60 to 100 kg ha -1.

The interaction of irrigation intervals and nitrogen fertilizer: There is a significant difference between different treatments. So the highest fresh flower performance belongs to I2N2 treatments with average of 356 kg ha -1 and the lowest performance is to ISN0 treatment with average of 197 kg ha -1.

Dry flower Performance

The effect of irrigation intervals, nitrogen fertilizer and the interaction of this 2 factor is significant. The effect of irrigation intervals: There is a significant difference based on comparison of averages at level of 5%between irrigation intervals of 6days and other irrigation intervals. And respectively lowest and highest of treatments were considered once every 18 days' irrigation with average of 180/7 kg ha -1 and treatment of once every 6 days irrigation with average of 262/2 kg ha -1. The effect of nitrogen fertilizer: The highest performance is seen in treatment of 80 kg ha -1 with average of 252/8 kg ha -1 and the lowest in the instance treatment with average of 181/7 kg ha -1. The effect of interaction irrigation intervals and nitrogen fertilizer: There is a significant difference at level of 5%between interaction of Factor, and the highest performance based on this table belongs to I2N2 treatment and the lowest performance to I2N2. The effect of irrigation intervals and nitrogen fertilizer rate and also effect of their interaction on the fresh and dry flower performance of chamomile at level of 1% is significant.

Essence percent

The effect of irrigation intervals at level of 5% is not significant but there is a difference between different levels of fertilizing at level of 1%. Also interaction of this factor is not significant at all. The effect of irrigation intervals; Represent a significant difference from irrigation intervals of 12 days to other irrigation levels, which based on this table the lowest essence rate is related to treatment of once every 18 days irrigation (50%) and the highest rate is to treatment of once every 12 days irrigation (68%).Nitrogen fertilizer: The results shows that there is a significant difference between Fertilizing levels 0 and 80kg per h-1 at level of 5%. The highest essence rate is under the influence of 80kg

Nitrogenous per h-1(0/67%) and the lowest essence percent is related to instance treatment (0kg per h-1) with amount of 0/46%. There is no significant difference between other Fertilizing treatments. the interaction of irrigation intervals and nitrogen fertilizer: The effect of irrigation intervals and nitrogen fertilizer and also their interaction on the flower essence percent got significant. Flower essence rate alter in synthetic treatments relating to 2 factors of irrigation intervals and nitrogen fertilizer from 0/4% in I3N0 treatment up to 0/81% in I2N1 treatment that shows a 49% difference between essence rates.

Essence performance

We see a significant difference at level of 5% between irrigation intervals treatments and also in level of 1% for different nitrogen levels but there is no significant difference between their interactions. Irrigation intervals: there is no significant difference between different irrigation levels and respectively from the minimum to maximum essence performance are treatments of once every 12 and 18 days irrigation (which means 0/92 and 1/46 L per h-1). The effect of nitrogen fertilizer: difference between 0 Fertilizing levels and 80kg per h-1 at levels of 5% is significant and the lowest performance belongs to instance treatment (0/82 L per h-1) and the highest performance is related to 80kg nitrogenous per h-1 (1/70 L per h-1). The interaction of irrigation intervals and nitrogen fertilizer: Danken exam shows significant difference between different treatments and the lowest performance is related to I2N2 treatment (2/17 L per h-1)

Discussion and Conclusion

The effect of irrigation intervals and the amount of nitrogen fertilizers on the yield of wet and dry chamomile, as well as their interaction were significant at probability level of 1%. Except than under limited irrigation treatments (every 12 days of irrigation in different fertilizers levels such as I1N0 and I3N2), the understudy treatments had no significant difference with each other in the term of flower yield. However, the highest amount of flower yield was 284.2 Kg per hectare related to the treatment was received 80 Kg nitrogen fertilizer per hectare with irrigation interval of 12 days and a 6-days delay in irrigation intervals with the same amount of nitrogen fertilizer led to flower yield reducing to 85.7 Kg per hectare. The loss may be justified in economic terms due to the water shortage in the region. Reduced yield in full irrigation treatments can be related to the water access. It is clear that high water access reduces availability of oxygen to the roots which can lead to respiratory depression and limited absorption of nutrients and other mutual relations (Hopkins, 1995). Lower yield levels in deficit irrigation could be attributed to lack of water. . Damage caused by the drought is probably related to detrimental effect on dehydration of the protoplasm and protoplasmic liquid concentration increasing resulting in shrinkage and plasmolysis which itself can cause to severe structural and metabolic effects on the cells. Being healthy cell membranes and proteins have closely associated with dehydration and dewatering disrupts the metabolic relationships of cell walls. In environments with a relative shortage of water, structural and cellular protein may endure minor damage caused by lack of adequate water supply, in addition to the damage of cell membrane. Photosynthesis can also be affected in two ways by water stress involving Stomata closure and the effect of the structural evolution. The photosynthetic mechanism of electron transport and photophosphorylation were simultaneously decreased in chloroplasts isolated from leaves of sunflower which were under the condition of water stress with lower leaf water potential about 1.0 Mpa

(Hopkins, 1995). The condition causes damage to the thylakoid membrane and ATP enzyme synthase (Raio et al, 1987). The result of all these events is disorder in the metabolism and reduction in yield and its components (Hopkins, 1995). The results of the study conducted in Uremia on the German chamomile indicated the effect of different irrigation regimes on the flower yield. In treatments with 6-days irrigation intervals, increasing nitrogen fertilizer had no effect on flower yield which was due to the leaching and lock of absorption of fertilizer in the soil by the plant. Although, the largest number of flowers per plant was belonged to the I2N0 treatment, but the treatment had the lowest level of flower yield. The effect of irrigation intervals and the amount of nitrogen fertilizers, as well as their interaction on the percentage of flower oil were significant. In general, the Chamomile irrigation intervals can be increased from 6 days to 12 days with a low effect on the flower oil. The percentage of flower oil in treatments with 18-day irrigation intervals were not affected by the amount of Nitrogen fertilizers. The percentage of flower oil had fluctuated between four levels of fertilizer ranging from 0.63 to 0.4. The overall results of the study showed that increasing irrigation intervals up to 12 days and Nitrogen fertilizers up to 80 Kg per Hectare increase the percentage of flower oil. One-time use of nitrogen fertilizer is not logical due to the lock of the development of the root system in the early stages of growth and thus leaching and the plant is not able to make optimum use of fertilizer. It is while that sufficient food consumption should be provided to the plant in rapid growth stages which need for nutrients is increased. There are reports about the inappropriate effect of severe water stress on decreased synthesis of secondary metabolites and essential oil yield or in the other words, the favorable effects of high soil moisture on increasing oil yield (Ram et al, 1995; Solinas et al, 1996; Zehtab Salmasi et al, 2000). Pirzad et al (2006) have reported highest level of oil essence of chamomile for the treatment of 85% of field capacity and the lowest one for the treatments of 55% and 100% of felid capacity. Increase in oil yield due to relative water stress (12-day irrigation) can be due to the more density of density of oil-secreting glands caused by leaf area reduction because of more stress and the accumulation of the oil (Carlos et al 1993). Since there was a significant difference between fertilizers level of zero to 100 Kg per hectare with 12 day irrigation rate in the term of oil yield, it is prefer to increase irrigation interval up to 12 days and to consider the amount of nitrogen fertilizers equal to 80 Kg per hectare in the case of chamomile cultivation to oil extraction. Adding fertilizers containing nitrogen, phosphorus and potassium increases the percentage and yield of flower oil. Nitrogen plays an important role in development and division of new cells containing oil and biosynthesis of the oil essence and active substances of medicinal plants. In the other side, nitrogen can cause to a considerable decrease of the oil in high levels (Omid Beygi, 2003). Increase in the yield of oil essence caused by Nitrogen fertilizer using can be due to the important role of nitrogen in development and division of new cells containing oil, oil ducts, excretory ducts and glandular trichomes (Abu Zeid and Al-Shar Bini, 1974; Mour, 1979). The results of Agmour et al study (2006) on German chamomile indicated that increasing nitrogen from zero up to 100 Kg per hectare decreased the oil yield. Similar results about the effect of Nitrogen on the oil content and oil yield

have been reported by Franz (1981), Mivad et al (1984), Dyatlov (1990) and Gholami et al (2004). According to the results of the study, it is clear that 12-day irrigation interval and the fertilizer rate of 80 Kg nitrogen per hectare was the best experimented levels which is in accordance with the results of other experiments such as Mirshekari et al (2007).

Table (1): analyzing variance and mean squares (MS): The effect of irrigation intervals and nitrogenous fertilizer on the quantitative and qualitative performance of chamomile

Source changes	Degree of freedom	Fresh flower performance	Dry flower performance	Essence percent	Essence performance
Replication	2	743.950 ^{ns}	492.292 ^{ns}	0.012 ^{ns}	0.037 ^{ns}
Irrigation intervals treatment(A)	2	3346.170 **	20616.827 **	0.122 ^{ns}	1.004 *
Error(A)	4	803.473	482.915	0.028	0.141
Nitrogen fertilizer treatment	3	12707.962 **	7876.239 **	0.078 **	1.299 **
Interaction 0f irrigation interval and nitrogen fertilizer(AB)	6	4348.726 **	2811.731 **	0.009 ^{ns}	0.175 ^{ns}
Error B	18	603.692	384.992	0.011	0.67

Ns, * and ** respectively show the lack of significant difference and significant different in level of 5 and 1 percent

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