Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Scholars Research Library

Annals of Biological Research, 2011, 2 (6) :692-698
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

The effect of different irrigation intervals and mineral nutrition on seed yield of Ajowan (*Trachyspermum Ammi)*

Seyed Mohsen Moussavi-Nik, Maliheh Salari, Hamid Reza Mobasser, Mohammad Hossein Bijeh keshavarzi[1]

Department of Agronomy and Plant Breeding, Zahedan Branch, Islamic Azad University, Zahedan, Iran
[1]Young Researchers club, Science and Research Branch, Islamic Azad University, Tehran, Iran

---

ABSTRACT

In order to investigate the effect of different irrigation intervals and different mineral nutrition on seed yield of ajowan, an experiment was conducted at the agricultural research station, University of Siatan in 2011. For this purpose a split plot experiment based on a Complete Randomized Block Design with three replications was used. Treatments included three irrigation intervals (7, 14 and 21days) set as main factor, mineral nutrition level was (Nitrogen 120 kg ha-1, Potassium 150 kg ha-1, Phosphorus 200 kg ha-1, Zinc 25 kg ha-1, Magnesium 25 kg ha-1 and control). Results indicated that irrigation had significant effect on umbel per plant, umbels per m2, 1000 seed weight, seed yield per m2. With increasing irrigation intervals, umbels per m2, umbels per plant, 1000-seed weight and seed yield per m2 were decreased. Mineral nutrition had significant effect on umbel per plant, umbels per m2, seed yield per m2. Our results showed that the maximum seed yield per m2 was obtained in irrigation intervals 7 days with Nitrogen.

Keywords: Ajowan, Irrigation interval, Mineral nutrition, Seed yield

---

INTRODUCTION

Trachyspermum ammi, commonly referred as Bishop's weed, Carom seed (English names) and ajowan or ajwain or omum in Indian languages, is an erect annual herb with striate stem originated in Persia and India. According to Ayurveda, the ajowan seeds are hot, pungent, stomachic, appetizer, aphrodisiac, carminative, laxative and diuretic. Ajowan is

traditionally used as remedy for gastric disturbances and as a digestive aid. The thymol & carvacrol derivatives and other minor components from ajowan are responsible for their yieldal properties [1, 2].

Water is one of the important environmental factor in crops production, and water shortage in crops production process may leads to high damages on growth and development and effective materials of herbal plants water is important from ecological and physiological aspects, because it interferes in most of the internal process and most of the plants cells metabolically activities such as creation of herbal plants effective materials is due to water presence [3]. Ali Abadi Farahani et al [4] by a research on *Coriandrum sativum* showed that impacts of irrigation periods on biological yield, flowered branches yield, flowered branches essential oil yield, seed yield, seeds essential oil yield and essential oil percentage of flowered branches were significant on 1% level, and the most yield of these characteristics were related to without stress conditions and the most essential oil percentage of flowered branches was due to stress conditions.

Kochaki et al [5] by a research on *Foeniculum vulgare* showed that by increasing irrigation intervals, number of umbels per m^2, number of umbels per plant a and subsidiary branches, number of umbellate per umbel and 1000-seeds weight decreased significant.

Nitrogen (N) is the basic element of protein, so it's needed for plants enough growth. Nitrogen is the first nutrition which its shortage is observable in dry and semi dry zones. This is because of lack of organic materials which are the most resource of Nitrogen storage in that zones [6]. Moradi et al [7] in an investigation on *Plantago ovata* reaction to irrigation intervals and Nitrogen different levels reported that those treatments were significant on economical yield of *Plantago ovate* and the most amounts of seed were related to in 7 days irrigation intervals and 60 kg ha^{-1} of pure nitrogen.

Valad Abadi et al [8] by investigating on Nitrogen consuming effects on essential oil yield and seed yield of *Cuminum cyminum L.* in Qazvin resulted that Nitrogen application increased seed and essential oil yield.

Potassium (K) is the mobiles nutrition element in plants which transfers from older organs to younger one principally, it stores in Vacuole more than other organs. It doesn't produce complicated organic molecules and works as activated for enzymes and coenzymes for 46 enzymes [9].

Hassan et al [10] by an experiment on *Anethum graveolens dhi* showed that number of umbellate, seeds yield and essential oil percentage is under effects of all K concentration in 2 growth seasons significantly and the highest levels of these parameters catches by the most amount of K. Aza et al [11] showed that number of umbels, fruit yield and essential oil percentage reacted to N and K fertilizers and their interaction effects in *Bunium persicum*.

Phosphorus (P) is one of the main elements for plants. This element interferes in all the biochemical process, energetic compounds and energy transfer mechanisms. In addition P is a

part of cell's core protein and nucleotides which are responsible of duplicate and growth of plants [6].

Zinc (Zn) amount as a heavy metal in soil is related to sand components which are foundation of soils and Weathering conditions. This metal compounds with chloride phosphate, nitrate and sulphate anions. The most important and common Zn complex type in soil is Zn sulphate and phosphate. Zn links to organic acids or appears as free 2 capacities cations in order to transfer to far intervals of xylem [12].

Manganese (Mn) is activating element for some enzymes specially those which interfere in fatty acids and nucleotides production and is necessary for breathing and photosynthesis [9].

MATERIALS AND METHODS

This experiment had been done in 2010 – 2011 in research agriculture field of Zabol University which is located in Chah Nimeh, 30 Km to south east of Zabol. Treatments included different irrigation intervals in 3 levels (7, 14, 21 days), as the main factor and elements (N 120 Kg per hec on the base of ammonium sulphate, Potassium (150 kg ha^{-1}) on the base of Potassium sulphate, Phosphorus (200 kg ha^{-1}) on the base of super phosphate triple, Zinc (25 kg ha^{-1}) on the base of Zinc sulphate, Manganese (25 kg ha^{-1}) on the base of manganese sulphate and control (0 kg ha^{-1}) were subsidiary factors which had been implicated as split plot in accidental complete blocks with 3 replication. Size of each plot is 2 × 4 meter intervals between plots are 0.5 meter and block intervals are 2 meters. In each plot exist 4 rows, and intervals between them were 40 cm, plants intervals on the row were 17 cm, and seeds were cultivated in 1.5 cm depth.

First irrigation had been done immediately after cultivation and was continued till seedlings establishment, then irrigation stopped and had been done on the base of experimental treatments thinking had been done in 4 leaves stages. During growth stage weed fighting had been done continuously and mechanically.

At the end of growth stage to determine number of umbel per plants, number of umbels per m^2 and seed yield, 2 margins from lines omitted in each plot, and 0.5 meter considered as margin from beginning and end of each plots. Then 10 plants had been selected accidentally and afore mentioned characteristics had been measured.

After margins omission, the rest surface harvested to determine seed yield and after dryness, seeds had been separated from hay and measured by a scale with 0.1 precision. To determine 1000-seed weight, 5 samples of 100 seeds had been selected from each plot and their means considered as 1000 seed weight [13]. Results analyzed by MSTAT and means comparison investigated by LSD test.

RESULTS

Variance analysis results in table 1 showed that irrigation intervals and nutrition elements effects on number of umbel per plants and number of umbel per m^2 were significant in 5% level.

Table 1- Variance analysis of irrigation and nutrition's different levels effects on under consideration characteristics of Ajowan (*Trachyspermum ammi)*

		Mean Square			
S.O.V	df	Umbel per plant	Umbels per m2	1000-seed weight	seed yield per m2
Replication	2	117.474	1441.476	0.022	33.272
Irrigation (A)	2	521.021*	6376.47*	0.33*	5994.456**
Error A	4	29.475	360.118	0.02	210.21
Mineral nutrition (B)	5	47.068*	576.7*	0.011	477.735**
Irrigation × Mineral nutrition (A×B)	10	21.13	259.029	0.009	339.92**
Error B	30	15.582	190.958	0.012	64.66
C.V (%)		20.72	20.73	20.69	29.99
*and ** indicate significant difference at 5% and 1% probability level, respectively					

Means comparison of treatments showed that the most amounts of these characteristics were related to 7 days irrigation which grouped in the same category of 14 days irrigation statistically, and the least amount of these characteristics had been observed in 21 days irrigation treatment (Table 2).

Table 2- Means comparison of irrigation distances effects on under consideration characteristics of Ajowan (*Trachyspermum ammi)*

Treatment	Umbel per plant	Umbels per m2	1000-seed weight	Seed yield per m2
7 days	23.29a	81.79a	0.6167a	46.4a
14 days	20.86a	72.9a	0.5944a	23.8b
21 days	12.99b	45.5b	0.3722b	10.2c
Similar letters in each column hadn't any significant statistical difference (on the base of LSD test in 5% probable level)				

Means comparison of nutrition showed that the most amount of these characteristics was related to N treatment which grouped in the same category of other nutrition and had significant difference according to control (Table 3).

Table 3- Means comparison of nutrition effects on under consideration characteristics in Ajowan (*Trachyspermum ammi)*

Treatment	Umbel per plant	Umbels per m2	Seed yield per m2
Nitrogen (N)	21.73a	76.15a	36.8a
Potassium (K)	19.4a	67.9a	27.2bc
Phosphorus (P)	20.61a	72.1a	20.7cd
Zinc (Zn)	18.95a	66.3a	31.9ab
Manganese (Mn)	18.56ab	64.9ab	27.4bc
Control	15.03b	52.6b	16.7d
Similar letters in each column hadn't any significant statistical difference (on the base of LSD test in 5% probable level)			

Variance analysis results in table 1 showed that in 5% level irrigation intervals effects were significant on 1000-seed weight but nutrition hadn't any significant effect on it. Means comparison showed that the most amount of this characteristic was related to 7 days irrigation treatment which grouped in the same category with 14 days irrigation statistically and the least amount was related to 21days irrigation treatment (Table 2).

Variance analysis results (table 1) showed that the effect of irrigation intervals and nutrition and their interaction effects were significant in 1% level on seed yield per m^2. Means comparison resulted of irrigation treatment showed that by increasing irrigation intervals, seed yield decreased. The most amount of seed yield was related to 7 days irrigation treatment and the least was due to 21 days irrigation (Table 2).

Means comparison of nutrition showed that the most amount of seed yield was due to N which grouped in the same category with Zn and had significant difference with other nutrition elements and control. The least amount was related to control (Table 3).
Means comparison of interaction effects of irrigation and nutrition showed that the most seed yield was related to 7 days irrigation × Nitrogen (Table 4).

Table 4- Means comparison of irrigation effects of irrigation distances × nutrition on under consideration characteristic of Ajowan (*Trachyspermum ammi)*

Irrigation intervals	Mineral nutrition	Seed yield per m2
7 days	Nitrogen (N)	74.3a
	Potassium (K)	39.1bc
	Phosphorus (P)	35.8bc
	Zinc (Zn)	54.1ab
	Manganese (Mn)	51.8ab
	Nitrogen (N)	23.1bc
14 days	Nitrogen (N)	28.1bc
	Potassium (K)	35.5bc
	Phosphorus (P)	17.4c
	Zinc (Zn)	28.7bc
	Manganese (Mn)	17.4c
	Nitrogen (N)	16.2c
21 days	Nitrogen (N)	8.05c
	Potassium (K)	7.2c
	Phosphorus (P)	9.2c
	Zinc (Zn)	13c
	Manganese (Mn)	12.9c
	Nitrogen (N)	10.9c

Similar letters in each column hadn't any significant statistical difference (on the base of LSD test in 5% probable level).

DISCUSSION

As stated in results, long irrigation intervals leads to decrease in number of umbel per plant and 1000-seed weight and seed yield; because when plants expose to drought stress, stomata become close or semi close and this leads to reduction in Co_2 absorbance, in the other hand plant consumes more energy to absorb water. Plant order stress conditions, decreases its leaves surface, so photosynthesis material production and material transfer to seed will decrease [9].
According to irrigation distance an effect on seed weight and number of umbel per plants were significant, may be seed yield increase in favor irrigation condition, and is because of its effect on 1000-seed weight and number of umbel per plant.

Results of this investigation were according to Ardakani et al [14] finding on *Melissa officinalis*, Ali Abadi Farahani and Valad Abadi [15] on *Coriandrum sativum*, Omid Beigi and Mahmodi Sorestani [16] finding on *Agastache foeniculum* and Rahimi et al [17] findings on *Plantago major L, Plantago ovate*.

In this research N leads to increase number of umbel per plant, number of umbel per m^2 and seed yield; because N plays an important role in chlorophyll building and the most important element in protein synthesis and its application leads to improvement in protein amount under favor conditions. By increasing proteins, plants develop growth and this development followed by increasing photosynthesis materials. By increasing these materials, number of umbel per plant, seed amount and 1000-seeds weight will increase and eventually seed yield will improve Rahmani et al [18]. Results of this investigation were according to Rahmani et al [18] findings on *Calendula officinalis L.*, Permenas et al on Ajowan.

REFERENCE

[1] KR. Anilakumar, V. Saritha, K. Farhat, AS. Bawa. *Food and Chemical Toxicology.*, **2009**, 47, 279-282.
[2] AK. Pathak, N. Nainwal, BM. Goyal, R. Singh, V. Mishra, S. Nayak, P. Bansal, V. Gupta.. *Journal of Pharmacology Research*., **2010**, 3, 895-899.
[3] R, Omid Beigi. Approaches of plants production in herbal plants, Tarahan Nashr Pub, Tehran, **1995**.
[4] H. Ali Abadi Farahani, A. Arbab, B. Abasszadeh. *Iranian Journal of Medical and Aromatic Plants*., **2008**, 24(1), 18-30.
[5] A. Kochaki, M. Nasiri Mahalati, G. Azizi. *Iranian Journal of Field Crops Research*., **2006**, 4(1), 131-140.
[6] M. Malakoti, M. Nafisi. Fertilizer on agricultural land, 2nd, Tarbiat Modares University, Tehran Pub, **1994**, 342p.
[7] K. Moradi, A. Hamdi Shangri, M. Shahrajabian, M. Gharineh, M. Madandost. *Iranian Journal of Medical and Aromatic Plants*., **2010**, 26(2), 196-204.
[8] A. Valad Abadi, H. Ali Abadi Farahani, P. Moaveni. *Iranian Journal of Medical and Aromatic Plants*., **2010**, 26(3), 348-357.
[9] A. Kochaki, G. Sarmad Nia. Physiology of Crop Plants, 16, Jahad daneshgahi Mashhad pub, Mashhad, **1998**, 400p.
[10] EA. Hassan, EF. Ali, AF. Ali. *Australian Journal of Basic and Applied Sciences.*, **2010**, 4(5), 948-956.
[11] A. Azza Ezz El-Din, S.F. Hendawy, Eman E. Aziz, E.A. Omer. *International Journal of Academic Research*., **2010**, 2(3), 192-197.
[12] M. Ghorbanli, M. Babalar. Mineral Nutrition of Plants., 1st, Tehran Teacher Training University Pub, Tehran, **2003**, 356p.
[13] M. Dehghan Shoar, A. Hamidi, S. Mobaser. Seed vigor measurement approaches, 1st, Azmon Keshavarzi Pub, Karaj, 212 p.
[14] M. Ardakani, B. Abass Zadeh, A. Sharifi Ashour Abadi, M. Lebaschi, F. Pakzadeh. *Iranian Journal of Medical and Aromatic Plants*., **2007**, 23(2), 251-261.

[15] H. Ali Abadi Farahani, A. Valad Abadi. *Iranian Journal of Soil Research*., **2010**, 24(1), 101-108.
[16] R. Omid Beigi, M. Mahmoudi Sorestani. *Iranian Journal of Horticaltural Sciences*., **2010**, 41(2), 153-161.
[17] A. Rahimi, MR. Jahansoz, S. Madah Hoseini, AR. Sajjadinia, HR. Roosta, E. Fateh. *Australian Journal of Crop Science*., **2011**, 5(1), 71-77.
[18] N. Rahmani, A. Valad Abadi, J. Daneshian, M. Bigdelui. *Iranian Journal of Medical and Aromatic Plants*., **2008**, 24(1), 101-108.