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Safflower Performance under Different Water Intervals in North and Khartoum States

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Abstract

Two field experiments were conducted at the Experimental farm in Agricultural Studies College, Sudan University of Science and Technology at Khartoum state and Agricultural Science College, Dongola University in Northern State in winter of 2011/2012. The experiments were conducted to study the effect of locations and three water intervals (7,14and 21days) on growth and seed yield of two varieties of safflower,(Gieza and Baldi varieties) .The experiment was laid out in Factorial Randomized Block Design with 3 replications. The results indicated that location and varieties had a significant effect on growth attributes (Plant height, number of leaves/plant, number of branches /plant and stem diameter) and on yield characters (number of seeds /capsule, thousand seed weight) .Location and variety displayed significant effect on number of seeds /capsules. Geiza variety gave promising results in term of vegetative growth (plant height) and number of seeds/capsule and seed yield more than Baldi ($P \leq 0.05$). Water intervals significantly affected thousand seed weight and irrigation every 7 and 14 day were more suitable compared to 21 day interval. There were negative correlation between number of seeds /capsule and plant population and stem diameter. Seed yield expressed similar trend with the same parameters. Moreover seed yield was positively correlated with plant population, plant height and number of seeds / capsule

Keywords: Safflower; Water Interval; Location; Geiza.

Introduction

Safflower was originally grown for the flowers that were used in making red and yellow dyes for clothing and food preparation (Robinson, 1976). Today this crop supplies oil, meal, birdseed, and foots (residue from oil processing) for the food and industrial products markets, although the crop is now primarily grown for the oil. The oil of safflower contains nearly 75% linoleic acid, which is considerably higher than corn, soybean, cottonseed, peanut or olive oils. Safflower contributes partially in the world edible and industrial oil market. This merit made safflower an important crop for vegetable oil (Emongor, 2010). The crop has been cultivated for edible oil extraction (McPherson et al. 2004). The oil is light in color and will not get yellow with aging; hence it is used in white and light-colored paints. This oil can also be used as a diesel fuel substitute, but like most vegetable oils, is currently too expensive for this use (Smith and Rust, 1989). The by-products of oil extraction, whole seed or kernel meal, is available for stock feed. All plant can be grazed or stored as hay or silage (Ravi S 2008). The forage is palatable and its feed value and yield are similar to or better than oats or alfalfa (Smith, 1996; Tabatabaei,et al2010).In China safflower is grown as a medicinal plant (Singh, 2007).

Safflower is considered as important winter crop in some semiarid regions due to its deep roots and its drought tolerance (Blachshow, 1992; Zaman .et.,al 1998) reported deeper water extraction from sandy loam soils under dry land than under irrigated cultures. Leaf area and evapotranspiration rate reduction, osmotic adjustment and increments in the cell density are other adaptive mechanisms of safflower plants to water stress conditions The effects of water stress on safflower yield has an important goal as (Hashemi Dezfuli,1994) indicated that water stress resulted in a decreased value in plant height and number of heads. Since safflower is known by its efficient use of soil moisture, because of its deep tab root,

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the crop is suitable for arid regions.(Ashrafi,et al 2010) indicated that an increase in the irrigation interval up to 15 days after the six-leaf stage had no significant effects on grain yield, but grain yield did decrease by 18 and 29.8% with increased irrigation intervals to 22 and 28 days respectively.

Safflower may be the alternative or rather the supplement for other oil seed crops because of its spiny nature which makes the crop more resistant for bird attack and no pest or diseases were recorded.. Safflower growth as well as composition and quality of seeds are influenced by many factors like genotype, environment and agronomic practices (Nagaraj, 1997; Weiss, 2000). One of the key points for optimizing safflower productivity is a choice of location and the appropriate sowing date (Burhan, A., E.,et al 2001). Despite many uses of safflower, the crop remained minor, neglected and no enough agronomy and ecophysiology information of the crop and very limit work has been done with safflower in Sudan .Thus this study proposed to compare the potential of the two varieties under Northern and Khartoum states condition using three water intervals

Materials and Methods

The experiments were conducted in the experimental farm of the Department of Agronomy, College of Agricultural Studies, Sudan University of Science and Technology, Shambat, Khartoum, and Agricultural Science College Dongola University in Northern state during winter of 2011/12 season.

Shambat area is suited in the low land of river Nile, at 15^0 40'N and 32^0 32' E. The climate is described as tropical semi-arid. Annual rainfall ranges 750-800 mm.. Relative humidity ranges between 31-51% during wet season and14-27%during dry season. Mean maximum and minimum temperature in Khartoum are 41.7^0C and 15.3^0C, respectively. The winter season from November to March and is relatively cool and dry. The soil is silty clay loam. Pumping water from the river Nile is common, (Sayed 2012).

Demonstrative farm of Agricultural Science College Dongola University at the eastern bank of the Nile, latitude19^0-10^- N longitude 30^0- 29^- The climate of the area is described as desert which is characterized by high temperature during summer and very low during winter ,it ranged between 36.4^0 c and 18.2^0 c respectively. Rainfall is very low an average of 12.3 mm. The soil is desert type .It is salt affected soil .Irrigation water from river Nile (Elfatih 2004).

The experiment was laid out in Factorial Randomized Complete Block Design with 3 replications. The main plots were varieties and the subplots were water intervals in the two locations. The field was first plowed then, it was leveled and divided to plots, plot size was 3x4m. After testing the germination percentage of the seeds, they were planted with the on-row spacing of 30cm at the depth of 4 cm. At the same day, the first irrigation was done. Data were collected from the central part of each plot. Five safflower plants were randomly selected and tagged and used for observations. To measure seed yield one meter square of each plot was harvested, the plants were dried in open air. Then, their seeds were separated and weighed. Next, seed weight per unit area and per hectare was measured. Prior to analysis of variance (ANOVA), data were subjected for normality and homogeneity of variance test using Shapiro-Wilk-W test and the Levene test, respectively.

The ANOVA directive of SAS package was used to perform the analysis of variance. Mean separation were made by Duncan test. Statistical significance was accepted at a level of $P < 0.05$ (Statgraphics 1985–1989).

Results and Discussion

Statistical analysis showed significant difference of location on stem diameter, number of leaves/plant and number of branches/ plant .Dongola area and baladi variety achieved higher number of leaves and thicker stem diameter than Shambat area and Geiza varity (**Table 1**)

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Table 1: Number of leaves /plant and number of branches/plant as influenced by location and water levels 7, 14 and 21 day respectively and their interactions of the two varieties of safflower

		Number of leaves/plant		Number of branches/plant	
Varieties	Water intervals	Dongola	Shambat	Dongola	Shambat
	7 days	22.6±(1.77)bb	20.2±(1.77)bb	7.17±(1.15)b	4.66±(1.12)b
Gieza	14 days	22.5±(2.38)bb	22.1±(2.33)bb	6.39±(0.69)b	3.89 ±(0.57)b
	21days	24.6±(1.17)ba	22.2±(1.71)ba	7.28 ±(1.02)b	4.77 ±(1.01)b
	7 days	24.6±(1.77)ab	22.2±(1.77)ab	9.37 ±(1.15)a	6.86 ±(1.17)a
Baladi	14 days	24.5±(2.35)ab	22.1±(2.38)ab	8.59 ±(0.69)a	6.08 ±(0.70)a
	21days	26.6±(1.17)aa	24.2±(1.17)aa	9.48 ±(1.02)a	6.97 ±(1.07)a

Data between parentheses are the standard error of the mean .Date followed by different letters is significant at P< 0.01 (Duncan test).

Differences between treatments on plant height were not significant in both locations but Geiza variety gave slightly taller plants compared to Baladi (**Fig .1**)

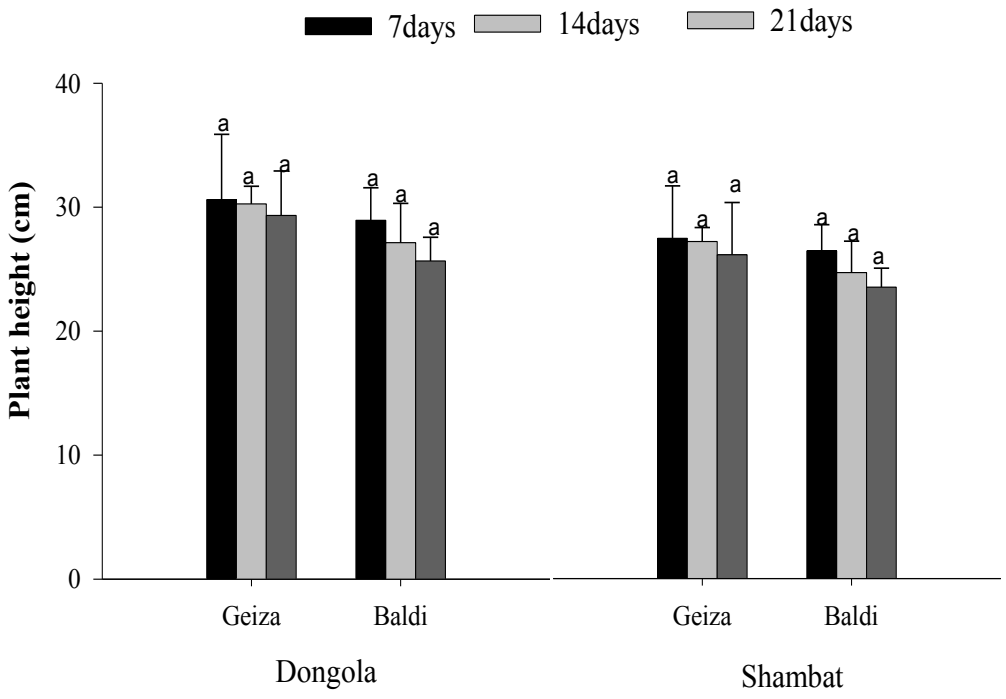

Fig1. Effect of location and water intervals on plant height

Error bars represent the standard error of the means. Bars marked with the same letters are not significantly different at P<0.05 (Tukey test).

According to statistical analysis it was clear that varieties had significant effect on stem diameter in both areas among other factors, Baladi variety gained thicker stem diameter (**Fig .2**). Baladi variety has more branches and a lot of leaves.

The differences of the interactions between location, water intervals and varieties appeared on number of branches /plant. However it was significant.

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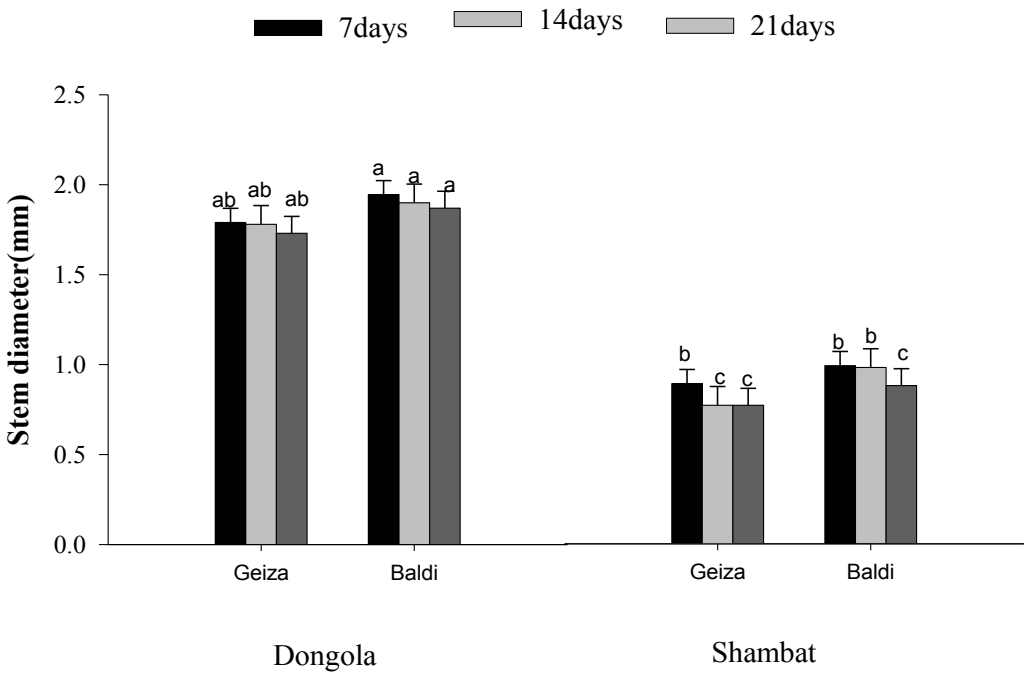

Fig 2: Effect of location and water intervals interaction on stem diameter

Error bars represent the standard error of the means. Bars marked with the different letters are significantly different at P<0.05 (Tukey test).

Analysis of variance showed significant differences (p=0.01) of water intervals treatment on growth parameters except plant height, irrigation every 14day seem to be more suitable.

There were obvious differences of varieties seed yield in both locations. However Dongola area achieved highest seed yield 22540.5 kg and 24000kg / ha compared to 17000 kg and 20000 kg /ha from Geza and Baldi varieties respectively (Table 2) (Zahra Bitarafan 1995) reported that the key point for optimizing safflower productivity is the choice of appropriate location .. It was evident that there was no effect of water intervals on seed yield in the two locations. Moreover, all treatments displayed significant difference on thousand seed weight and number of seed/ capsules the same finding of (Mosallayi A.A2011) indicated that high irrigation regime intervals would decrease the seed content of the head, as the least quantity of the head seeds (**Table 2**)

Table 2: F-values for yield and some yield components.

Seed yield kg/ha				**Thousand seed weight**		**Number of seeds /capsules**	
Sources	DF	Mean square	F value	Mean square	F value	Mean square	**F value**
Location (L)	1	2.30	0.03*	86.49	79.16***	61.36	**5.08***
Varieties (v)	1	0.02	0.05*	55.65	50.93 ***	910.02	**73.31*****
Water intervals(W)	2	0.62	1.36	38.09	34.86**	79.08	**6.54***
L X V	1	0. 03	0.08	0.00	0.00	3.36	**0.28**
L X W	2	0.03	0.07	53.84	49.28***	2.52	**0.21**
V X W	2	0.49	1.07	7.08	6.49**	37.19	**3.08**
L X V X W	2	0.03	0.08	0.00	0.00	0.19	**0.98**

*=P<0.05;**=P<0.01;***=p<0.001

L= Location, V= Varieties and W= Water interval.

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The general trend is there a negative correlation between number of seeds /capsoules , plant population and stem diameter also between seed yield , plant population and stem diameter . All other growth parameters were positively correlated Moreover there was positive relationship of seed yield with number of seed /capsouls ,this in agreement to (Steer and Harrigan 1986) reported that the number of capitulums per plant and the number of filled seeds per plant in safflower were linearly correlated with each other. (**Table3**)

Table 3: Spearman correlation between growth parameters and yield components

	Plant population	Plant height	Stem diameter	Seed/cap	Yield kg/ha
Plant population	1.000				
Plant height	0.259	1.000			
Stem diameter	0.388*	0.509**	1.000		
Seed/cap	-0.011	0.102	-0.076	1.000	
Yield kg/ha	-0.041	0.563**	-0.486**	0.154	1.000

*=P<0.05;**=P<0.01;***=p<0.001

Conclusions

In summary, it is concluded that Geiza is a promising variety and northern state is more suitable for growing safflower than other areas in Sudan. Water supply is necessary to increase grain yield in safflower. Number of seeds /capsule was negatively correlated with plant population in safflower. Drought stress can severely reduce the grain of safflower, but moderate drought stress had no significant effects on these traits. Although safflower is an important oil seed crop well adapted to drought stress, further investigations are required to determine agronomic treatments of this crop.

References

[1] Ashrafi E, Razmjoo K. (2010). Effect of irrigation regimes on oil content and composition of safflower (Cartham tinctorius L.) cultivars. J Am Oil Chemist Soc. 87:499–506.

[2] Blackshaw RE. (1993). Safflower (Carthamus tinctorius) density and row spacing effects on competition with green foxtail (Setaria viridis). Weed Sci. 41:403–408.

[3] Burhan, A., E., Esendal, and Z. Ekin.(2001). The effects of N application times on morphology, yield and quality characters of safflower. In: Proceedings of the 5th International Safflower Conference, North Dakota, USA, eds. J. W. Bergman and H. H. Mundel, pp. 203–207. Williston, ND: North Dakota University.

[4] Elfatih.E.A.Elkarim, and Mustafa.A.M.Idris(2004). Response of Wheat to manure and phosphors fertilization in the high terraces soil of northern Sudan.

[5] Emongor, V. (2010). Safflower (Carthamus tinctorius L.) The underutilized and neglected crop: a review. Asian Journal of Plant Science, 9,299–306.

[6] Esendal, E. (1997). Agro-physiology Outlook on Safflower. In: The IVth International Safflower Conference, eds. A. Corleto, H.-H. Mundel, pp. 155–161. Bari, Italy: Adriatica Editrice.

[7] Hashemi-Dezfuli A (1994). Manipulation of crowding stress in corn. Ph. D. Dissertation. University of Massachusetts. Amherst. U. S. A.

[8] Robinson.,R.G. and Otto,.,H.J. (1967). Safflower - An Oilseed Crop for Minnesota. Agronomy Factsheet- No. 10, University of Minnesota Agricultural Extension Service.

[9] Smith,H.A. C. Rust, D. Baldridge, J. Bergman, and J. Caprio, (1989). Safflower A Montana Specialty Crop. No. MT 8916., Montana State University Extension Service, Bozeman.

ISSN 2454-1672

[10] Singh, Vrijendra, J. H. Akade and N. Nimbkar. (2007). Existence of apomixis in safflower. Extended Summaries. National Seminar on "Changing Global Vegetable Oils Scenario: Issues and Challenges before India: January 29-31, 2007, DOR, Hyderabad. pp. 110-111.

[11] Statgraphics (1985–1989). Statgraphics Statistical Graphics Systems, v.4.0. Rockville, MD: STSC.

[12] Sayed,T.Abdelhalim(2012).Development and integration of biocontrol products in branched broomrape (Pheilipanche ramose) mangment in tomato .Phd thises.

[13] Steer BT, Harrigan EKS.(1986). Rate of nitrogen supply during different developmental stages affect yield components of safflower (Carthamus tinctorius L.). Field Crop Res. 14: 221–231.

[14] Mosallayi A.A, 2Sharifmogaddasi M.R. and 2Omidi A.H. (2011) Evaluation of Different Irrigation Regimes Effects on Grain Yield and Some Important Traits of New Iranian Safflower Cultivars.Journal of Advances in Environmental Biology, 5(5): 868-871, 2011.

[15] McPherson MA, Allen GG, Keith A, Topinka C, Linda MH. (2004). Theoretical hybridization potential of transgenic safflower with weedy relatives in the New World. Can J Plant Sci. 84:923–934.

[16] Nagaraj, G., and P. S. Reddy. 1997. Some factors influencing safflower seed and oil quality. In: IVth International Safflower Conference, eds. A. Corleto, and H.-H. Mundel, pp. 347–349. Bari, Italy: Adriatica Editrice.

[17] Ravi S, Channal HT, Hebsur NS, Patil BN, Dharmatti PR, (2008). Effect of sulphur, zinc and iron nutrition on growth, yield, nutrient uptake and quality of safflower (Carthamus tinctorius L.). Karnataka J. Agric. Sci., 21: 382-385.

[18] Tabatabaei, S. A GH. Zarei and P. Aghaei. (2010). Study of relationships between agronomic characteristics and yield in autumnal safflower, pp 51, M. Sc. Thesis, Islamic Azad University, Maybod Branch, Iran.

[19] Weiss, E. A.(2000). Oilseed Crops. Oxford: Blackwell Science.

[20] Weiss, E.A., (2000a. Oilseed Crops (2nd edition), Blackwell Science Ltd., pp: 109.

[21] Zaman A and Das PK (1998) Growth and yield performance of safflower under different nitrogen levels in semi arid tropics. Annuals of Arid Zone 29(2) 141-14.

[22] Zahra Bitarafan Amir Hossein Shirani Rad, Babak Delkhosh(1995) Changes in Yield and Morphologic Traits of Spring Safflower as Affected by Nitrogen Rates and Sowing Dates Journal of Advances in Environmental Biology, 6(1): 72-78, 2012.