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ORIGINAL ARTICLE

Study of Nitrogen Fertilization Times Effects on New Sunflower Hybrids for Grain and Oil Yields

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ABSTRACT

To study of nitrogen fertilization times effects on grain and oil yields and growth stages, two new sunflower hybrids -Mehr & Azargol- as main plots and three nitrogen fertilization times: initial fertilization during steam formation stage (8 to 10 leaves), secondary fertilization in head formation stage (blooming), and the third stage-nitrogen fertilization- was done in efflorescence stage as sub plots were evaluated in a split plot design based on randomized complete block arrangement with 4 replications in Azad Islamic University of Saaveh in June, 2007. The results showed a significant difference (5%) between the treatments of fertilization times. During the steam formation the fertilization treatment showed the highest effect and during flowering it the lowest effect. A significant difference was observed between the treatments of fertilization's dates in thousand-seed weight, so that the highest thousand-seed weight is related to the fertilization treatment during steam formation, and the lowest is related to the thousand-seed weight fertilization treatment during flowering. A significant difference (5%) observed among the genotypes, and with a difference about 12 grams, Mehr genotype showed more thousand-seed weight. A significant difference was observed between the treatments of fertilization's dates in the number of seed in each head. The fertilization treatment during steam formation (679/67 seeds) had the most number of seed per head, and the fertilization treatment (495/45 seeds) per head had the least number. A significant difference (1%) has been observed between the treatments of fertilization's date in the number of full seed per head, in such a way that fertilization treatments during steam formation, with 573/66 filled seeds per head, was the superlative, and fertilization treatments during flowering, with 356/7 filled seeds per head, was the lowermost. And this difference reached to 39 percent. A significant difference (5%) has been observed between the numbers in terms of full seed per head. Azargol's figure (501/06 filled seeds) is higher than Mehr's (437.25 filled seeds). A significant difference(5%) was observed between the treatments of fertilization's date in terms of oil percentage, so that, in the stage of head and steam formation, fertilization time was catergorized in a statistic group while has the most percentage of oil; and in the stage of flowering, fertilization time was categorized in another statistic group of Dancan Multiple Range Test while has the least percentage of oil. A significant difference (1%) has been observed between the numbers; Azargol's figure (47/01%) has more percentage of oil than Mehr's figure (44/15%). There was also a significant difference (1%) between the times of planting with a view to the function of oil; fertilization time, in the stage of steam formation with 1871/20 Kg per hectare, had the most oil function, and fertilization time in the stage of flowering with 1136/77 Kg per hectare, had the least oil function. According to the results of the experiment, the best time for fertilization is the use of fertilizer in the stage of steam formation and then head formation. Using nitrogen fertilizer in time of steam formation, the fertilizer which is used during the formation of floret primordia is at plant's disposal and the maximum florets will be formed. This issue is as a result of the number of seed in head and also the number of full seed in more heads in the stage of steam formation. Meanwhile, the fertilization during steam formation may lead to availability of food resources and

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therefore suitable growth. Fertilization in the stage of steam formation leads to accretion of function, tousand-seed weight, the number of seed in head, the number of full seed in head, head's diameter, oil percentage, and function of oil. The above mentioned characteristics were in the lowest level when using nitrogen fertilizer in time of efflorescence. Generally speaking, in climate conditions of Saaveh, the stage of steam formation of Sunflower is the ideal time to fertilize.

Key words: safflower, nitrogen, fertilization,hybrid variety,oil percentage, seed yield

Introduction

Sunflower (Helianthus annuus) is one of four important agronomic monocarpic plants which are planted to produce edible oil in the world [44]. Sunflower is native to central areas of America continent, and seemingly it is Peruvian or Mexican in origin [12]. All over the world, Sunflower production in the countries which have temperate regions is higher than the tropical. [44] Several factors affects the type and amount of fertilizer in field studies; such as transformation of organic materials into inorganic (mineral) form, leaching potential, formation of self-rising compounds, soil's capacity to cationic exchange, the amount of soil's water, the correlation between humidity and temperature, PH of soil, harvest rates by the plant and interactions of these factors on the suction and superiority of fertilizer were very effective and sometimes unpredictable [32]. In addition to the mentioned factors, climatic conditions such as temperature, humidity, air, wind, cloudiness rate, and have an important role in plant reaction to other environmental factors in field studies. One of the Characteristics of nitrogen fertilizers is that due to its high solubility, it releases nitrogen which will be used by the plant directly.

Releasing speed of fertilizer's components significantly reduce gradually. As various nitrogen compounds which have been absorbed by plant are easily exposed to washing, in order to ensure that it would not be wasted, nitrogen releasing from its source ought to coincide with its absorption rate by plant.

When washing is done immediately after using nitrogen's source in soil and before any significant absorption, resources which have high capability to solute will be washed easily and this would bring about non-uniformity in the reaction of plant function [79]. Pearson et al did an equation on several soil textures in Georgia, Mississippi and Alabama and came to this conclusion that in comparison with spring application of nitrogen fertilizer, only 49 percent of the diffusion of nitrogen fertilizer was effective in autumn and the usefulness rate turns to 62 percent during receiving nitrogen fertilizer, because washing of nitrogen brings its wastage [79].

During a series of examinations Olson et al reached the conclusion that using of fertilizer in autumn will bring about wastage of the fertilizer, in such a manner that using of 90 to 180 Kg/h of nitrogen in autumn or about spring will produce an operation with approach of next almost equal to 45 and 90 Kg/H of nitrogen respectively in spring. In comparison with autumn, a little difference between ammonium sulphate was observed there [85].

According to Jong et al time of nitrogen fertilizer usage has been a significant factor in such a manner that by eight weeks after planting, the operation of seed and texture was increased. The use of nitrogen faced with a decline in operation by passage of this period but the concentration of nitrogen in seed and texture was increased [71].

According to the studies, increasing of nitrogen fertilizer efficiency and more operation is achieved on the condition that, instead of being used before planting, nitrogen fertilizer is used several times during the growing season; specially regarding soils which have light texture [61,91]. Some reports have been published concerning lack of difference between the usage of fertilizer before and after planting [107].

There are many reports regarding the effects of nitrogen fertilizer to stages of development.

Nitrogen fertilizer also brings about delay in flowering time and physiologic consideration for the sunflower through increasing the vegetative growth.

The nitrogen fertilizer would increase the total period of development and growth in such a manner that prior to the stage of the appearance of the head, the nitrogen fertilizer has no effect on the period of the plant's growth, but it will postpone the day of planting to full consideration [41]. According to Robinson's report the sunflower is a short-day plant. But it flowers in a wide range of photo-period. (even during 20 hours day) The difference between flowering time or growth period is attributed to photo-period difference between variable environments [92]. These differences are often affected by soil fertility, humidity, and temperature. The Interaction between the growth and crop's operation in the condition of farm is determined by photo-logical pattern by which the humidity condition and leaf's area is estimated in the stage of pollination, and the sunflower operation can be calculated by those variations. [88]

The nitrogen fertilizer brings about a delay in flowering time through increasing the vegetative growth and physiological consideration of the sunflower. The nitrogen fertilizer also increases the entire growth and development period of the

sunflower [45]. Before the stage of the head appearance, the nitrogen fertilizer has no effect on the growth period of plant, but it will postpone the day of planting to full maturity.

The Materials and the Methods:

To study of nitrogen fertilization times effects on grain and oil yields and growth stages, two new sunflower hybrids -Mehr & Azargol- as main plots and three nitrogen fertilization times: initial fertilization during steam formation stage (8 to 10 leaves), secondary fertilization in head formation stage (blooming), and the third stage-nitrogen fertilization- was done in efflorescence stage as sub plots were evaluated in a split plot design based on randomized complete block arrangment with 4 replications in Azad Islamic University of Saaveh in June, 2007. The city of Saaveh Coordinates: 35°1 N 50°20 43″E and its average height from the see level is about 1030. Saaveh is located in dry and semi-dry climate. Annual rainfall is 200 millimeters on average in Saaveh. The maximum amount of rainfall is 280 mms and the minimum of it is 130 millimeters. Experimental plots consisted of 12 rows with 4-m long and 0.5-m apart .After emergence manual seedling thinning were used to obtain normal density.The space between the subsidiary plots is also supposed 100 centimeters. The aseptic seeds, which have been gotten from institute of Research and Seed's Sapling of Karaj, were planted on the planting queues and in approximate 5 centimeter depth of soil in 1386/3/15. In order to prevent from passerine damages during sprouting, 2 or 3 seeds were planted in every pit hull; therefore, in each stage of this plan which is calculated based on the time of nitrogen fertilization in 3 mentioned stages (1/5 Kg nitrogen fertilizer for each acacia) and also based on treatments. It was distributed similarly in furrow which was created among the planting queues. And it was never fertilized until the end of the season. In order to evaluate the effect of nitrogen fertilization on growth and performance of the sunflower, half of it was performed before planting and the other half was performed in 3 clear -cut stages.In order to prevent from irrigation of nitrogen and wasting it away, the first irrigation was done with lower pressure after the fertilization. In this research urea was used as the nitrogen fertilizer. As this performed plan has been a plan which has to do with the fertilizer, and was done during 3 stages of nitrogen fertilization; the amount of nitrogen fertilizer was calculated for 3 stages:

5/4 Kg after the planting ½ # pure nitrogen fertilizer 46%

30 Kg before the planting # super-phosphate fertilizer

5/1 Kg 1-the stage of forming stem (8 to 10 leaves) pure nitrogen fertilizer 46 %

The Results:

The results of the operation showed that there was a significant difference (5%) between the treatments of the fertilization's time, and a significant difference was not observed between the figures. (tables 1-4 & 2-4)

Maximum operation has to do with the treatment of fertilization during the steam formation, and minimum operation has to do with the treatment of fertilization during the flowering.

Probably the reason of operation increase during the fertilization is the availability of enough foodstuffs for primary growth during the steam formation.

However, by fertilizing during steamformation, and providing the fertilizer during formation of florets' promordia the amount of the formed florets will be maximized; as a result, it will have a positive effect on the amount and increasing of seed's operation.

According to report the nitrogen fertilizer also brought about the increasing of the operation, and they attributed this increase to increasing of seed's figure [44].

Supposing potential of the sunflower's operation associated with environmental conditions of period of the plant's growth, the mentioned that the environment is the most important determining factor of the sunflower's operation. It was also mentioned that the number of the seed in the head is dependent on the ability of floret production and their growth, which is associated directly with the amount of available photosensitive materials in time range of the appearance of the florets to post-pollination.

Also emphasized high association of the seed's number in each head and opperation with the availability of photosensitive materials during the pollination [90].

According to Table (1-4) a significant difference (5%) was observed between the treatments of the fertilization date in weight of thousand-seeds. So that the fertilization treatment has the most weight of the thousand-seeds during steam formation and the fertilization treatment during flowering has the least weight of the thousand-seeds. A significant difference(5%) was observed between the figures, and Mehr's figure had more thousand-seeds weight (about 12g) than Azargol's.

The results of table (1-4) represented that there is a significant difference (5%) between the treatments of the fertilization date per seed's number per head.

Table 1-4: Analysis of Variance for the measured traits.

SOV	df	MS								
		Seed yeild	1000seed weight	Seed number in capitul	Full seed number in capitul	Empty seed number in capitul	Hight	Capitul diameter	Oil percentage	Oil yieald
(R)	3	595239	77/79	20197	16277	765	154	16/5	62/11	93633
Fertilizatio time (a)	2	3267880 *	81/599 *	65879 *	96483 **	8242 *	5/9	92/1	86/2 *	548391 *
error	6	728449	97/78	11123	7892	885	05/33	86/3	06/0	42261
variety	1	345	66/864 *	9644	24435 *	3448	68/10	53/8	68/24 **	47829
intraction(ab)	2	443168	08/28	17770	6173	4761	136	43/3	47/1	1687
Error (c)	9	582693	37/88	7591	6406	2103	64/98	65/5	66/0	321751
CV %		03/23	83/12	94/14	06/17	40/38	46/10	05/18	78/1	42/38

*: Significant (P<0.05), **: Highly significant (P<0.01) and ns: non significant

Table 2-4: Means comparison of Zinc spraying treatments for measured traits in safflower.

	Seed yield (kg/ha)	1000 seed weaight(gr)	Seed number in capitul	Full seed number in capitul	Empty seed number in capitul	Hight (cm)	Capitul diameter (cm)	Oil percentage (%)	Oil yield (kg/ha)
A factor,time of fertilization									
Stem	25/3907 a	88/81 a	67/679 a	66/573 a	51/103 b	62/94 a	47/13 a	06/46 a	20/1871 a
Start flowering	87/3399 ab	31/73 ab	51/577 ab	11/479 ab	40/98 b	17/96 a	43/13 a	08/46 a	77/1421 ab
Flowering	50/2637 b	56/64 b	45/495 b	70/354 b	37/156 a	06/94 a	60/12 a	60/44 b	77/1136 b
B factor ,varieties									
Mehr variety	08/3311 a	25/79 a	16/563 a	25/437 b	41/137 a	28/94 a	77/13 a	15/44 b	45/1413 a
Azargol variety	66/3318 a	25/67 b	25/603 a	06/501 a	44/107 a	62/95 a	57/12 a	01/47 a	71/1539 a
CV(%)	03/23	83/12	94/14	06/17	40/38	46/10	05/18	78/1	42/38

Table 3-4: Means comparison of different genotype for the measured traits.

	Yield	Hight	Sedd number in capitul	Empty seed number in capitul	Full seed number in capitul	1000 seed weaight	Capitul diameter	Oil yield
yield	1							
Hight	15/0	1						
Sedd number in capitul	** 88/0	16/0	1					
Empty seed number in capitul	* 23/0-	004/0	Dec-00	1				
Full seed number in capitul	**88/0	Jan-00	** 92/0	35/0	1			
1000 seed weaight	56/0	006/0	32/0	02/0-	26/0	1		
Diameter capitul	48/0	Aug-00	37/0	001/0	24/0	61/0	1	
Oil yield*: Significant (P<0.05),	* 82/0	Jan-00	* 81/0	37/0	**90/0	35/0	16/0	1

**: Highly significant (P<0.01) and ns: non significant

The fertilization treatment had the most number of seed per head (679/67 seeds) during steamformation; and the fertilization treatment had the least (495/45 seeds).

By fertilizing during steamformation, there would be available fertilizer to the plant during formation of the floerts' promordia ; as a result, the plant would produce the maximum floret and brings about increasing of the seed's number in more head in comparison to two other treatments.

Ravson and Henid Marsch (1983) also emphasized intense association of seed's number in head as well as the operation with the availability of photosensitive materials during pollination.

Researcher had also mentioned that the seed's number in the head depends on power of floret production during primary stages of the production of promordia and their growth which has direct association with the amount of available photosensitive materials in time range of peeping the florets until post-pollination [35].

There was no significant difference between the figures, but Azargol's figure had more seeds than Mehr's figure. A significant difference (1%) was observed between the treatments of the fertilization time regarding the number of full seed in the head. (Table 1-4)

So that the fertilization treatment had the most number of seed in the head (573/66 full seeds) during steam formation; and the fertilization treatment had the least (356/7 seeds) during flowering. And this difference would reach to 39%. A significant difference (5%) was also observed between the figures regarding the number of full seed in the head. So that the figure of Azargol (501/06 full seeds) was standed in higher position in comparison to the figure of Mehr (437/25) A significant difference (5%) was observed between the treatments of the fertilization time regarding oil percentage. So that the fertilization time had the most percentage of oil and was placed in one statistical group during steam formation, and the fertilization time had the lowest percentage of oil during flowering and was placed in another statistical group regarding Duncan categorization. (Tables 1-4 & 2-4) A significant difference (1%) was also observed between the figures, so that Azargol's figure (47/01%) toward Mehr's (44/15) had more oil percentage.

There was a significant difference (1%) between the treatments of planting time regarding the oil operation.

So that the fertilization time during the steam formation (1871/20 Kg/H) enjoyed the maximum oil operation, and the fertilization time during flowering (1136/77 Kg/H) enjoyed the lowest amount of oil operation.

There was not significant difference between the figures, but Azargol's figure (1539/71 Kg/H) had more oil operation than Mehr's (1413/45).

According to examination results, using nitrogen fertilizer during steam formation as well as head formation is the ideal time to fertilize. By using nitrogen fertilizer during steam formation, this fertilizer is used by the plant and the maximum florets will be growen during formation of promordia of the florets (promordia).

This issue is resulted from the seed's number per head, full seed's number per head during steam formation, positive and significant correlation between the seed's operation and the oil operation and also between the seed's number per head and full seed's number per head Meanwhile, the fertilization during steam formation whould probably bring about on time availability of nutritional sources and suitable growth. The fert ilization during steam formation brings about increase in operation, thousand-seeds weight, (full) seed's number per head, head diameter, oil and operation percentage.

Above-mentioned features enjoyed their lowermost amount during flowering and using of the nitrogen fertilizer, and there was a negative correlation between the operation and the number of hollow seed.

So that, during steam and head formation, fertilization enjoyed fewer amounts of hollow seeds per head than fertilization during flowering.

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