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Effect of sowing date and nitrogen on yield and yield components of medicinal flax

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Abstract

In order to investigate the effect of sowing date and different nitrogen (N) levels on yield and yield components medicinal flax, an experiment performed in split plot in form of Randomized Complete Block Design, with 4 replications and during farming year of 2005-2006 and of 2006-2007 in Yasooj Agriculture Research Station. 5 sowing date included 4,6,8,10,12 on the basis of depth temperature of 5cm in main plots and 4 fertilizer levels in sub-plots included sample (no fertilizer) 50, 100 and 150 kg/ha pure N from urea source that 50% was used at the time of sowing and 50% in the way of top-dressing. The results of complex 2-year analysis of data indicate that with delayed sowing plant height, none of branch, none of fruits, grain yield, 1000-seed weight, leaf area index, dry mater, crop growth rate and were reduced significantly. The use of 100kg/ha pure N significantly increased plant height, none of branch, none of fruits, grain yield, leaf area index, dry mater, crop growth. First sowing date with 1801.12 kg/ha had the most yields and fifth sowing date with 760.48 had the least product. The most and the least yield rates of seed in 100kg/ha pure N and sample were 1895.22 and 1351.87 respectively.

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Introduction

Oil flax (*Linum usitatissimum* L.) is one of the greasy plants whose planting is considered for using of its major material in medicine, makeup, and hygienic industries. Oil flax is an herbaceous, one-year plant which belongs to flax family (Linaceae) and its origin is reported in east of Mediterranean (Omid Beighi, 2005).

Flax (*Linum usitatissimum* L.) is a local resource in northern Europe, it is an annual summer crop. The structure of the plant is complex (Akin et al., 2005; Franck, 2005; Morvan et al., 2003).
flax fibers have excellent specific mechanical properties and are being evaluated as a replacement for E-glass fibers (Martin *et al*, 2013; Lefeuvre *et al*, 2013; Coroller *et al*, 2013).

The lack of nitrogen into two stages of vegetative and generative postpones the phonological growth of oil flax and decreases the speed of leaf expansion and leaf area duration; therefore, the efficiency of light usage also declines in this condition. However, the more density of nitrogen increases in leaves the more amount of getting carbon extends. Because nitrogen exists in the form of protein as well as it is the main element of chlorophyll which is the fundamental factor in getting carbon in the plant.

The amount of existed nitrogen in the plant has considerable effect on the process of leaf expansion and its final size in the oil flax, and shortage of nitrogen often results in smallness and general weakness of bushes, leaf yellowing particularly at the margins of aged leaves through main veins (Walker, 2001).

Assigning the proper date of cultivation is very significant for greasy plants and it should be assigned on the basis of every region's climate separately. The best time for cultivation of a variety or a group of varieties is analyzed in a condition in which the collection of occurred environmental factors of that time for sprouting, stability and survival of plantlet are appropriate. Then, each stage of plant's growth has desired condition and it doesn't encounter with undesirable environmental status (anonymous, 2006).

Research of hesabi *et al* (2014)showed that Yarrow extract increased the germination percentage of flax.
Silva (2005) indicated in an experiment by delay in planting from May till July, the function of seed and the oil percentage of oil flax decline significantly. Garsid (1984) performed a study on four varieties of sunflower during February till July and indicated the amount of oil percentage and greasy linoleic acid decrease due to delay in planting. He said through on-time cultivation, the time exposes to cool weather after flower's inoculation upon seed expansion; then, Assimilates convert into oil more due to less breath.
The analysis of temperature's effect on the amount of flax greasy acids shows that delay in cultivation results in flowering and getting grain with high temperature simultaneously and therefore the quality of oil is different regarding the components of greasy acids (Green and marshall, 1984). One of the ways for expanding the qualitative and quantitative functions of studied plant is to perform cultivation management such as proper date of planting, and optimized consumption of nutrients (nitrogen).

But researches of greasy plants particularly oil flax are rare, and regarding numerous usages of oil flax in medicine and industry and shortage of resources, this research is necessary in use.

Since the exact time of planting and proper amount of consumed nitrogen influence the qualitative and quantitative functions of the plant, thus assigning precise time of planting and allocating the amount of demanding nitrogen in each region are the first step in relation to cultivation of a new plant.

The goal of this research is to study the effect of sowing dates and different amount of nitrogen on the qualitative and quantitative features of medical flax.

Materials and methods

Location of experiment plan

In order to investigate the effect of planting dates and various levels of nitrogen on the qualitative and quantitative features of experimental oil flax in Islamic Azad University of Yasooj Agriculture Research Station. latitude 30 degree 50 minutes, longitude 51 degree 41 minutes, at 1832 m of sea level, average yearly temperature of 14.8 C, average yearly raining of 877.2 mm and loam clay at depth of 6 cm, PH=7.21, absorbable phosphorus and potassium of 0.18% and 6.26%, 189 PPM with organic carbon of 0.9% via using scattered plots on the basis of randomized complete block design with 4 replications, this study is accomplished.

Planting in the the Farm

The planting dates included 4,6,8,10,12 on the basis of depth temperature of 5cm in main plots. The amount of pure nitrogen fertilizer in 4 levels in sub-plots included sample (no fertilizer) 50, 100 and 150 kg/ha; 50% of them during planting and 50% of them were used from the source of urea.

The seed of oil flax which was used in this research is Hungarian variety named Olaye Ozen. Preparation procedure of the land started in fall and when the temperature in the depth of 5 cm reached 4 C, the first planting date of oil flax was performed manually. Before planting, the demanding phosphorous and potassium regarding soil test distributed via using disc from the sources of super-phosphate and potassium sulfate in the amount of 90, 80 kg for the ground. Each border-strip had 12 lines with length of 6 m and the distance between each adjunct border-strip was one meter, and the space between two main border-strips was considered of 2 meters.

The seeds planted in the depth of 2 cm with row distance of 20 cm and the space of 6 cm on the row with the density of 833333.3 bushes per hectare.

Sampling method

After planting the flax in considered dates, the irrigation performed once each week via using siphon tube; then, weeds are weeding twice during the growth program. The measured features included: plant's height, number of adjunct branches, number of fruit, the weight of 1000-seed, harvest index, yield, solid substance of plant, leaf level index, and the growth speed of crop.

Statistical Analysis

The results obtained were analyzed using the statistical software MSTATC, EXCEL and the mean of data were compared by Duncan test.

Results and discussion

Biomass

The effect of various planting dates on biomass of the plant indicates that the most of biomass 420.4 gr relates to first planting date and the least biomass 289.2gr/m^2 relates to 5th sowing date (Table 1). The mutual effect among the various planting dates and nitrogen on biomass is significant in a way that most biomass of first sowing date is gained with 100 kg pure nitrogen in a hectare (Table 2). Therefore, due to delay in planting, the germination period is longer; the growth phase is shorter, and produced biomass decreases (Zargari, 2004).

*Crop Growth Rate (*CGR)

The planting date of CGR in 5% is significant (Table 1). First planting date shows the highest growth speed of 22.8 gr/day in every square meter rather than next planting dates. It can be understood due to delay in planting, the growth speed of crop also decreases and plant has to pass various phonology stages in shorter period (Demark, 1999). There is a significant difference between various levels of nitrogen in 5%. Thus, the most CGR is gained through 100 kg consumption of nitrogen in a hectare (Table 1).

Leaf area Index

The most leaf area index is 4.7 and 4.6 for the first and second planting dates and the least leaf area index is 1.9 of the 5th planting date (Table 1). Decrease in leaf area index is related to delay in planting due to non-adaptation of environmental status with growth condition of the plant.

Besides, the amount of crops and number of leaves

directly relate to the length of period between the beginnings of flowering and complete flowering of plant; the more this period declines due to delay in planting the more leaf area will decline (Turner, 2001).

Various nitrogen levels also are significant for the leaf area index. Then, the most leaf area index of 3.9 and 3.8 are gained with the pure nitrogen consumption of 100 and 150 kg/ha (Table 1).

Table 1. Effect of Sowing dates and Nitrogen different levels on the yield and yield component of Medicinal flax.

N (Kg/h)	Plant height (Cm)		Branch Nu/Plant		Fruit Nu/Plant		1000 grain Weight(g)		Grain (kg/ha)		yield LAI		Biomass (g/plant)		CGR	
0	65.22	B	16.54	C	43.14	B	6.11	A	1351.87	B	1.8	C	207.8	C	12.6	B
50	65.47	B	25.11	B	43.89	B	6.13	A	1392.45	B	2.3	B	312.1	B	13.2	B
100	70.36	A	38.24	A	71.67	A	6.22	A	1895.22	A	3.9	A	458.6	A	28.6	A
150	72.21	A	38.12	A	71.11	A	6.21	A	1882.12	A	3.8	A	451.5	A	27.1	A
Sowing date																
12.20	71.36	A	31.26	A	69.42	A	5.67	A	1801.12	A	4.7	A	420.4	A	22.8	A
1.01	68.22	B	35.19	B	69.91	A	5.61	A	1798.17	A	4.6	A	417.1	A	18.9	B
1.10	68.1	B	31.02	B	51.41	B	4.63	B	1532.24	B	3.2	B	345.7	B	18.1	B
1.20	57.36	C	23.51	C	51.22	B	4.59	B	1112.36	C	2.1	C	339.9	B	21.2	C
2.1	57.1	C	15.37	D	32.12	C	4.01	C	760.48	D	1.9	C	289.2	C	14.1	D

Means with similar letters in each column are not significantly different.

Table 2. The interaction of Nitrogen different levels and sowing date on mean of some quantity and quality characteristics of Medicinal flax.

Treatment	Plant Height)cm(		Branch Nu/plant		Fruit Nu/plant		1000 grain Weight(g)		Grain yield(g)		LAI		Biomass		CGR	
D_1N_1	51.2	D	17.2	D	47.9	D	5.4	B	11.4.12	DE	2.3	B	298.8	C	18.6	C
D_1N_2	58.3	C	22.5	C	55.8	C	5.7	B	1459.19	C	2.5	B	337.8	B	21.2	B
D_1N_3	69.8	B	35.9	B	78.5	A	6.6	A	2135.26	A	3.4	A	451.2	A	29.8	A
D_1N_4	77.1	A	39.1	A	75.7	A	6.8	A	2128.14	A	3.4	A	441.2	A	28.6	A
D_1N_1	50.2	D	19.5	D	42.2	D	5.1	BC	1005.18	E	2.1	BC	288.7	C	17.6	C
D_2N_2	57.1	C	25.2	C	47.8	D	5.4	B	1236.25	D	2.7	AB	321.9	B	18.1	C
D_2N_3	68	CD	36.6	B	56.9	C	5.9	B	1617.41	B	3.1	A	449.1	A	22.8	B
D_2N_4	70.4	B	41.3	A	59.1	C	6	AB	1719.36	B	3	A	445.6	A	22.1	B
D_3N_1	49.2	D	18.6	D	35.1	EF	4.9	C	820.19	F	2	BC	238.6	CD	16.4	CD
D_3N_2	55.2	C	24.2	C	39.2	E	5.4	B	951026	E	2	BC	282.5	C	18.2	C
D_3N_3	65.8	C	36.2	B	50.2	CD	6.6	B	1256.31	D	2.9	AB	352.7	B	20.2	B
D_3N_4	55.2	CD	37.7	B	51.3	CD	5.9	B	1189.29	D	2.8	AB	341.6	B	21.1	B
D_4N_1	38.2	EF	15.5	E	29.8	G	4.5	C	782.51	G	1.8	C	217.5	D	12.1	DE
D_4N_2	39.2	EF	20.2	DE	35.2	F	4.9	C	812.21	F	1.9	C	247.1	CD	15.2	CD
D_4N_3	45.5	DE	22.4	C	39.1	EF	5.2	BC	889.44	EF	2.3	B	332.2	B	17.3	C
D_4N_4	48.2	D	25.1	C	42.6	D	5.5	B	991.52	E	2.5	B	332.1	B	17.1	C
D_5N_1	32.1	F	8.6	F	21.1	G	4.1	D	491.61	I	1.2	D	179.1	E	23.8	DE
D_5N_2	38.1	EF	12.1	EF	24.2	FG	4.5	C	549.39	H	1.4	D	211.2	D	24.2	DE
D_5N_3	45.2	DE	14.2	E	33	EF	4.7	C	623.12	GH	1.9	C	278.1	C	16.9	D
D_5N_4	43.2	DE	15.8	E	34.2	EF	4.8	C	652.28	GH	1.9	C	271.2	C	16.1	D

Means with similar letters in each column are not significantly different.

$N_1 = 0kg/haN$ ، $N_2 = 50kg/haN$ ، $N_3 = 100kg/haN$ ، $N_4 = 150kg/haN$

=12/20 D_1 =1/1، D_2 =1/10، D_3 =1/20، D_4 =2/1، D_5

Thousand grain weights

The weight of 1000-seed is not affected by different nitrogen levels, but it is influenced by various planting dates (Table 1). Then, the maximum weight of 1000-seed is 5.67 Gr and 5.61 Gr which are related to first and second planting dates; the minimum weight of 1000-seed is 4.01 obseeved in 5th planting date.

It is interpretable that the time of getting seeds coincidences with days in which the high heat temperature and expansion in breathing block getting the seeds and then it leads to decline in saved components of the plant. Heat influences the procedure of material transforming to seeds and this disorder leads to lightness or porosity of seeds (Alyari, 2006).

Plant Height, Number of Branches per Plant, Number of Fruits per Plant

According to results of averages, the influence of various nitrogen levels on the height of plant, number of branches per plant and number of fruits per plant are significant (Table 3).

Table 3. Analyze variance of data squares from quality and quantity characteristics of Medicinal flax.

S.O.V	df	Plant Height (cm)	Branch Nu/plant	Fruit Nu/plant	1000 grain Weight(g)	Grain yield (kg/ha)
R	6	65.836ns	3.714ns	47.615ns	0/495 ns	33157.036ns
Sowing data(A)	4	1584.352**	729.119**	4893.492**	53.92**	4099091.035**
Error	24	24.48	12.391	17.747	0.267	12994.083
Nitrogen(B)	3	4270.58**	731.223**	3414.18**	0.086ns	13332119.499
AXB	12	68.024	35.726**	34.481*	0.071ns	322926.682**

* And ** significant at the 5 and 1% levels of probability, respectively.

The highest plant, the maximum number of branches per plant and the number of fruits per plant are gained via using 100, 150 kg/ha of nitrogen. Then, there is not any significant difference between two levels of 100, 150 kg/ha of nitrogen (Table 1). The results of this experiment adapt with experiments of Omid Bagheri and *et al* (2001), and Green (2000).

Grain yield

Seed's function regarding various planting dates has significant difference of 1% (Table 3). There is not any significant difference between first and second planting dates but there are significant differences between first (1801.12), second (1798.17), third (1532.24), fourth (1112.36), and fifth (760.48) planting dates of 1%.

Since the length of vegetation period in the first and second planting dates is longer than later planting dates, there is more time for plant's function in that heat and moist condition. It is assumed that function of seed decreases too due to shortening growth season and encountering flowering time and getting seed during hot summer (Hans, 2002).

The effect of various nitrogen levels on the function of seed show significant difference of 1% (Table 1). The maximum operation is 1895.22 kg/ha and the minimum operation is 1351.87 kg/ha which are gained with 100 kg consumption of pure nitrogen in sample group.

Conclusion

This research has been performed to study the effect of sowing dates and different amount of nitrogen on yield and yield component of medical flax. The results of complex 2-year analysis of data indicate that with delayed sowing grain yield and weight of thousand seeds were reduced significantly.

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