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Measuring the Yield and Its Components of Canola Cultivar by Different Plant Densities in the West Mazandaran (Iran)

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ABSTRACT

Background: The aim effects of planting density on yield and its components of canola of three cultivars of winter canola and planting them in the test treatments and variety**,** factorial experiment in randomized complete block design in three replicates in which the planting distance in 3 levels: 35, 45 and 55 cm and three varieties. **Objective**: This experiment was carried out in 2011-12 crop season. **Results**: The results showed that effect of variety simple has significant on the number of branches in plants ($P<0.05$), number of pods on main stem and grain yield ($P<0.01$). The effect of planting distance has a significant effect on the number of branches and pods on main stem ($P<0.01$) and on grain yield ($P<0.05$) has significant. **Conclusion**: In mean comparison of varieties was found that the varieties of Zarfam in comparison with the average 2599 ($Kg.ha^{-1}$) maximum and Hyola 401varieties with an average 1575.7($kg.ha^{-1}$) had the lowest grain yield. Also in mean comparison interaction varieties and planting distance was most biological yield in this study, varieties Zrfam mean 12963.8 ($Kg.ha^{-1}$) and planting distance of 45 cm and this trait varieties Hyola 401 the lowest mean 8884.6 ($Kg.ha^{-1}$) and planting distance 35 cm is obtained.

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INTRODUCTION

Canola (*Brassica napus* L.) is a valuable oil seed that has attracted the attention of many people in recent years. This plant has been given a great importance in the plan for "oil seed import reduction". The canola plant, on account of enjoying high percentage of oil and protein, was ranked third and second, respectively among the oil seeds. This plant grows annually in the favorable weather conditions (Angadi *et al*.,203). The meal and oil are two products extracted from this plant. The canola seed contains 40-50 percent oil (Crubbens and Denton, 2004). Canola oil contains a desirable profile of saturated fatty acids (7%) and high level of unsaturated fatty oleic acids (about 61%) and medium level of unsaturated fatty linoleic acids (21%) and linoleic acid (11%). The average yield of oil crops in Iran is 245000 ton (Area harvested 521000 ha), whereas the world average yield of oil crops is 261,099,000 ton (Area harvested 157,382,000 ha) as stated by FAO (2010). In oilseed rape, row spacing or plant density vary considerably worldwide, depending on the environment, production system and cultivar. Previous studies have shown that plant density is an important factor affecting rapeseed yield (James *et al*.,1994). Plant density in rapeseed governs the components of yield, and thus the yield of individual plants. A uniform distribution of plants per unit area is a prerequisite for yield stability (Diepenbrock 2000). Al Barzinjy *et al* (1999) investigated the effects of different plant densities ranging from 20 to 130 plants/m2 in rapeseed. They concluded that pods per plant, seed weights and dry matter per plant decreased as plant density increased. Leach *et al*. (1999) also reported that plants grown at high density had fewer pod-bearing branches per plant but produced more branches and that with an increase in density 1000-seed weight increased. The same researchers also observed that there was no effect of density on seed oil content. Rapeseed is sometimes grown in rows with spacing wide enough to allow for mechanical cultivation. In most areas where herbicides are used, the crop is either broadcast seeded or planted in drill rows spaced 15–20 cm apart (Lewis and Knight 1987). Rapeseed has generally slight or inconsistent seed yield responses to various row spacing's. Therefore, optimum densities for each crop and each environment should be determined by local research. The researches mentioned above show that for reaching to the maximum yield in each region, an optimal density is needed (Potter *et al*.,202). On the other hand, this amount changes under the effect of different conditions, Changing in the seed or density ratio causes the change of maturity time and/or the way of harvest, so that moisture of seed decreases in harvest time or density increases (Ghosh and Mukhopadhyay ,1994). In researches of Clarke and Simpson (1978), the

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maximum yield was obtained from the minimum amount of seed (1.5 k/ha) and they concluded that producing of subshrubs and pod, neutralizes the effect of density decrease and the yield is remained fixed or it does not change drastically, but Morrison (1990), reported the increasing of yield under the influence of increasing of density. The decrease of "row spacing" causes increasing of plant spacing on row, and more consistent distribution of them, and it consequently leads to competition decreasing and yield increasing.

An experiment to study the Effects of plant density on some morphological traits of canola cultivars was conducted at the Noor region, Mazandaran, Iran. The purpose of this study was to understand morphological changes in different cultivars at plant density.

MATERIAL AND METHODS

In this field experiment was conducted in 2011-2012 in Noor region ,Iran .According to the weather , the weather hot and humid regions of the with mild winters and hot summers and temperate and humid tropical areas is public. To determine the effects of planting density on yield components of three cultivars of rapeseed fall and planting them in the test treatments and variety**,** Factorial experiment in randomized complete block design in three replicates in which the planting distance in 3 levels: 35, 45 and 55 cm in 3 levels and varieties, including Sarigol, Zarfam and Hyola 401. At the end of the growing season, to determine the agronomic characteristics of each experimental plot, 10 plants were randomly selected and their characteristics were measured. According to statistical data model factorial design in randomized complete block analysis of variance was simple and mean comparison using Duncan's multiple range test was performed. Comparison of data for analysis and statistical software MSTAT-C – SPSS and Excel software was used for drawing diagrams.

RESULTS AND DISCUSSION

Grain Yield:

Grain Yield of rapeseed is the most important traits, can be affected in varieties , different treatments and different climates and the volatility is large (Shirani rad *et al*.,2005). In mean comparison of Varieties was found that the varieties in comparison with the average Zarfam 2599 ($Kg.ha^{-1}$)) maximum and Hyola 401 varieties and with an average 1575.7 ($Kg.ha^{-1}$)) had the lowest grain yield. This is difference a significant between the varieties (table 1). In the mean comparison distance of planting on yield attributes of varieties of the highest Hyola 401with an average 2211.4 ($Kg.ha^{-1}$) and the Sarigol character to the lowest mean is 1983.4 kg per hectare that the simple analysis of data in normal distribution, this difference was significant (table 1). According to various research studies on the performance of different density can be changed given that the density of plants per hectare, the planting distance between plants on line and the line has fluctuated. And regional plans, the use of varieties Hyola 401 introduced to the short height is not a good performance .Chen *et al*, The study of four different concentrations of 1,3,6 and 9 plants per square foot of rapeseed ,Three planting dates, they observed an increase in density to 32 plants per square meter increased performance, But was observed with the increasing density of the reduced performance. The highest yield on 16 April and the density was 32 plants per square meter (Chen *et al*.,2008).

The number of branches per plant:

Simple effects of planting distance and number of branches per plant in the level of five percent and one percent is in the critical region**,** The interaction of cultivar and planting distance was not significant on the branches of the rapeseed plant (Table 1). Effect of planting distance on average than the maximum number of branches per plant, branches per plant Hyola 401with mean 3.1 and the lowest number of branches per plant, number of Sarigol with mean 2.2 is the time difference has been significant analysis of variance (Table 1).

In the mean interaction between cultivars and planting was found that the highest number of branches per plant of canola in this study, the Sarigol is 55 cm row spacing. The interaction is also shown that with increasing density (planting distance of 35 cm) is reduced of the number of branches per plant.

The number of pods on lateral branches:

Simple effects of planting distance and number of pods on lateral branches is probably a significant percentage the interaction of cultivar and planting distance has no significant effect on the lateral branches and pods per plant of canola. In the mean interaction between cultivars and planting was found that the highest number of pods on lateral branches in this study**,** Zarfam varieties with an average of 33.4 and the planting distance of 55 cm and a Sarigol with the average minimum is about 20.1 and the planting distance of 35 cm (Table1)**.** Johnson and Hanson (2003), reported a higher performance culture within narrower than wider rows, the plant is uniformly distributed, The proper distribution of solar radiation in vegetation and reduce is competition within species and this will increase the number of pods per plant.

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The number of pods on main stem:

Simple effects were significant numbers of pods on main stem (P<0.01). The effect of planting distance and the interaction between cultivars and planting on the main stem, number of pods per plant canola is not significant (Table 1). In the mean interaction between cultivars and planting was the largest bag in the main stem in the present study , a Sarigol with the average 40.4 and planting distance of 35 cm and the lowest trait varieties Hyola 401with an average 25.5 and the planting distance is 35 cm.

Table 1: Mean Comparison the effect of cultivars and planting density on canola agronomic traits.

Treatment	Grain yield ($Kg.ha^{-1}$)	The number of branches per plant	The number of pods on lateral branches	The number of pods on main stem
Variety(A)				
V_1=Sarigol	2359.6a	2.8a	23.3b	38.6a
V_2=Zarfam	2454.8a	2.3b	29.3a	37.6a
V_3=Hyola 401	1575.7b	2.8a	20.3c	28.5b
Planting density (B)				
$R.S_1$=35*30 cm	1983.4b	2.2c	21.2c	34.4a
$R.S_2$=45*30 cm	2195.4a	2.7b	24.2b	35.1a
$R.S_3$=55*30 cm	2211.4a	3.1a	27.3a	35.2a
Variety* Planting density (AB)				
$V_{1*}PD_1$	2068.2bc	2.2cd	20.1de	40.4a
V_{1*} PD_2	2441.8a	2.8abc	22.4de	35.9a
V_{1*} PD_3	2568.8a	3.4a	27.1bc	39.6a
V_{2*} PD_1	2448.5a	1.9d	24.5cd	37.4a
V_{2*} PD_2	2599.5a	2.4b-d	29.8ab	36.5a
V_{2*} PD_3	2316.5ab	2.8ab	33.4a	39.1a
V_{3*} PD_1	1433.4d	2.5bc	18.9e	25.5b
V_{3*} PD_2	1544.8d	2.9ab	20.5de	33ab
V_{3*} PD_3	1748.9cd	3.1a	21.5de	27.1b
Significant (M.S)				
A	**	*	**	**
B	*	**	**	NS
A*B	NS	NS	NS	NS
CV%	9.5	13.2	11.2	14.3

Means with similar letter were not significant at the 5% probability level.
Levels of significant:* =P< %5, **= P<%1 and NS = not significant

Biological Yield:

A simple analysis of variance showed that effect simple of variety and row spacing was significant on biological yield (P<0.01,0.05).In mean comparison of varieties the Zarfam variety of highest (12020.9 $Kg.ha^{-1}$) and Hyola 401 variety of minimum (10681.5 $Kg.ha^{-1}$) obtained the biological yield. Also noted that 95% of the difference between varieties may be seen in the critical region (Table 2). Also in mean comparison interaction varieties and planting distance was most biological yield in this study, varieties Zrfam mean 12963.8 ($Kg.ha^{-1}$) and planting distance of 45 cm and this trait varieties Hyola 401 the lowest mean 8884.6 ($Kg.ha^{-1}$) and planting distance 35 cm is obtained. Given the low density of these treatments, this study has shown that the biological yield is reduced. This may be due to the lower branches occur at lower densities and also reduced the stem diameter may be from other factors.

Harvest Index:

A simple analysis of variance showed that Simple effect of varieties and interaction effect of varieties and distance planting (P<0.01) as the simple effect of distance planting on harvest index is significant (P<0.05) (Table 2). In mean comparison Varieties was found that Zarfam varieties (20.6%) the highest of percent and of varieties Hyola 401 had percent lowest (15.1 %) harvest index. In mean comparison interaction varieties and planting distance was found that the highest harvest index in this study, a Sarigol with the average 22.7 percent and with distance planting of 55 cm and had the lowest harvest index Zarfam Varieties (13.3 %) and planting distance of 45 cm (Table 2). In addition, research has shown that plants that were planted in 15 cm row spacing, Canopy closure took them 2 to 3 days (Johnson and Hanson, 2003).

Oil Content:

A simple analysis of variance showed that Simple varieties of the seed oil was significantly (P<0.01). The comparison showed that varieties mean varieties Zarfam 41.9 of the most and Sarigol with a mean of 28.9 percent allocated to the lowest seed oil, as noted above ,this difference was significant among the varieties(P<0.01) (Table 2). In the mean interaction between varieties and sowing was found that the highest percentage of oil in this study Zarfam varieties with an average 42.8 % and 35 cm row spacing, also the lowest value of this attribute to a Sarigol is obtained with the average 27.8 % and planting distance 35 cm. In this study,

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the density has no significant effect on the varieties the varieties of varieties Zarfam won the highest percentage of oil, In this study has not been seen the relationship between density and seed oil.

Table 2: Mean Comparison the effect of cultivars and planting density on Canola agronomic traits.

Treatment	Biological Yield (Kg.ha^{-1})	Harvest Index (%)	Oil Content (%)
Variety(A)			
V_1=Sarigol	11486.8ab	20.6a	28.9c
V_2=Zarfam	12020.9a	20.7a	41.9a
V_3=Hyola 401	10681.5b	15.1b	32.1b
Planting density (B)			
R.S_1=35*30 cm	10133.5c	19.4a	34.4a
R.S_2=45*30 cm	12612.4a	17.6b	33.7a
R.S_3=55*30 cm	11443.4b	19.4a	34.8a
Variety* Planting density (AB)			
V_1*PD_1	10116.5cd	20.2abc	27.8d
V_1* PD_2	12946.2a	18.8c	29.2cd
V_1* PD_3	11347.9abc	22.7a	29.7cd
V_2* PD_1	11349.5abc	21.6ab	42.8a
V_2* PD_2	12963.8a	20.8abc	40.5a
V_2* PD_3	1174936abc	19.7bc	42.4a
V_3* PD_1	8884.6d	16.2d	32.7b
V_3* PD_2	11927.4ab	13.3e	31.3bc
V_3* PD_3	11232.7bc	15.6de	32.2b
Significant (M.S)			
A	*	**	**
B	**	*	NS
A*B	NS	*	NS
CV%	8.2	8.3	5.2

Means with similar letter were not significant at the 5% probability level.
Levels of significant:* =P< %5, **= P<%1 and NS = not significant

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