Zagazig J. Agric. Res., Vol. 33 No. (3) 2006 401 - 411

EFFECT OF SOWING AND HARVESTING DATES ON YIELD OF CANOLA (*Brassica napus* L.) UNDER SANDY SOILCONDITIONS

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Accepted 2/ 4 / 2006

ABSTRACT: Eight field experiments were carried out at the Experimental Farm, Al-Khattara region, Faculty of Agriculture, Zagazig University, Sharkia Governorate, Egypt, during two winter successive seasons (2003/2004 – 2004/2005). The experiments aimed at studying the effect of four sowing dates (first and mid of October, first and mid of November) and harvesting dates (harvesting after 13, 16, 19 and 22 day from full siliquae set) as well as their interactions on yield of canola "cv. Pactol".

Sowing dates significantly affected all estimated characters in both seasons and their combined analysis over them. Where, sowing in mid of October produced the highest number of siliquae/plant, number of seeds/siliqua, seed yield/plant and seed yield/fad..

Delay in harvesting date from 13 to 22 day from full siliquae set was followed by a respective significant increase in thousand seed weight and hence seed yield/fad. in both seasons and the combined. Whereas, number of siliquae/plant, number of seeds/siliqua and seed yield/plant were not significantly affected by harvesting date in both seasons and in their combined analysis.

Concerning the interaction effect, the obtained results indicated that thousand seed weight and seed yield/plant were the only significantly affected by the interaction between the two studied factors.

Key words: Canola, sowing dates, harvesting dates, under sandy soil conditions

INTRODUCTION

Canola (*Brassica napus* L.) recently moved up to the world has third most important edible oil source after soybean and palm, and has the largest annual growth rate of the ten major edible oils (Downey, 1990). The expansion of world cultivated area with canola is attributed to some aspects; oil contains both low erucic acid (2%) and low defatted meal (30um/g of aliphatic glucosinolates). Moreover, it is tolerant to drought and salt, and hence can be grown in new reclaimed soils. With the use of saline irrigation water. The crop is adaptable to Egyptian conditions in winter season. For these reasons, more attention has been paid for cultivating canola as an oil crop in Egypt to overcome the wide gab in oil production needed for national consumption. Canola, like other crops, needs proper cultural practices to give satisfactory yield of seeds and oil. Since, oil and quality yields are greatly affected by both sowing and harvesting dates. Therefore, it is necessary to study the effect of both sowing and harvesting dates on yield of canola

Regarding sowing date effect: Boughadady *et al.* (2003) in Egypt, found that the promising date was of October compared with other two sowing dates i.e. 15 September, 1 November. This was true in all yield components. Fathi *et al.* (2003) in Iran, found that any delay in sowing date beyond 7 November caused a reduction in all yield components particularly number of pods/plant, At the same time, Leilah *et al.* (2003) in Kingdom Saudi Arabia, recorded that early sowing date (mid of October) was associated with the highest number of pods/plant as well as seed yield/ha.. Moreover, Rabiee *et al.* (2004) observed significant effects on yield and yield components like, seed yield, thousand seed weight and number of pods/plant due to varying the date of sowing.

Respecting harvesting date: Zaman *et al.* (1994) in Bangladesh, found that shattering loss was increased with yellow pod percentage in a linear fashion. However, up to 80% yellow pod, yield was increased because any loss was compensated by an increase in seed weight, but this was not true with the 100% yellow pod or over-ripping, as the increased shattering loss led to a fall in yield. Abbosdakht *et al.*, (2001) in Iran, stated that harvesting date had a significant effect on thousand seed weight and

hence seed yield. They added that among the yield components, the number of pods on the main stem and the number of seeds per pod were significantly correlated with seed yield/ha.. Therefore, the present investigation was planned to find out the influence of sowing and harvesting dates on yield and yield components of canola under sandy soil conditions.

MATERIALS AND METHODS

Eight field experiments were carried out at the Experimental Farm, Al-Khattara region, Faculty of Agriculture, Zagazig University, Sharkia Governorate, Egypt during two winter successive seasons (2003/2004 – 2004/2005). The experiments aimed at studying the effect of four sowing dates (first of October, mid of October, first of November and mid of November) and harvesting dates (harvesting canola plants after 13, 16, 19 and 22 day from full siliquae set) as well as their interactions on yield of canola "cv. Pactol".

The soil of the experimental field was sandy in texture, had an average PH value of 7.8; 0.51 organic matter and 11.5, 3.2 and 255 ppm available N, P and K, respectively (averaged over of the two seasons for the upper 10 cm and 30 of soil depth). The study included a separate experiment for each sowing date, and four harvesting dates i.e. 16 treatments. Each experiment i.e. sowing date was laid out in a randomized complete block design with three replicates. The treatments of both factors were as follow:

A- Sowing dates were as follows:

1- Sowing on October 1st

2- Sowing on October 15th

3- Sowing on November 1st

4-Sowing on November 15th

B-harvesting dates were as follows: H_1- the 1st harvesting date was done when the colour of seed coat presented in the lower zone of the terminal racime was yellowish, it was practiced at 13 day from full siliquae set.

H_2- the second harvesting date was done when the colour of seed coat presented in the lower zone of the terminal racime was brown, it was practiced at 16 day from full siliquae set.

H_3- the 3rd harvesting date was done when the colour of seed coat presented in the lower zone of the terminal racime was darkish, it was practiced at 19 day from full siliquae set.

H_4- the 4th harvesting date was done after three days from the latter date of harvesting i.e. the 3rd one. The experimental unit included 7 rows 40 cm in width and 2, 40 m in length, occupying an area of 6.72 m^2. The preceding crop was maize in the 1st season and fallow in the 2nd one. Nitrogen in form of ammonium sulfate (20.6 % N) was supplied from thinning (30 DAS) up to flowering stage at the rate of 90 kg N/faddan, in 10 splits. Phosphorous fertilizer was applied during seed bed preparation in the form of superphosphate (15.5% P_2O_5) at a level of 15.5 kg P_2O_5/faddan. Potassium fertilizer in the form of potassium sulphate (50 % K_2O) was added partly in two doses i.e. at thinning and at flowering stage i.e. 30, 81 days after sowing. The normal cultural practices of canola were applied properly as recommended for the region.

The outer two rows of each plot were left as border, where five guarded plants were taken from the 2nd and 5th rows to determinate the following characters at harvest:

1-Number of siliquae /plant

2-Number of seeds/siliqua

3-Thousand seed weight (g)

4-Seed yield /plant (g)

In order to determine seed yield /faddan (kg) two central rows were harvested i.e. the 3rd and 4th ones and calculated per faddan.

Statistical analysis of each experiment was performed as outlined by Steel and Torrie (1980). Significantly of differences between the various means were compared with the help of Duncan's multiple range test (Duncan's, 1955).

In the interaction Tables capital and small letters were used for the comparison among row and columns means, respectively.

RESULTS AND DISCUSSION

A. Seed Yield Components

Sowing date effect

As shown in Table 1 significant differences could be detected among the four sowing dates in the three yield components under study.

Regarding number of siliquae /plant and number of seeds/siliqua, mid of October produced the highest number of seeds/siliqua followed by mid of November sowing date. Differences in both number of siliquae/plant and number of seeds/siliqua were much greater in

Table 1 :Number of siliquae/plant, number of seeds/siliqua and thousand seed weight (g) d by sowing and harvesting dates (both season and their combined analysis)

Main effects and interaction	No. of siliquae/plant			No. of seeds /siliqua			Thousand seed weight (g)		
	2003/2004 season	2004/2005 season	Combined analysis	2003/2004 season	2004/2005 season	Combined analysis	2003/2004 season	2004/2005 season	Combined analysis
Sowing date (D):									
1st October	200.2 d	194.6 d	197.4 d	23.1 c	22.7 c	22.9 c	2.58 a	2.49 b	2.53 c
Mid October	331.0 a	296.2 a	313.6 a	25.5 a	24.6 a	25.0 a	2.30 c	2.28 c	2.29 d
1st November	281.5 b	263.9 b	272.7 b	23.4 bc	23.4 bc	23.4 bc	2.92 a	2.89 a	2.91 a
Mid November	265.2 c	230.4 c	247.8 c	24.0 b	23.7 b	23.9 b	2.84 a	2.78 a	2.81 b
F. test	**	**	**	**	**	**	**	**	**
Harvesting date (H):									
Days from full siliquae set:									
13 day	269.4	246.1	257.6	24.4	23.5	24.0	2.34 d	2.29 d	2.31 d
16 day	269.3	247.0	258.2	24.0	23.8	23.9	2.58 c	2.49 c	2.53 c
19 day	269.7	246.0	257.9	23.9	23.5	23.7	2.79 b	2.75 b	2.77 b
22 day	269.8	245.9	257.8	23.7	23.6	23.7	2.94 a	2.91 a	2.92 a
F. test	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
Interaction:									
D x H	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N. S	N.S

October sowings than in November sowings. A response possibility due to different climatic conditions examined by the various sowings dates was expected. Similar results were in general, found by Bughadady *et al.* (2003) in Egypt, who found that the promising date was of October compared with other sowing dates. This was true in all yield components. The reverse was true for thousand seed weight, where, the 1st November sowing gave the heaviest weight, in both seasons and in the combined analysis. In this respect, Lutman and Dixon (1987) reported that late sowing produced slightly smaller seeds but more seeds/siliqua of canola than early one.

Harvesting date effect

With respect to the effect of harvesting date, the results clearly indicated that there was no significant differences in both number of siliquae/plant and number of seeds/siliqua among the four harvesting dates which ranged from 13 up to 22 days from full siliquae set. This was clear through the two seasons and the combined analysis. However, any delay in harvesting date was followed by a respective significant increase in thousand seed weight. This was clear through the two seasons and the combined analysis. Where, as seen in the pooled data and compared to the earliest date of harvest, the relative increase in thousand seed weight due to delaying harvest date from 16, to 19 and 22 days from full siliquae set was 8, 21.7 and 26% respectively. Similar results were also found by Suraj Bhan *et al.*, (1980) who reported that delay harvesting date until full maturity of canola increased thousand seed weight compared to harvesting at physiological maturity.

Interaction effect

Data presented in Table 1-a reveal the effect of sowing dates with harvesting dates interaction on thousand seed weight.

Regarding sowing date effect, it might be said that November sowings had the heaviest seed weight compared to October sowings, this was in general true for all harvesting dates. On the other hand, under October sowings harvesting after 19 and 22 days from full siliquae set had higher values of thousand seed weight compared to 13 day harvesting date. However, for the late sowing date of mid November a gradual increase in thousand seed weight could be noticed due to any delay in harvesting date from 13 till 22 days from full siliquae set.

Table 1-a: Thousand seed weight (g) as affected by the interaction between sowing and harvesting dates (combined analysis)

Sowing date	Harvesting date (Days from full siliquae set)			
	13	16	19	22
1st October	C 2.18 bc	BC 2.41 b	AB 2.70 b	A 2.84 b
Mid October	C 2.09 c	BC 2.26 b	AB 2.34 c	A 2.47 c
1st November	C 2.56 a	B 2.79 a	A 2.06 a	A 2.22 a
Mid November	D 2.42 a	C 2.68 a	B 2.98 a	A 3.17 a

B. Seed Yield

Sowing date effect

It was evident, from Table 2, that seed yield/plant (g) and seed yield /faddan(kg) as affected by sowing dates, it was found that mid of October as well as mid of November sowings had statistically the same highest seed yield /plant. Meantime, it was observed that mid of October sowing had the highest seed yield (kg/faddan) followed by mid of November sowing. This was true in both seasons and in the combined analysis. The increased seed yield per plant (g) and per faddan (kg) in mid of October sowing was a consequence of increases in some yield components, like number of siliquae/plant, number of seeds/ siliqua and thousand seed weight (Table 1). The same results were found by Leilah *et al.*(2003) who showed that sowing in the mid of October was associated with the highest seed yield of canola per plant and per faddan of canola.

Harvesting date effect

Respecting harvesting date, the results of both seasons as well as their combined analysis showed no significant differences in seed yield/plant due to varying harvesting date from 13 up to 22

Table 2: Seed yield/plant(g) and seed yield / faddan (kg) as affected by sowing and harvesting dates (both seasons and their combined analysis)

Main effects and interaction	Seed yield/plant (g)			Seed yield/faddan (kg)		
	2003/2004 season	2004/2005 season	Combined analysis	2003/2004 season	2004/2005 season	Combined analysis
Sowing date(D):						
1st October	10.29	9.45 c	9.87 c	459.0 d	456.9 b	458.0 d
Mid October	15.05 a	14.14 a	14.59 a	1205.0 a	1191.0 a	1198.0 a
1st November	13.98 b	13.09 b	13.53 b	766.1 c	754.4 c	760.3 c
Mid November	14.87 a	14.80 a	14.34 a	1151.9 b	1138.0 a	1145.0
F. test	**	**	**	**	**	**
Harvesting date (H):						
Days from full siliquae set:						
13 day	13.40	12.29	12.84	892.6 b	883.9 b	888.3 b
16 day	13.54	12.64	13.09	895.1 ab	885.0 ab	890.0 ab
19 day	13.66	12.95	13.29	898.3 a	886.0 a	892.1 a
22day	13.58	12.60	13.09	896.1 ab	885.4 ab	890.8 ab
Interaction:						
D x H	*	*	*	N.S	N.S	N.S

days. Whereas, the only significant difference in seed yield / faddan was recorded between 13 and 19 days from full siliquae set infavour of the latter.

Interaction effect

The effects of the interaction between sowing and harvesting dates on seed yield/plant are given in Table 2-a. It would appear that mid Oct. as well as mid Nov. sowing had the highest seed yield/plant, whereas the lowest values were associated with the early sowing of the 1st Oct., this was clear for all harvesting dates.

On the other side, for mid Nov. sowing, the only significant difference in seed yield/plant was found between 16 and 22 days harvesting dates infavour of the first. But, for the other three sowing dates, there was no significant differences in seed yield/plant among the all harvesting dates ranged from 13 up to 22 days from fill siliquae set.

Table 2-a: Seed yield/plant (g) as affected by the interaction between sowing and harvesting dates (combined analysis)

Sowing date	Harvesting date (Days from full siliquae set)			
	13	16	19	22
1st October	A 9.660 c	A 9.618 c	A 10.137 c	A 10.064 c
Mid October	A 14.403 a	A 14.237 ab	A 10.024 a	A 14.710 a
1st November	A 13.173 b	A 13.602 b	A 13.691 b	A 13.667 b
Mid November	AB 14.136 ab	A 14.914 a	AB 14.382 ab	B 13.908 ab

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تأثير مواعيد الزراعة والحصاد على محصول الكانولا تحت ظروف الأراضي الرملية

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أقيمت ثماني تجارب حقلية خلال موسمي ٢٠٠٣/٢٠٠٤ و٢٠٠٤/٢٠٠٥ بالمزرعة التجريبية بكلية الزراعة- جامعة الزقازيق بمنطقة الخطارة - بمحافظة الشرقية، لدراسة تأثير أربعة مواعيد للزراعة (أول أكتوبر، منتصف أكتوبر، أول نوفمبر ومنتصف نوفمبر) و أربعة مواعيد للحصاد (بعد ١٣، ١٦، ١٩و٢٢ يوم من تمام عقد الخرادل) على المحصول في الكانولا صنف "باكتول".

كان لمواعيد الزراعة تأثيرا معنويا على جميع الصفات تحت الدراسة خلال الموسمين وكذلك التحليل المشترك، حيث وجد أن الزراعة المبكره في منتصف أكتوبر أدت إلى زيادة عدد الخرادل/النبات، عدد البذور/الخردلة، محصول البذور/النبات(جم) ومحصول البذور (كجم)/الفدان.

أدى التأخير في الحصاد من ١٣ إلى ٢٢ يوم من تمام عقد الخرادل إلى زيادة معنوية في وزن الألف بذرة (جم) ومحصول البذور (كجم)/الفدان خلال موسمي الدراسة و التحليل المشترك و على العكس من ذلك لم يكن لأي من مواعيد الحصاد أي تأثير معنوي على كل من عدد الخرادل/النبات، عدد بذور الخردلة ومحصول البذور/النبات.

أوضحت نتائج التحليل التجميعي للموسمين التأثير المعنوي لتداخل الفعل بين مواعيد الزراعة ومواعيد الحصاد على كل من وزن الألف بذرة (جم) ومحصول البذور/النبات بينما لم يكن هناك تأثير معنوي لتداخل الفعل بين عاملي الدراسة على كل من عدد خرادل النبات وعدد بذور الخردلة ومحصول بذور الفدان(كجم).

وبناء عليه فإن هذه الدراسه توصى بزراعة الكانولا فى منتصف أكتوبر مع تأخير الحصاد الى ثلاث أسابيع من تمام عقد الخرادل و هوالتأثير العلم لكل من عاملى الدراسة حيث لم يكن لتداخل الفعل بينهما تاثيراً معنوياً على محصول البذور/الفدان وذلك تحت ظروف الأراضى الرمليه بمحافظة الشرقيه.