Effect of planting date and planting pattern on quality and quantity yield of canola hybrid seed (Hayola 401)

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ABSTRACT

In order to determine of planting pattern and planting date on quality and quantity yield of Canola a field experimental was conducted in 2008 at Dezful Safiabad research center in a complete block design with four replicates. Treatments were: planting date (2008/12/3 and 2008/11/16) and tow level planting pattern (8:2 and 12:2) that was tow line in a row. In this research different ratio level of paternal and maternal line evaluated. Result indicated that planting date has a significant effect on biological yield (2324 k/ha), grain yield (407 k/ha), seed size (5.8g), harvest index (17.53%), number of pod in plant (147). And planting date 2008/11/16 was higher than another one, the effect of planting pattern on biological yield (2289 k/ha), grain yield (351 k/ha), seed size (5.8g) and number of pod in plant (136), were significant in 5% level. The effect of planting pattern (8:2) on biological yield, grain yield was better than (12:2), but has not significant effect on harvest index, number of seed in pod and plant height.

Key word: canola, planting pattern, quantity and quality yield, planting date

Introduction

Canola has unique characteristics among oil seeds. This plant averagely has the 40-45 percent of oil in the grain. 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 linolenic acid (11%). This plant can easily be placed in alternation with cereals as a one-year autumnal oil-seed plant. Although this plant has entered Iran from years ago, there is not a considerable increase in planted areas, yet. In the farming year of 2003-2003, Mazandaran province had the highest planted area of 30598 hectares, and Golestan, Fars and Khuzestan provinces were in the second, third and fourth ranks, respectively. According to annual increase of planted areas of this plant, and necessity for preparing the seed of this plant, with the effects of ministry of Agricultural Jihad, from some years ago, producing hayola 401 hybrid seed has been started in the country and - because of certain weather conditions- in Khuzestan province [1]. Gross [15], reported in the effect of planting date on the growth stages of spring canola that by delaying in planting date, the required time for vegetative and reproductive growth gets shorter which leads to decrease in total performance.

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comparing to October 25th and November 11th, is the best planting time because it does not meet the cold season. Various tests in different regions emphasize on the planting of canola in September. This planting date may change in Khuzestan province because of big difference with the regions mentioned above. Also, some researches have been done about the effect of different planting patterns and density on the canola growth; so that Danayi [8], studied the effect of planting pattern and the amount of seed on the quantity and quality yield of canola with the cultivar of RGS003 in the region of Behbahan. Results showed that the maximum yield with the usage of 4 and 6 kg per hectare of seeds obtaine respectively by the yield of 2640 and 2494 k/ha. Also a stack with a width of 60cm and with two planting rows and usage of 4kg seed per hectare produces the maximum yield.

Jalal Abadi et al., conducted an experiment in the weather conditions of Ahvaz to study the effect of density and nitrogen fertilizer on the quantity and quality of canola oil hayola 401. They belive that the production of hybrid seed, and for commercial usage, line ratio of 2:8 usually is used. Due to the importance of canola seed producing in Khuzestan province, and because it is a new work, this test has been done to study the effects of planting date and planting pattern on the yield and yield components in the region of Safiabad, Dezful.

Materials and Methods

This experiment has been conducted in farming year of 2008-2009 in the agricultural research center of Safiabad, Dezful. This region is in the 32 degrees and 25 minutes of north latitude; and 48 degrees and 16 minutes of north longitude; and its height from the sea is 82 m. it has a hot and dry weather with long, hot summers. The average of annual raining is 279 mm; and the average of maximum annual temperature in August is 48.4°C and the average of minimum annual temperature in January, are 2 and 3°C. This test was conducted in the format of randomized complete block design with 4 replications. Test treatments were:

1) T1: planting date: 11/16/2008 and the pattern: 2:12
2) T2: planting date: 11/16/2008 and the pattern: 2:8
3) T3: planting date: 12/3/2008 and the pattern: 2:12
4) T4: planting date: 12/3/2008 and the pattern: 2:8

To remove weeds, 4 liter per hectare of Sultanun herbicide was used before planting when preparing the ground and immediately get mixed with soil by a disk. The planting operation was done by an olericulturer existing in the region in the form of two rows on each stack by a distance of 17.5 cm and seed spacing of 4cm on each stack and in the depth of 2cm. The plant density per unit area considered as constant and about 60000 plant per hectare. One week before harvest, paternal parent's lines were omitted from the farm and only maternal lines were harvested as seed. Measured characteristics in this test were: plant height, biological yield, harvest index, number of pods per plant, number of grains per pod, Thousand-grain weight, grain yield and pod length. Analyzing the data was done with the aid of software called Mstat-C, and comparing the averages was done in Duncan test method and for correlation coefficients between characteristics SAS software was used. 

Results and Discussion

Biological yield:

The effect of planting date on the biological yield became meaningful in the level of one percent (table 1) and the comparison between averages showed that (table 2) planting date of November 16th with an average of 2712 k/ha owned the maximum of biological yield itself as compared to planting date of December 3th with an average of 1897 k/ha. Early planting time causes more aggregative absorption of solar radiation and thermal units by plant which leads to height, subshrub and leaf number and consequently biological yield increases. These results are in accordance with the researches of Hodyson.
Grain yield:

The effect of planting date on the grain yield became meaningful in the level of one percent (table 1), and comparison of averages showed that (table 2) planting date of November 16th with an average of 4071 k/ha assigned the maximum grain yield to itself meaningfully as compared to the planting date of December 3rd with an average of 2404 k/ha showed excellence as compared to other planting date and planting pattern.

Table 1: Mean squares analysis variance of evaluated characteristics.

<table>
<thead>
<tr>
<th>S. O. V</th>
<th>df</th>
<th>Plant length</th>
<th>The number of grains per pod</th>
<th>pod length</th>
<th>The number of pods per plant</th>
<th>Harvest index</th>
<th>Thousand-grain weight</th>
<th>Grain yield</th>
<th>Biological yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>block</td>
<td>3</td>
<td>5.44ns</td>
<td>1.71ns</td>
<td>0.71ns</td>
<td>6.39ns</td>
<td>0.17ns</td>
<td>0.62ns</td>
<td>1.71ns</td>
<td>0.67ns</td>
</tr>
<tr>
<td>planting date</td>
<td>1</td>
<td>20.50</td>
<td>17.98</td>
<td>16.57</td>
<td>162.28</td>
<td>18.67</td>
<td>9.0</td>
<td>194.74</td>
<td>12.80</td>
</tr>
<tr>
<td>planting pattern</td>
<td>1</td>
<td>0.06ns</td>
<td>0.06ns</td>
<td>5.73</td>
<td>12.81</td>
<td>0.07ns</td>
<td>15.39</td>
<td>18.09</td>
<td>8.72</td>
</tr>
<tr>
<td>planting date × planting pattern</td>
<td>1</td>
<td>3.83ns</td>
<td>2.92ns</td>
<td>3.67ns</td>
<td>0.01ns</td>
<td>4.08ns</td>
<td>44.79</td>
<td>1.56ns</td>
<td>2.79ns</td>
</tr>
<tr>
<td>Error</td>
<td>9</td>
<td>0.0016</td>
<td>0.7</td>
<td>0.042</td>
<td>21.42</td>
<td>2.67</td>
<td>0.044</td>
<td>0.0005</td>
<td>908.88</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>29.83</td>
<td>23.37</td>
<td>26.72</td>
<td>202.91</td>
<td>25.66</td>
<td>69.84</td>
<td>216.1</td>
<td>933.86</td>
</tr>
<tr>
<td>CV (%)</td>
<td>7</td>
<td>3.2</td>
<td>8</td>
<td>4.9</td>
<td>3.5</td>
<td>4.1</td>
<td>7</td>
<td>10.3</td>
<td></td>
</tr>
</tbody>
</table>

ns: non significant, *, **: respectively significant (p ≤ 0.05) and highly significant (p ≤ 0.01)

Grain yield:

The effect of planting date on the grain yield became meaningful in the level of one percent (table 1), and comparison of averages showed that (table 2) planting date of November 16th with an average of 4071 k/ha assigned the maximum grain yield to itself meaningfully as compared to the planting date of December 3rd with an average of 2404 k/ha showed excellence as compared to other planting date and planting pattern. Also, the effect of planting pattern on the Thousand-grain yield became meaningful in the level of one percent. The comparison of averages, the planting date of November 16th and the planting pattern of 2:8 had the maximum grain yield (4378 k/ha).

Thousand-grain weight:

The effect of planting date on the Thousand-grain weight became meaningful in the level of one percent (table 1) and the comparison of averages showed that the planting date of November 16th with an average of 5.3 g had the maximum of Thousand-grain weight meaningfully (table 2) as compared to the planting date of December 3rd with an average of 5g. The obtained result was in accordance with the researches of Mendham et al [20], Norton et al [24], Kurmi and Kalta [17], Singh et al. [28]. Also, the effect of planting pattern was a determinant effect on the Thousand-grain weight and the increase of ratio of maternal lines to paternal lines has caused the decrease in the Thousand-grain weight in the planting pattern of 2:12.

Harvest Index:

The effect of planting date on the harvest index became meaningful in the level of one percent (table 1) and the comparison of averages (table 2) showed that the planting date of November 16th with an average of 17.69 percent had the maximum of harvest index which is because of increase in the vegetative growth and better and faster transfer of photosynthetic substances from source to the store, and it consequently causes an increase in the yield and harvest index in early planting dates which was in accordance with the researches of Scott and Mendham [20], Clarke [7], Saran and Giri [26]. The effects of planting pattern and the mutual effect of planting pattern X planting date on the mentioned characteristic did not become meaningful.
Table 2: Mean comparison of morphological evaluated characteristics.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant length (cm)</th>
<th>The number of grains per pod</th>
<th>The number of pods per plant</th>
<th>Harvest index (%)</th>
<th>Thousand-grain weight (g)</th>
<th>Grain yield (k/ha)</th>
<th>Biological yield (k/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>planting date</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>November 16th (D1)</td>
<td>130 a</td>
<td>11.4 a</td>
<td>4.4 a</td>
<td>147 a</td>
<td>17.53 a</td>
<td>5.3 a</td>
<td>407 a</td>
</tr>
<tr>
<td>December 3rd (D2)</td>
<td>121 b</td>
<td>9.6 b</td>
<td>4.0 b</td>
<td>117 b</td>
<td>13.31 b</td>
<td>5.0 b</td>
<td>246 b</td>
</tr>
<tr>
<td>planting pattern</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:12 (P1)</td>
<td>125 a</td>
<td>10.4 a</td>
<td>4.3 a</td>
<td>128 b</td>
<td>15.55 a</td>
<td>4.9 b</td>
<td>302 b</td>
</tr>
<tr>
<td>2:8 (P2)</td>
<td>126 a</td>
<td>10.5 a</td>
<td>4.1 b</td>
<td>136 a</td>
<td>15.29 a</td>
<td>5.3 a</td>
<td>351 a</td>
</tr>
<tr>
<td>Interaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1P1</td>
<td>128 a</td>
<td>11.7 a</td>
<td>4.6 a</td>
<td>143 a</td>
<td>16.68 a</td>
<td>4.7 c</td>
<td>375 a</td>
</tr>
<tr>
<td>D1P2</td>
<td>132 a</td>
<td>11.1 a</td>
<td>4.2 a</td>
<td>151 a</td>
<td>18.39 a</td>
<td>5.9 a</td>
<td>438 a</td>
</tr>
<tr>
<td>D2P1</td>
<td>123 a</td>
<td>9.2 a</td>
<td>4.0 a</td>
<td>113 a</td>
<td>14.45 a</td>
<td>5.1 b</td>
<td>229 a</td>
</tr>
<tr>
<td>D2P2</td>
<td>119 a</td>
<td>10.1 a</td>
<td>4.0 a</td>
<td>121 a</td>
<td>12.19 a</td>
<td>4.8 bc</td>
<td>264 a</td>
</tr>
</tbody>
</table>

Mean followed by the same letters in each column are not significantly different by using Duncan multiple rang test at %5 probability level are not significantly different by using Duncan multiple rang test at %5 probability level.

The number of pods per plant:

The effect of both planting date and planting pattern on the mentioned characteristic became meaningful (table 1) and by comparing the averages (table 2) it is observed that the maximum number of pods per plant is related to the first planting date (November 16th) with an average of 147 pods per plant and the planting of 2:8 with an average of 136 pods per plant which was in accordance with the research results of Hodyson [16], and the Mendham [20].

The number of grains per pod:

The effect of planting date on the number of grains per pod became meaningful in the level of percent (table 1) and by comparing the averages it was observed that the planting date of November 16th with an average of 11.43 grains per pod had the maximum number of grains per pod (table 2). In the posterior planting date, because of increasing the temperature, the warm weather in the time of flowering has a negative effect on the production of pollens which leads to a decrease in the number of grains per pod in the second planting date. The above result is in accordance to the researches of Bouttier and Morgan [3], Norton [24], Choudh [6], Sharma. The effect of planting pattern and mutual effect of planting pattern on the planting date did not become meaningful on the mentioned characteristic.

The correlation between under-study characteristics:

The correlation of grain yield with the biological yield became positive and meaningful in the level of one percent. The correlation of Thousand-grain weight with the biological yield, and grain yield and harvest index became positive and meaningful in the level of one percent, but the correlation of the number of pods per plant with the Thousand-grain weight did not become meaningful. The correlation of the number of grains per pod with the biological yield, and the grain yield and the pod length became positive and meaningful in the level of one percent. Also, the correlation of the number of grains per pod with the number of pods per plant became positive and meaningful in the level of 5 percent, but the correlation of the number of grains per pod with the Thousand-grain weight and the harvest index did not become meaningful (table 3).

Conclusion:

The planting date of November 16th, as compared to the planting date of December 3rd, enjoyed a higher yield because of the increase of vegetative growth period and more and better usage of solar radiation and the absorption of more thermal units by plant to enter the reproductively period. Also, planting pattern of 2:8 had a better yield - as compared to the planting pattern of 2:12 - because of more number of pollens maternal base owned, and also due to less competition among plants in this planting pattern.

Acknowledgements

We would like to thank all the staff of Safi-Abad Agricultural Research Center specially the staff of Seed and Seedling control and certification unit for all their cooperation in doing this research.
Table 3: Correlation matrix between evaluated characteristics.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Biological yield</th>
<th>Thousand-grain weight</th>
<th>Harvest index</th>
<th>Grain yield</th>
<th>Biological yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological yield</td>
<td>0.260**</td>
<td>0.718**</td>
<td>0.596**</td>
<td>0.680**</td>
<td>0.260**</td>
</tr>
<tr>
<td>Thousand-grain weight</td>
<td>0.260**</td>
<td>0.718**</td>
<td>0.596**</td>
<td>0.680**</td>
<td>0.260**</td>
</tr>
<tr>
<td>Harvest index</td>
<td>0.628**</td>
<td>0.790**</td>
<td>0.749**</td>
<td>0.750**</td>
<td>0.749**</td>
</tr>
<tr>
<td>Grain yield</td>
<td>0.290**</td>
<td>0.579**</td>
<td>0.414**</td>
<td>0.424**</td>
<td>0.718**</td>
</tr>
<tr>
<td>Harvest index</td>
<td>0.424**</td>
<td>0.415**</td>
<td>0.484**</td>
<td>0.508*</td>
<td>0.559*</td>
</tr>
<tr>
<td>Thousand-grain weight</td>
<td>0.290**</td>
<td>0.579**</td>
<td>0.414**</td>
<td>0.508*</td>
<td>0.559*</td>
</tr>
<tr>
<td>Harvest index</td>
<td>0.628**</td>
<td>0.790**</td>
<td>0.749**</td>
<td>0.750**</td>
<td>0.749**</td>
</tr>
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<td>Thousand-grain weight</td>
<td>0.290**</td>
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<td>0.508*</td>
<td>0.559*</td>
</tr>
</tbody>
</table>

ns: non significant, *, **: respectively significant (p<0.05) and highly significant (p<0.01)

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