OIL CROPS: BRASSICA SUBNETWORK

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ABBAS OMRAN
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Brassica Subnetwork

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The second round of Sino-Canadian rapeseed project was conducted from April 1987 to March 1990. During that period, the rapeseed group of Xinjiang Academy of Agricultural Sciences has successfully completed the breeding objectives.

**BREEDING OBJECTIVES**

A. Breeding single-low or double-low *B. juncea* cultivars adaptable to Xinjiang and the other spring rapeseed areas in China.

B. Evaluating collected double- or single-low *B. napus, B. campestris* and *B. juncea* introductions.

**RESEARCH HIGHLIGHTS**

1. **Released cultivars**

As a result of previous years work, two *B. juncea* cultivars, Xinyou No.4 and No.5, the first low erucic acid *B. juncea* cultivars, were registered and released by Xinjiang Crop Cultivar Examination Committee in May 27, 1989. Xinyou No.4 (test code, 85-1312) is good in one year-one crop areas in the North; and Xinyou No.5 (test code, 85-991) is good to be grown in cold mountain areas or one year-two crops areas.

Their yield, quality, maturity and resistance are shown below.

2. **Yield capacity**

2.1 **Regional tests:** In the provincial trial, Xinyou No.4 yielded 2848.5 kg/ha, and ranked the first. In six out of eight locations, Xinyou No.4 gave the highest yield. Compared with check variety (Xinyou No.1), the range of yield increase was 3.63 - 30.34% for Xinyou No.4. Xinyou No.5 yielded 2649 kg/ha, occupied the third place, 4.59% lower than the check. However, no significance existed in yield difference between Xinyou No.4 and the check or Xinyou No. 5 and the check, Table 1.

In Northern regional co-op trail which covered six provinces, Xinyou No.4 and No.5 were 2.41% and 2.9% lower than check (Xinyou No.1), ranked second and third, respectively. Out of the 10 locations, both cultivars got higher yield than the check at five locations. The yield range increase was 0.84 - 74.14% for Xinyou No.4, and 3.14 - 144.83% for Xinyou No.5, respectively.

2.2 **Performance of yield in farmer's field:** While carrying out the regional test, the two cultivars were being demonstrated at two farmer's fields. Results show that both cultivars yielded higher than the check, Table 2. From 1987 to 1989, Xinyou No.5 was grown in 0.42, 1.3 and 20.2 ha in Baicheng county, respectively, and yielded 3210, 2940 and 1980 kg/ha on the average. In 1989, Xinyou No.5 was grown in 218 ha in Xinjiang province. Its yield was 10% higher on the average than the commercially dominant cultivars. Therefore, it is accepted by farmers.

3. **Quality aspects and oil content**

Erucic acid content in the two cultivars is below 1%. Oil content is higher than the check (Xinyou No.1) as well as double-high cultivars, Baicheng Hung and Yili Hung, which are the commercially dominant cultivars in Xinjiang province at present, Table 3.

The breeder seeds of Xinyou No.4 and No.5 is erucic acid-free. Its oleic and linoleic acid content are significantly higher than high erucic acid cultivars. Therefore, its nutrition value is much higher than the high erucic cultivars.
Table 1. Yield of Xinyou 4 and Xinyou 5 in regional test.

<table>
<thead>
<tr>
<th>Test</th>
<th>Year</th>
<th>Cultivar</th>
<th>Plot Yield</th>
<th>Average Yield</th>
<th>+/- over Check (%)</th>
<th>Difference</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provincial test</td>
<td>1986-88</td>
<td>Xinyou 4</td>
<td>6.33</td>
<td>2848.5</td>
<td>+ 2.60</td>
<td>ns</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Xinyou 5</td>
<td>5.89</td>
<td>2649.0</td>
<td>- 4.59</td>
<td>ns</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Xinyou 1</td>
<td>6.17</td>
<td>2776.8</td>
<td>-</td>
<td>ns</td>
<td>2</td>
</tr>
<tr>
<td>Among province test</td>
<td>1988-89</td>
<td>Xinyou 4</td>
<td>4.19</td>
<td>1883.9</td>
<td>-</td>
<td>ns</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Xinyou 5</td>
<td>4.15</td>
<td>1869.5</td>
<td>-</td>
<td>ns</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Xinyou 1</td>
<td>4.29</td>
<td>1928.9</td>
<td>-</td>
<td>ns</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2. Yield of Xinyou 4 and Xinyou 5 in demonstration (kg/ha).

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Test Variety</th>
<th>Average Yield</th>
<th>+/- Check (%)</th>
<th>Difference</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhaosu</td>
<td>1988</td>
<td>Xinyou 4</td>
<td>3031.5</td>
<td>+</td>
<td>14.8</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Xinyou 5</td>
<td>2767.5</td>
<td>+</td>
<td>4.6</td>
<td>n</td>
</tr>
<tr>
<td>Anningu</td>
<td>1988</td>
<td>Xinyou 4</td>
<td>2646.5</td>
<td>+</td>
<td>5.8</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>1988</td>
<td>Xinyou 5</td>
<td>2163.1</td>
<td>+</td>
<td>1.5</td>
<td>n</td>
</tr>
</tbody>
</table>

Table 3. Fatty acid and oil content in B. juncea cultivars.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Fatty acid composition (%)</th>
<th>Oil (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C16:0</td>
<td>C18:0</td>
<td>C18:1</td>
</tr>
<tr>
<td>Xinyou 4</td>
<td>5.27</td>
<td>0.51</td>
</tr>
<tr>
<td>Xinyou 5</td>
<td>4.95</td>
<td>-</td>
</tr>
<tr>
<td>Xinyou 1</td>
<td>3.63</td>
<td>0.26</td>
</tr>
<tr>
<td>Baicheng</td>
<td>Huang</td>
<td>3.40</td>
</tr>
<tr>
<td>Hili</td>
<td>Huang</td>
<td>3.21</td>
</tr>
</tbody>
</table>

4 Adaptability

According to the multi-year and multi-location tests, the two low erucic B. juncea cultivars have good adaptability to wide areas. Xinyou No.4 is a mid-early cultivar in maturity. Total growth period is 85-90 days. Xinyou No.5 is an early cultivar which has a growth period of 75-80 days, Table 4.

5. Resistance to stress

The plant height of the two cultivars is quite short. Xinyou No.5 is only 1.6 m in height. It is lodging-resistant, and is field favourable to be harvested by combine. Xinyou No.4 is tolerant to whiterust and downy mildew, and its seeds are plump with high oil content.

A number of single- or double-low lines with high yield capacity have been selected, and some male sterile B. juncea with low erucic acid content have been bred. These could be the fundamental materials for this breeding project.

6. Introductions

A number of double-low B. campestris and B. napus and single-low B. juncea introductions have been evaluated in field and lab for possible use. A total of 182 varieties have been intro-duced from Canada, France, Sweden, India, Poland and Australia in the last three years, Table 5.
Table 4. Growing period and adaptable areas of Xinyou 4 and Xinyou 5.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Days to maturity</th>
<th>Date of maturity (month/day)</th>
<th>± over check (day)</th>
<th>Suitable growing areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xinyou 4</td>
<td>85-90</td>
<td>7/20</td>
<td>+ 1-2</td>
<td>one year-one crop areas in the north</td>
</tr>
<tr>
<td>Xinyou 5</td>
<td>75-80</td>
<td>7/10</td>
<td>+ 8-12</td>
<td>cold mountain areas or one year-two crops in plain areas</td>
</tr>
</tbody>
</table>

Table 5. Introduced materials.

<table>
<thead>
<tr>
<th>Country of origin</th>
<th>No.</th>
<th>B. juncea</th>
<th>B. napus</th>
<th>B. campestris</th>
<th>Others</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>115</td>
<td>96</td>
<td>12</td>
<td>0</td>
<td>7</td>
<td>1987</td>
</tr>
<tr>
<td>Canada</td>
<td>7</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1986</td>
</tr>
<tr>
<td>Sweden</td>
<td>50</td>
<td>15</td>
<td>14</td>
<td>0</td>
<td>16</td>
<td>1988</td>
</tr>
<tr>
<td>Australia</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1989</td>
</tr>
<tr>
<td>India</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1989</td>
</tr>
<tr>
<td>Poland</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1988</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>116</td>
<td>333</td>
<td>21</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

7. Utilization

Except a few strong winter types, most of the introductions can ripe normally in Urumoqi with a growth period of 71-96 days.

7.1 Direct use in production: After successfully growing Oro, which was introduced from Canada in 1974, we have tried Tower, Topas, Leijinter recently. Up to 1989, the total acreage of high quality B. napus grown in Xinjiang is nearly 50,000 ha. It has put the rapeseed production in Xinjiang province at a new level.

7.2 Indirect use: Through two years investigation, some high yield and high quality materials such as, spring B. napus (Topas Line and Wesbrook), B. campestris (Emma and Tobin) etc., have been used in our double-low rapeseed breeding program as the high quality parental forms.

From the economic point of view, some favourable agronomic characters in some of the introductions have been identified. For example, two American B. juncea strains, American 1 and 2, bred more pods/plant, were white rust- and downy mildew- tolerant, and the 1000 seed weight of RH was up to 6.75g. A cross of Chinese x nigra produced more pods/plant; and a spring B. napus gave 30 seeds/pod, etc. All of these materials with good agronomic traits have been used in the recent breeding program as well.

DISCUSSIONS AND SUGGESTIONS

High yield, high quality, disease resistance or tolerance are still the key points in single- or double-low rapeseed breeding program in China. At present, to develop high yielding, disease resistant or tolerant, double-low B. juncea cultivars is even more difficult since the gene source of low glucosinolate in B. juncea is not available. Thus, to exchange breeding materials between Chinese and Canadian scientists will be mutually beneficial and to work out effective selection and evaluation methods in breeding double-low B. juncea in the third round of the project is also important.