OIL CROPS: BRASSICA SUBNETWORK

PROCEEDINGS OF THE THIRD WORKSHOP, QUALITY TRAINING, AND CHINESE PROJECT REPORTS, HELD IN SHANGHAI, PEOPLE'S REPUBLIC OF CHINA, 21–24 APRIL 1990

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Oil Crops: Brassica Subnetwork

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Yan Zhang and Guanghua Fang

The good quality rapeseed breeding progremme in SAAS was begun in 1981. Since 1983, 1,100 domestic and foreign good quality rapeseed germplasms were collected, preserved and evaluated. Crosses for good quality were made. Low erucic acid (single low) and low erucic acid and glucosinolate (double low) strains were selected and demonstrated in a certain area. The breeding techniques, analysis methods for quality and feeding broilers with low glucosinolate rapeseed meal were studied. Many Canadian scientists visited SAAS and held training courses in the last six years. Four postgraduates and two visiting scholars went to Canadian Universities and research stations to get their master's degrees and to engage in advanced studies, respectively. The equipments of the chemistry laboratory have been supported by IDRC and is expected to be supported further. All of these laid solid foundations for selection, demonstration and popularization of rapeseed varieties with good quality.

GENERAL OBJECTIVES OF THE PROJECT

A. Screening and evaluating rapeseed varieties (*Brassica napus* L.).
B. Improving rapeseed breeding techniques.
C. Studying the methods of analyzing erucic acid and glucosinolate of rapeseed oil.
D. Expanding production area of good quality rapeseed variety and satisfying the needs of people and animals.

PROGRESS OF THE PROJECT

A. <u>Screening and evaluating rapeseed varieties (*B. napus* L.)</u>

a. In 1984, the first year of the project, the yield comparison test of four lines with single low was conducted. The result indicated that the yield of the tested lines decreased, compared with check "Huyou 9". The decrease of yield ranged from 14.0% to 23.0%. However, the yield comparison test of 21 lines with single and double low was carried out, among which the yields of six tested lines were higher than that of check "Huyou 50" in 1989. The yield increase varied from 6.6% to 20.7%.

b. "84 - 24016" is a double low line selected in 1984. It was derived from the cross between the local early maturing and high yielding variety "No. 23" and Canadian canola cultivar "Regent". Its maturity suits to the ecological conditions of Shanghai. The experimental results showed that this line was of good resistance, of high quality oil and meal, but of comparatively low seed yield. Siliqua numbers/plant and seed numbers/siliqua of "84 - 24016" was from 79 to 139 and from 3 to 4 less than that of check "Huyou 9", respectively. The oil content of "84 - 24016" was 2 - 3% less and the seed yield was 10% less than that of the check "Huyou 9". "No. 23" was used as a recurrent parent, backcrossed to "84 - 24016" for improving the agronomic characters. The result indicated that the siliqua numbers/plant have been increased, the seed numbers/siliqua has reached 18, but the oil content has not been increased yet. Its erucic acid in oil is still low, but its glucosinolate content in meal is more than 30 μmole/g. This line now is still being improved.

c. "8701" is a single low strain derived from the cross between the local early maturity and high yield strain "8201" and the Australian cultivar "Wesbell" in 1983. After several years of field and chemical selections, mass selection was made in F_4. Since 1987, it entered into the seed yield comparison test, such as the cooperative tests in 1987 and 1988, Shanghai Rapeseed Variety

Performance Pre-test in 1988, Shanghai Rapeseed Variety Performance Test and the National Variety Performance Test in the lower reaches of the Yangtze River in 1989. Eight good quality strains and two check varieties, "Ningyou 7" and local check, were put into the National Variety Performance Test in the lower reaches of the Yangtze River. Among them, the seed yield of "8701" ranked third, and the oil yield ranked second in the test. Seed yield of "8701" was the same compared with check "Ningyou 7". There was no significant difference in comparison of the mean, Table 1. However, seed yield of "8701" was significantly different from the local commercial varieties in Jiangsu, Zhejiang, Anhui provinces and Shanghai, Table 2. The yield of 8701 was stable in seven locations, Table 1. According to the determination in 1989, linoleic and erucic acid contents were 22% and 0.25%, respectively, in oil of "8701". Oil content was 41% in dry seed. The growth phase was 235 days. It is 1-2 days earlier than that of the check "Huyou 50". Thus, "8701" has reached the objective of the project. This line has been checked and accepted by the experts of the Industrial Crops Group of Shanghai Crops Examination Committee.

B . Improving rapeseed (*B. napus*)

a. Anther and pollen culture: The laboratory of rapeseed biotechnology was built under the support from Canadian IDRC and the Ministry of Agriculture, China. Since 1985, several factors influenced the embryoid induction frequency, and plant regeneration rate were investigated. These factors are genotypes of materials inoculated, anther/pollen inoculation time, sucrose and auxin concentrations in the medium, changing temperature treatment and embryoid types. Fifty eight lines from haploid are planted in the field for selection in 1990.

Table 1. The Comparison of the Seed Yield and Stability among Eight Good Quality Rapeseed Varieties (B. napus L.), 1989.

Strains	Seed Yield* (kg/ha)	Difference** 5%	1%	Interactive Variance	C.V.(%)
Ningyou 7(CK)	1859.9	a	A	0.273	14.05
Jian 7	1824.8	ab	A	0.090	8.22
1026	1824.8	ab	A	0.218	12.79
8701	1799.9	ab	A	0.039	5.49
4039	1749.8	b	AB	0.021	4.12
75-01-1	1649.9	c	B	0.090	9.10
D89	1464.9	d	D	0.131	12.34
126	1154.9	e	D	0.137	16.02
135	1124.9	e	D	0.105	14.40

* The average of the seed yield of 7 testing locations.
** Varieties with the same letter in the column are not significantly different.

Table 2. The Comparison of the Seed Yield between 8701 and Local variety, 1989; showing no significant differences.

Place	Strains	Seed Yield (kg/ha)
Shanghai	8701	1669.5
	Huyou 50 (CK)	1540.5
Jiangsu	8701	2079.9
	Shenyou 1 (CK)	1922.6
Zhenjiang	8701	1657.5
	92-13-58 (CK)	1622.5
Anhui	8701	1721.3
	Dangyouzao 1(CK)	1725.0

b. Artificial vernalization: Artificial vernalization for winter *B. napus* was studied for speeding up breeding. The result indicated that the germinating seeds of early/medium materials can develop, bloom, and set siliquae normally after artificial vernalization. The rate of setting siliquae can be increased using artificial supplementary pollination in growth room. Thus, the breeding materials on hand can add one growth cycle in summer of Shanghai.

C. **Studying the methods of analyzing erucic acid and glucosinolate**

The chemistry analysis laboratory for rapeseed quality was set up in 1984. Assay methods of UV thiourea, TMS, thymol and palladium were introduced. Three technical evaluations namely the modified UV thiourea assay method, infrared spectrum method and modified TMS method have been established. Standard analysis method for erucic acid has also completed the technical evaluation under cooperating with the Institute of Oil Crops of Chinese Academy of Agricultural Sciences, Huazhong University of Agriculture and Jiangsu Academy of Agricultural Sciences. Cooperated with Shanghai Institute of Biochemistry, Academia Sinica, a rapid determination method of total glucosinolate in rapeseed was studied using enzyme electrode principle. GUL - 01 glucosinolate meter has been developed by Shanghai Institute of Biochemistry, Academia Sinica, based on this principle.

D. **Expanding production area of good quality rapeseed variety and satisfying the needs of people and animals**

a. In 1986, a natural isolation condition was found in a small island of Qingpu county. There, a base of reproduction foundation seed has been built in order to insure the seed purity.

b. The double low strain "84 - 24016" was put into demonstrational experiment in Songjiang and Nanhui counties in an area of 34 ha from 1986 to 1988. The single low strain "8701" was demonstrated in Songjiang, Qingpu counties and Baosheng district covering the area of 16 ha.

c. The feeding broilers test with low glucosinolate rapeseed meal has been studied according to schedule.

d. Salad oil, salad sauce and margarine have been processed using good quality rapeseed oil.

RESEARCH METHODS

1. This project was conducted in the experimental farm of SAAS mainly. There were 250 germplasm materials each year in a complete systemized design (CSD). About 700 hybrid materials were planted in the nursery in CSD each year. About 250 lines were grown in the line plot in CSD. Ten to 20 strains were tested per year in a completely randomized design (CRD) with three replications. The regional experiment tested 8 - 10 strains in CRD with three replications.

2. The main breeding method was that the Chinese high seed yield and early maturing cultivar was used as maternal plant and the Chinese/ foreign single/double low cultivar was used as parent plant and intervarietal cross was made. The hybrid progeny was selected in field and chemistry laboratory. Backcross is a common method for improving some agronomic characters in hybrid progeny.

3. The production demonstration experiment was carried out in Shanghai suburbs. We discussed the cultivation techniques with local technicians and agrono-mists. The local agriculture company is held responsible for this experiment.

4. The experiences and lessons of the research method:

a. The research area of the rapeseed breeding with good quality is extensive. We organized scientists of breeding, agronomy, chemistry, plant protection and biotechnology specialties to discuss the research proposal. Also, we have made cooperation with other institutions.

b. Artificial vernalization test was studied with success. Two growth cycles can be finished within one year in field and growth room in Shanghai. The rapeseed breeding programme will be speeded up.

c. At the beginning of the project, the selection of the quality characters received a great attention due to transferring good quality characters into local cultivars. With the development of rapeseed quality breeding, the most important thing is to select the high yield traits. Backcrossing was used for improving agronomic traits of the breeding materials.

d. Virosis is the main disease in Shanghai. Resistant source has not been found in *B. napus* yet. A few materials possess tolerance. Resistant source will be searched in

other species of *Brassica*.

e. Due to the lack of parent research, a certain blindness in making hybrids is existent.

f. The F_2 population is too small. The selection efficiency is affected.

g. A set of reproduction systems of fine variety which is suited to the *Cruciferae* vegetable crops intercropping area in Shanghai will be studied in the future.

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