From table 1, there are certain amounts of yellow-seeded rapeseed both in B. campestris and in B. juncea local cultivars. But the proportion of B. juncea is over twice higher than B. campestris, especially the percentage of pure yellow in B. juncea is much higher than B. campestris (amounting to 48.24% in B. juncea, while only 4.97% in B. campestris). That means a higher proportion (81.25%) of "mixture" exists in B. campestris, while an even higher proportion (85.41%) of pure yellow exists in B. juncea approximately one half (48.24%), while a little bit of the proportion of "pure yellow" cultivars (about 5%) in B. campestris. But the most parts of B. campestris are "mixture", that is, there exists simultaneously various kinds of seedcoat color, such as light yellow, yellow, yellowish brown, reddish brown and dark brown,etc. within the same population. This is the reason why Chinese farmers call them as "Wu-hua-zi" or "Hua-zi", i.e. there are five kinds of seeds in the mixture. For example, the local cultivars of B. campestris from Sichuan Province have been collected and presented in <<Annals of Chinese Rapeseed Cultivars>>. There are 28 cultivars in total, among which there are 14 "mixture" but only 2 "Pure yellow", i.e. "Qi-Xing-jian" and "Golden" yellow rape in Lishan, Sichuan Province. One of the main features of the seedcoat in Chinese rapeseed, as a rule, is a higher production of "mixture" and lower production of "pure yellow" in B. campestris, and an even higher production of "pure yellow" in B. juncea.

The area for the distribution of B. juncea is more concentrated in the western part of China. The production of yellow-seeded B. juncea in such region exists for a long time, e.g. the acreage of "Bai-cheng" yellow rape in Xingjiang District is nearly 26.67 thousand hectares. It is a famous local cultivar with better quality for the utilization. Its origin may be come from certain region of Central Asia. But its historical background is still unknown.

The detailed discription about this famous local cultivar had been presented in <<Chinese Rapeseed Cultivation>> in early 60'S. Until now, it still remains as the best cultivar in Chinese northwestern region. Yunnan Province is on of the areas having more abundant amounts of local cultivars in B. juncea in China. There are 30 local cultivars described in <<Annals of Chinese Rapeseed Cultivars>>, including 22 "pure yellow" and only 2 "mixture" with 80% in total. This is also the same cases showing a much higher proportion of yellow-seeded B. juncea in local cultivars.

In natural conditions, there exists no yellow-seeded Brassica napus. That means there are only ordinary black-seeded ones. Prof. Dr. Olsson, G. (1960) in Sweden first found a few yellow-seeded B. napus from the progenies of resynthetized B. napus. But after working many years, the genetical behavior of seedcoat in yellow-seeded B. napus had not yet been stabled (Jönsson, 1985). Prof. Dr. Röbbelen, G. (1981, in private communication) in West Germany and Prof. Dr. R. A. stefansson (1986, in private communication) in Canada had studied yellow-seeded B. napus for many years. But no formal experimental reports had been published.

In China, Prof. Dr. H. L. Liu and firstly discovered yellow-seeded B. napus from the progenies of interspecific hybrid "Hua-you No. 3". Since then, a lots of yellow-seeded

materials from different origins, such as from improved and introduced cultivars, from intraspecific and interspecific hybrid cultivars, from either early or later generations of different hybrids, etc. After his reports were made known to his colleques in China, a lot of different yellow-seeded B. napus have also been discovered by different units. Hence it is a general rule for the existence of yellow-seeded B. napus every where.

B. GENETICAL STUDIES ON THE SEEDCOAT COLOR AND OTHER RELATED CHARACTERS OF YELLOW-SEEDED B. NAPUS

This kind of yellow-seeded rapeseed is quite different from B. campestris and B. juncea. In general, the seedcoat color of yellow-seeded B. napus is just like the ordinary yellow color of soil (called "Soil" yellow), or as the yellow color of ginger (called "ginger" yellow). Particularly, there are more or less black dots, or black spots, or brownish black rings, or rings surrounding seedcoat across hilums. We may say that there are two main kinds of "yellow": firstly, we call it "pure yellow" in which there is no dots or spots or rings at all along the whole seedcoat; secondly, we call it "mixed yellow" in which there may have different kinds of colors from different shades of yellow to black, or different degrees of black or brown dots, or spots, or rings. As a rule, the genetical behavior of "pure yellow" is bred successfully and keeps "pure yellow" in many generations; but the appearance of "mixed yellow" is quite different from "pure yellow". It is always unstable by continuous selfing and selection and segregates in many generations. That is the reason why we can't keep them bred ture even more than 10 generations. The seedcoat color of "mixed yellow" assumes "half yellow and half black" or "like yellow and unlike yellow". This kind of yellow in B. napus is quite different from ordinary yellow seed of B. campestris and B. juncea. Recently, by further studies on the seedcoat color of B. campestris and B. carinata, the same conditions have been discovered in both species just as in B. napus (Wang, H.Z., 1989). But further studies should be kept for the justification on the seedcoat color of B. juncea, whether they may possess or nor the same conditions as reported by Indian scientists. If so, these two kinds of seedcoat yellow colors might be as a general rule existing in all kinds of rapeseeds. A new idea has been proposed by my graduate studies, Mr. Wang, H.Z. (1986). He suggested that this kind of seedcoat color might be controlled by transposor elements, as firstly proposed by Prof. Dr. McClintock (1947). Hence we are going to search for the genetic means of assuming the black dots or spots or rings, their genetical behavior, their practical means of the assumption, and how to control or adjust them in the courses for breeding high oil content.

In order to understand the basic information about the genetical behavior of seedcoat color in B. napus, we kept a series of research programs on the inheritance of seedcoat color in B. napus (Liu Hou-li, 1978; Xiao, D.R., 1982; Li, Y.C., 1982; Chen, B.Y., 1985; Wang, H.Z., 1987; Hu, X.J., 1989). Xiao, D.R. (1982) had classified the different grades of yellow and black colors of yellow-seeded population into 8

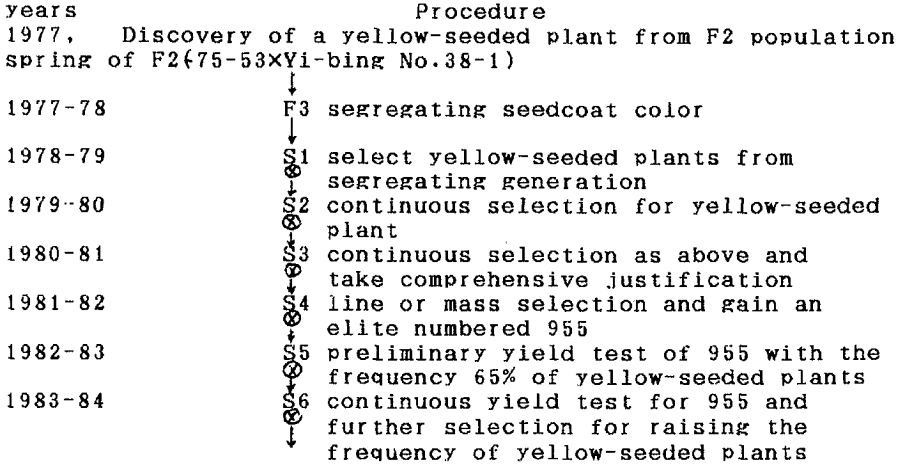
grades according to National standards as analyzed by colorimeter, within which 1-6 grades assumed yellow on their color background, while 7-8 grades assumed non-yellow. Chen B.Y., (1985) classified 1-5 grades as yellow, their thickness of seedcoat having no significant differences, while 6-8 grades as non-yellow (or black) having significant differences between these two groups. He considered that the inheritance of seedcoat color was controlled by two pairs of genes. Wang, H.Z., (1987) kept further studies on the analysis of seedcoat color and huskiness (%). He found that yellow seeds had low huskiness, while black seeds had high huskiness; and also he got the same conclusion as above, that means there were not any correlations between 1-5 grades of seedcoat color. But when the change of 5 grade to 6 grade of seedcoat color occurred, the huskiness had been expressed the qualitative change. Owing to the huskiness of yellow mutant being significantly lower than black one without any exceptions, it mightbe indicated that the correlation between seedcoat color and huskiness was not controlled by genic linkage, but produced by multigenic effects of multiple effects for a single gene or a genic system.

Meng, J.L. (1985) studied the anatomical traits about yellow-seeded B. napus by continuous selfing. He found that the extrastructural organelles within the chloroplasts had been destroyed. It was one of the reasons that the occurrence of serious degenerations of yellow-seeded B. napus was caused by continuous selfing.

C.STUDIES ON THE BREEDING OF YELLOW-SEEDED B. NAPUS

Since 1975, we have been keeping on the breeding of yellow-seeded B. napus for more than 15 years. Up to now, the first cultivar "Hua-yellow No. 1" (955) has been approved and registered by Hubei Provincial Justification and Approval Committee in 1990.

Fig. The breeding program of first cultivar "Hua-yellow No. 1" (955) of yellow-seeded B. napus
(Liu Hou-li and Gao Yong-tong, 1989)



1984-85 955 yield test for 955 with 95% frequency of yellow-seeded plants.
1985-89 955 National Yield Trail of Hubei Province.

The most important values of Hua-yellow No. 1 are high oil content and high oil-producing rate as well as its higher yield potentional and suitable maturity. First of all, the oil content of this new cultivar maintained at the level above 46% from 1983 to 1987, which was 5-7% higher than the standard cultivars grown at the same time. The large amounts of the samples (more than 100kg to 150kg) for oil extraction in several different locations revealed the same trend that this new cultivar has higher oil-producing rate than other cultivars. Data from one of the experiments are shown as follows (see table 2).

Table 2. The oil-producing rate of Hua-yellow No.1 (Gao, Y.T., 1987)

source of seeds used for extraction	oil producing rate (%)	% more than CK
Hanyang Agricultural Institute	36.09	6.29 (CK:76-1)
Huang-gang District Agricultural Bureau	35.80	3.00 (CK:821)
E-zhou Agricultural Institute	35.45	7.65 (CK:Ganyou No.5)
Huazhong Agricultural University	36.00	6.20 (CK:Ganyou No.5)
Average	35.84	5.79

D. CHARACTERISTICS, ADVANTAGE AND WEAKNESS OF THE FIRST YELLOW-SEEDED CULTIVAR.

"Hua-yellow No. 1" was bred in 1982, and passed four years regional trails in Hubei province. It is medium maturity, semi-winterness cultivar. The seedlings show semi-erected, but assume weak growth until 5-leaves age. Before Chinese spring festival no flowering had occurred and with stronger winter hardness, stronger resistance to lodging, tolerance to-over fertilizing, strong adaptation, strong resistance to virus, and compact plant type. All of these characters are fitted for rapeseed production in Central China along the Yangtze River.

One of its main advantages is high oil content and also high oil extraction amount per unit for seeds. Its oil content is stable more than 46% within three years (1987-1989) in Hubei regional experimental trails. In general, its oil extraction rate was 35-37%, even as high as 42%, while only 28-32% for ordinary cultivars. Hence high oil extraction rate is one of the most significant features of this cultivar.

Secondly, the resistance to various unfavorable conditions is strong, Because of its compact plant type and strong strength of main stem, the resistance of lodging is very strong. The disease resistance is almost the same as the standard (821); and also strong resistant to winter and spring withering, hence there is no dead seedlings in winter time and

no partial fruiting during spring time.

But there exists some weakness: firstly, owing to the thinner seedcoat, the germination rate of seeds is lower than ordinary rapeseed; secondly, less outward appearance in quality, beacuse the appearance of non-pure yellow color in seeds seems to be half yellow and half black, or brownish yellow or yellowish brown; thirdly, the yielding capacity of the first cultivar is about 10% lower than the highest yielding cultivar (821). However, th oil content of Hua-yellow No. 1 is still higher than ordinary cultivar. Hence the acreage of this cultivar is more than 13.3 thousand hectares in Hubei province in 1989.

E. ADVANCES IN STUDIES ON THE BREEDING FOR QUALITY IN YELLOW-SEEDED BRASSICA NAPUS

Since 1985, we have concentracted at the breeding for quality in yellow-seeded B. napus. Through the transfer of the genes for quality in many years, we have built a series of breeding materials, including low erucic acid content, low-glucosinolates, and double low materials for yellow-seeded B. napus.

a. Some basic studies on the quality characters in yellow-seeded B. napus.

Studies on the difference of different amounts of authiocyanins and oil contents between different cultivars have been carried out by Hu, X. J. (1988) as follows (see Table 3).

Table 3. Difference of different amounts of anthiocyanins and oil contents between different cultivars of Brassica napus L.

(Hu, X. J., 1988)

Cultivars	seedcoat color	authiocyanins in seedcoat (mg/g)	oil contents (%)
Hua-you No. 8	dark brown	7.117	37.12
	yellowish br.	0.367	40.45
	difference	-6.75	-3.33
Liu-you No. 7	dark brown	2.504	41.09
	yellowish br.	0.282	43.18
	difference	-2.222	-2.09

Studies on the variations of the components of fatty acids have been carried out and the results have been obtained as follows (see table 4).

Table 4. The variations of the components of fatty acid and the content of glucosinolates

(Gao, Y. T., 1984)

Component / line	16:0	18:1	18:2	18:3	20:1	22:1	glucosinolates
Y508	3.067	16.779	15.537	10.024	9.357	44.476	
Y524	3.590	18.478	14.326	8.159	10.981	42.917	
Hua-you No. 8(CK)	2.860	13.770	11.580	9.340	6.270	54.690	
Y84205*(00)	5.567	57.808	23.087	8.368	3.293	1.756	0.189

* data obtained in 1985, just for comparison.

From above data, we may say there may be some tendency for decreasing the content of authiocyanins, oil and erucic acid in ordinary yellow-seeded B. napus. But the rule for the accumulation of erucic acid and glucosinolates for both kinds of rapeseed is almost the same.

b. Ways for the breeding of single or double low yellow-seeded lines.

As for the main ways for the breeding of single low or double low yellow-seeded rapeseed, we may state briefly as follows:

1. Segregation by selfing from ordinary single low or double low strains or lines, we may get yellow-seeded single low or double low strains or lines. But such strains or lines derived from introduced cultivars are prostrate in plant type in seedling stage, late maturity, low yielding capacity, unstable seedcoat color. All of these traits are not fitted for the rapeseed production in Central China.

2. Intraspecific and interspecific hybridization in order to transfer the genes for quality into B. napus. In general, F1 all black seeds, F2 segregating into different kinds of seedcoat color, but the percentage of yellow seeds is quite low, e.g. only 1-2%. If we use ordinary double low as male, and yellow-seeded strain as female, the frequency of the occurrence of yellow-seeded double low materials will be much more less. For example, only 0.065% occurred for yellow-seeded double low in 1984. Hence we have to enlarge the population of F2 and to take some further treatments.

3. Double direction crossing between two series of basic breeding materials. That means when we start the breeding procedure, we must build two systems of basic breeding materials. The first system will be low erucic acid and high-yielding, while the second one will be low glucosinolate and high-yielding. Then, we make some program for testing the combining ability between these two systems, and choose the best cross or better crosses for making further crossing, then select the best line or better lines from the progenies and compare their yielding capacity.