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SOYBEAN DEVELOPMENT PROJECT IN THAILAND
REPORT ON SOYBEAN BREEDING EXPERIMENTS IN THAILAND
(JANUARY 1975-JANUARY 1976)

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JAPAN INTERNATIONAL COOPERATION AGENCY
AGRICULTURAL DEVELOPMENT COOPERATION DIVISION

CONTENTS

PREFACE

This report is a representation of the results of the soybean breeding experiments which the author assumed, as an expert on the soybean breeding in the Thailand Primary Products (Soybean) Development Cooperative Project undertaken by the Japan International Cooperation Agency or JICA, during the term of one year from 11 January 1975 when the author was dispatched to Thailand to 10 January 1976 when he came back to Japan, together with the Thai researchers at the Mae Jo (Chiengmai) and several other Agricultural Experiment Stations which belong to the Upland Crops Division, Department of Agriculture, Ministry of Agriculture of Thailand. This cooperative project was started as a Soybean Development Project, and from the onset, soybean breeding through introduction of good and highly productive varieties and selection of good lines out of the progeny derived from the hybridization was one of the important subjects for study in the project. As, the author was assigned the work of selecting and evaluating the progeny in late generations from the hybridization, the present report is concerned mainly with the results of yield trials conducted on the breeding lines in late generations. Comments from the individuals concerned with the project and any others are welcome, and the author hopes the report will serve as a useful material for future development in this field in Thailand.

Kouichi Sasaki
Tokachi Agricultural Experiment Station, Hokkaido, Japan

I. Outline of Soybean Cultivation in Thailand

Outline of soybean cultivation in Thailand will be described briefly with reference to those in the prefectures of Chiengmai and Sukhothai where the agricultural experiment stations for soybean breeding, namely Mae Jo and Srisamrong Agricultural Experiment Stations are located respectively.

1) Chiengmai

Chiengmai is situated in the northern part of Thailand and constitutes the so-called northern inland height (19°N, 300 meters above the sea level). The prefecture is mountainous with highest points in Thailand such as Doi Inthanon 2595 m, Doi Pha Hom Pok and Doi Chiang Dao, and the basin surrounded by these mountains and extending along the River Pin (a tributary of the River Chao Phraya) which runs through such mountains is developed as a rice planting area. With the mountains in the background as stated in the foregoing and abundant rainfall in these mountains, the prefecture has had irrigation facilities developed since early times. Therefore, in rainy season, paddy rice constitutes a greater part of the crop, but in dry season, many others are cropped, such as vegetables (more specifically, red pepper and garlic), tabacco, soybeans, peanuts and peas in addition to the paddy rice, these crops being in a competitive relationship.

Chiengmai is one of the biggest sites of soybean production next to Sukhothai in Thailand with the area of 18,726 hectares or more than 20 percent of the total area of soybean in Thailand in 1971, but the soybeans are generally of secondary crop in the paddy fields.

The soybean cropping as secondary to paddy rice is started ordinarily in the latter part of January after harvest of the paddy rice and harvested in or about April. Generally, seeds are planted directly onto the land having rice straws or stubs burnt down, and the subsequent managements are not always satisfactory. Presently, a method of cultivation in which the fields are plowed and soybeans are planted in several grouped rows with irrigation ditches therebetween is encouraged but not yet in a large area.

The Mae Jo Agricultural Experiment Station is located about 30 km north of the city of Chiengmai and is noted with a long history as an important agricultural experiment station for upland crops or, more specifically, beans. With an irrigation system provided in the compound, the

cropping of soybeans in the dry season is enabled in almost all fields in the station. Thus, the station is assuming a principal role as a main site for soybean breeding. The soil of the station is of sandy loam belonging to the alluvial soil of the River Pin but is not of high soil fertility. Surface solidification of the soil which occurs after heavy rainfall is apt to reduce the degree of emergance of soybeans. Results of meteorological observations at the station are shown in Table 1. As seen, in the dry season, the temperature in December and January is particularly low and the humidity is generally low when compared with that in the central part of Thailand. On soybeans in the dry season, mildew diseases are observed, while the crop in the rainy season suffers from heavy occurrences of rust diseases. Therefore, the station is considered to be the best site for selection of resistant lines to such diseases.

(2) Sukhothai

The prefecture of Sukhothai belongs to the central plain according to the general geographical classification. It is, however, apart from the plain in the basin of the River Chao Phraya and includes undulations leading to the northern mountainous area so that it may be classified as an intermediate area or peripheral area of the central plain. With the River Yam (a tributary of the River Chao Phraya) running through the prefecture, the low land along the basin is developed as a paddy rice area and the high land as an area of upland crops. Sukhothai is one of the old capitals of Thailand but is rather backward in the irrigation facilities, and the cultivation of crops is scarcely carried out in the dry season but mainly in the rainy season. Soybeans are produced mostly in the Suwankhalok county where soybean seeds are planted in the fields plowed by large tractors for hire at a row width of about 90 to 120 cm in the early part of May soon after enough rainfall for wetness of soil every year, with cotton planted between rows in the middle stage of growth of soybeans, generally. But, as the relative advantageousness of the cotton has decreased recently, the cultivations of soybeans only or sugar cane or corn in place of the cotton are seen.

The area of soybean cultivation in Sukhothai constitutes nearly 50 percent of the whole area of soybeans in Thailand with 37,608 hectares in 1971, and the cropping of soybeans is done, for the greater part, in upland fields in the rainy season. Thus, the farmers in Sukhothai are far more enthusiastic for the soybean cropping than those in Chiengmai and are

Table 1 Climatological Data at The Mae Jo Agr. Exp. Sta

(Average of 1970 - 1974)

Month		Air temp. (C°) Max. temp.	Min. temp.	Ave. temp.	Humidity (Ave. %)	Rainfall (mm)	Soil Temp. (10cm, C°)	Sunshine (hr)
	E	27.3	11.7	19.5	66.6	0.5	(21.2)	86.4
Jan.	M	28.2	12.5	20.4	66.8	-	(22.0)	86.7
	L	29.5	12.3	20.9	65.6	0.2	(22.8)	101.7
	E	30.3	13.1	21.8	65.0	-	24.4	89.4
Feb.	M	31.4	13.4	22.3	63.2	-	25.1	92.2
	L	32.9	13.9	23.6	62.4	-	26.0	77.6
	E	33.4	15.9	24.8	62.6	6.1	26.8	84.0
Mar.	M	33.6	17.4	25.6	64.6	4.7	27.5	78.7
	L	32.8	17.7	25.4	64.6	23.8	27.8	83.9
	E	33.9	19.2	26.6	65.8	23.3	29.0	74.5
Apr.	M	33.9	20.1	26.4	64.6	25.7	29.6	81.2
	L	34.5	21.2	28.1	67.2	26.5	30.4	78.6
	E	33.9	22.1	27.8	69.2	31.7	30.9	84.6
May	M	33.3	22.7	27.9	70.6	83.6	30.7	67.6
	L	31.7	22.5	27.1	74.0	112.1	29.0	62.0
	E	31.6	22.9	27.2	76.2	44.1	29.2	44.6
June	M	31.9	23.1	27.4	75.6	34.6	28.9	44.1
	L	32.2	23.1	27.7	73.6	45.0	29.6	50.5
	E	31.6	23.3	27.5	76.6	54.2	29.4	41.2
July	M	30.5	23.2	26.9	78.4	81.2	29.0	34.7
	L	30.3	23.0	26.7	79.2	98.1	28.5	24.4
	E	30.0	23.3	26.7	81.0	49.6	28.3	35.6
Aug.	M	30.2	23.4	26.9	80.6	102.1	28.4	37.5
	L	29.7	23.0	26.0	81.8	115.3	28.1	39.5
	E	30.4	23.1	26.9	78.8	37.3	28.5	45.7
Sep.	M	30.9	23.0	26.9	79.2	102.1	28.7	61.3
	L	30.9	22.6	26.6	78.8	79.9	28.4	53.6
	E	31.1	22.3	26.6	75.6	27.4	28.2	69.8
Oct.	M	30.8	21.4	26.0	74.6	15.6	28.1	64.9
	L	30.0	21.0	25.7	75.2	27.4	27.5	70.9
	E	29.8	19.8	24.8	74.6	28.0	26.6	63.3
Nov.	M	28.9	18.7	23.8	73.8	6.4	26.0	60.2
	L	28.2	16.7	22.5	71.8	9.5	24.5	64.3
	E	28.7	16.6	22.8	72.4	6.6	24.1	62.6
Dec.	M	28.1	14.9	21.5	69.8	11.4	23.5	72.4
	L	27.6	13.7	20.7	69.0	3.4	22.8	84.8

generally exercising cropping managements including cultivation, weeding, etc.

The Srisamrong Agricultural Experiment Station is situated midway between Sukhothai and Sawankhalok and has been operating as one of the main experiment stations for cotton. The soil of the station is of sandy loam in the alluvion of the River Yam with high fertility. At the station, pedigree selection on a part of breeding materials and yield trials were carried out during the rainy season only, but the problem was that there were observed only a small number of cases of rust disease which would cause serious damage to the

soybean crop at other places in the rainy season. Meteorological observations at the station are shown in Table 2.

Table 2. Climatological Data at The Srisamrong Agr. Exp. Sta. (1974)

Month		Air temp. (C°) Max. temp.	Min. temp.	Ave. temp.	Humidity (Ave. %)	Rainfall (mm)	Soil Temp. (100cm. °C)	Sunshine (hr)
Jan.	E	27.7	(9.3)	(18.9)	67	-	24.7	84.1
	M	31.6	15.0	24.3	71	0.6	38.3	82.7
	L	33.1	17.5	25.4	71	-	30.9	87.2
Feb.	E	32.4	15.6	24.0	70	0.1	29.8	83.1
	M	32.2	15.2	23.7	(68)	-	28.5	74.9
	L	34.4	19.3	26.9	62	-	31.5	60.0
Mar.	E	35.8	20.7	28.3	67	-	32.8	80.0
	M	36.4	23.4	30.0	67	2.7	35.8	86.9
	L	32.7	21.4	27.1	70	37.7	31.6	72.3
Apr.	E	36.3	(23.5)	(29.9)	65	1.4	36.3	91.2
	M	35.6	22.9	29.3	65	3.1	36.7	94.7
	L	(34.7)	(24.6)	(30.1)	(72)	(7.9)	(36.0)	(45.6)
May	E	36.6	23.5	29.9	67	110.8	33.2	92.4
	M	34.2	23.6	28.8	73	73.6	33.0	75.2
	L	31.2	23.9	27.6	79	60.5	30.9	34.7
June	E	32.2	24.0	28.1	77	5.4	32.8	(40.6)
	M	32.9	24.2	28.6	76	15.3	33.2	39.8
	L	33.9	23.4	28.7	73	40.3	32.5	65.8
July	E	33.7	24.0	28.9	71	12.8	31.2	48.2
	M	35.1	24.7	29.9	65	4.7	34.2	49.2
	L	31.2	23.2	27.2	80	98.7	30.9	(26.3)
Aug.	E	32.7	23.8	28.3	(77)	70.2	32.1	64.4
	M	31.3	24.2	27.8	(80)	45.2	30.2	20.4
	L	31.1	24.1	27.6	81	145.4	30.3	(55.9)
Sep.	E	31.7	24.1	27.9	80	137.0	30.4	52.6
	M	32.0	23.7	27.9	78	53.8	30.8	59.5
	L	32.3	23.9	28.1	79	62.5	31.6	43.4
Oct.	E	32.0	23.7	27.9	83	33.9	31.7	57.6
	M	31.6	23.7	27.7	82	32.2	31.1	59.4
	L	31.5	23.4	27.6	81	67.2	31.6	83.4
Nov.	E	30.9	22.8	26.9	84	19.6	30.0	64.9
	M	30.4	21.7	26.1	79	18.3	29.0	60.8
	L	29.9	18.8	24.4	(75)	-	29.6	80.4
Dec.	E	31.6	20.1	25.9	76	-	31.0	74.4
	M	32.2	17.3	23.8	73	-	29.8	74.2
	L	30.8	19.0	25.0	74	-	30.5	(86.4)

Thailand is situated 5°30" N in the south and 21°N in the north or in the so-called tropical monsoon zone. In Table 3 are shown the meteorological observations at the various sites. The day length is longest at 12 to 13 hours in June and July and is not much different in December and January at about 11 hours as the shortest.

Table 3. Climatological Data for the Period 1951 - 1970 at Selected Locations

Location	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year	Remark
1. Chiengmai														
Temp(°C) max.	29.3	32.2	35.2	36.4	36.5	32.2	31.5	30.8	30.9	30.7	30.0	28.6	31.8	18°47'N, 98°59'E,
min.	13.4	13.9	17.0	23.1	23.3	23.5	23.3	23.2	22.8	21.5	18.6	14.8	19.7	313.13 m near Mae Jo
ave.	21.1	23.0	26.1	28.8	28.7	27.9	27.4	27.0	26.9	26.2	24.3	21.7	25.8	Agr. Exp. Sta.
Relative humidity (ave. %)	70.6	65.3	57.0	59.0	72.2	79.3	80.6	83.7	83.7	81.4	80.3	77.8	74.5	
Rainfall (ave. mm)	9.8	8.4	19.1	51.3	168.1	156.3	175.0	235.4	257.8	133.8	30.9	15.4	1261.3	
2. Phitsanulok														
Temp (°C) max.	31.7	33.6	36.0	37.4	35.2	33.6	32.8	32.3	32.1	32.4	32.0	31.3	33.4	16°50'N, 100°16'E,
min.	19.7	20.0	22.7	24.7	25.0	24.6	24.3	24.3	24.3	23.8	21.5	18.5	22.6	44.81 m near
ave.	24.7	26.9	29.4	31.1	30.3	29.1	28.5	28.3	28.2	28.1	26.8	24.7	28.0	Srisamrong Agr. Exp.
Relative humidity (ave. %)	69.4	67.6	64.9	66.5	73.8	79.9	81.3	82.9	83.5	80.6	75.9	71.8	76.7	Sta.
Rainfall (ave. mm)	7.9	13.8	37.8	55.3	205.5	169.9	192.1	226.0	266.7	140.6	21.9	6.5	1342.0	
3. Khonkaen														
Temp(°C) max.	30.5	32.7	35.6	36.5	34.9	33.1	32.6	32.1	31.5	31.5	31.0	30.1	32.3	16°26'N, 102°51'E,
min.	15.8	18.7	21.9	24.0	24.6	24.6	24.1	24.0	23.6	22.2	19.4	16.1	21.6	166.63 m near
ave.	23.2	25.1	28.8	30.2	29.8	28.6	28.2	28.1	27.6	26.3	25.2	23.1	27.1	Kalasin Agr. Exp.
Relative humidity (ave. %)	64.3	62.8	61.2	63.4	72.4	76.4	77.7	80.1	81.6	76.9	70.5	66.6	73.1	Sta.
Rainfall (ave.mm)	9.2	19.8	39.6	63.0	166.0	187.6	149.5	176.9	272.6	95.7	11.4	1.5	1197.8	
4. Nakhonratsima														
Temp(°C) max.	30.9	33.5	35.8	36.4	34.8	33.8	33.1	32.7	31.8	30.7	30.8	29.7	32.8	14°58'N, 102°07'E,
min.	16.0	19.2	21.9	23.3	23.9	23.8	23.4	23.2	23.0	22.2	19.4	16.3	21.3	188.00 m
ave.	23.4	26.3	28.9	29.9	29.4	28.8	28.3	28.0	27.4	26.4	25.1	23.0	27.0	
Relative humidity(ave.%)	68.9	65.7	66.3	69.2	77.2	76.9	78.0	79.1	83.4	82.2	77.6	73.1	74.8	
Rainfall (ave.mm)	3.6	27.8	55.6	71.1	177.4	109.3	143.2	133.2	261.1	176.0	29.9	2.7	1190.9	
5. Nakhonsawan														
Temp(°C) max.	32.8	34.5	36.2	37.7	35.8	34.3	33.7	33.1	32.2	31.8	31.5	31.0	33.7	15°48'N, 100°10'E,
min.	17.6	20.9	23.5	25.0	24.9	24.5	24.0	23.9	23.9	23.5	21.1	17.9	22.6	28.00 m
ave.	24.9	27.7	30.2	31.6	30.5	29.6	28.9	28.5	28.0	27.6	26.3	24.6	28.2	North of Chainat
Relative humidity(ave.%)	63.8	62.6	60.7	62.0	69.8	76.1	76.0	78.6	81.8	79.7	73.6	68.1	70.9	
Rainfall (ave.mm)	11.8	26.5	43.3	71.8	161.3	133.7	143.6	166.5	263.8	151.8	29.5	6.0	1187.4	
6. Lopburi														
Temp(°C) max.	32.7	34.6	36.4	37.3	35.3	33.7	32.7	32.2	31.6	31.6	31.5	31.5	33.4	14°48'N, 100°37'E,
min.	19.0	21.9	23.8	24.4	23.8	24.2	23.9	24.0	23.9	23.6	21.4	19.1	22.9	33.00 m near
ave.	25.8	28.2	30.1	30.9	30.0	28.9	28.3	28.1	27.8	27.5	26.4	25.4	28.1	Phraphuthabat Agr.
Relative humidity(ave.%)	59.8	63.2	64.9	66.6	74.3	76.9	79.2	80.8	83.3	78.7	71.2	62.9	71.8	Exp. Sta.
Rainfall (ave.mm)	11.2	16.0	62.0	73.2	170.9	154.6	185.5	170.1	279.3	172.6	39.2	8.5	1343.2	
7. Donmuang														
Temp(°C) max.	32.1	33.3	34.7	35.6	34.6	33.5	32.8	32.5	32.0	31.6	31.1	30.9	32.9	13°55'N, 100°36'E,
min.	20.3	22.1	23.8	25.1	25.3	25.3	25.0	25.0	24.8	24.9	23.8	21.3	23.9	12.30 m within
ave.	26.2	27.7	29.2	30.4	30.0	29.4	28.9	28.7	28.2	28.3	27.5	26.0	28.4	Bangkok
Relative humidity(ave.%)	73.0	74.2	74.1	73.8	77.4	77.1	78.3	79.3	79.9	78.5	76.8	73.6	76.2	
Rainfall (ave.mm)	4.8	21.0	35.7	67.2	178.0	170.6	173.8	239.2	329.1	250.5	38.7	15.3	1523.9	

Source : "Climatological Data of Thailand, 20 year period (1951 - 1970)", Meteorological Department, Ministry of Communications

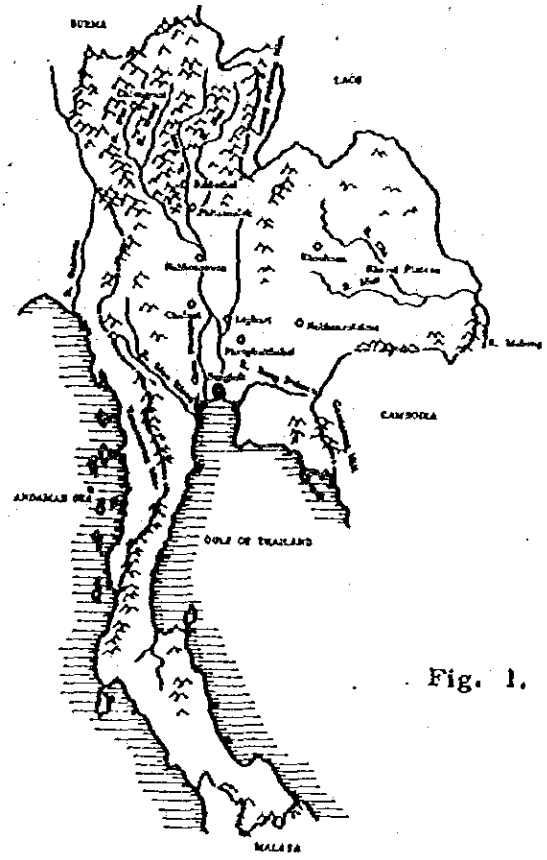


Fig. 1. A Sketch of Thailand

2. Soybean Breeding Experiments

1) Past Progress

Soybean breeding experiments under the project were started with the arrival of an expert dispatched from Japan, namely Mr. Takashi Sanbuichi, Tokachi Agricultural Experiment Station, Hokkaido, in May 1970. Thereafter, the experiments were carried out mainly with respect to selection and evaluation of the progeny derived from artificial crossing at the Mae Jo Agricultural Experiment Station (Chiengmai) and other stations belonging to the Department of Agriculture, Thailand, by the researchers of Thailand and breeding experts dispatched subsequently from Japan, namely Messrs. Kijiro Kikubun, Tohoku Agricultural Experiment Station, Ministry of Agriculture; Yoshimitsu Tanimura, Central Agricultural Experiment Station, Hokkaido; Dr. Shoshin Knno, National Institute of Agricultural Sciences, Ministry of Agriculture; Koji Hashimoto, Hokkaido Agricultural Experiment Station, Ministry of Agriculture; Kouichi Sasaki, Tokachi Agricultural Experiment Station, Hokkaido; and Masataka Saito, Central Agricultural Experiment Station, Hokkaido, successively and followed by Dr. Shoshin Konno again from December 1975. Names of such researchers and their subjects of experiments are set forth in Table 4.

Table 4. Names of the Researchers in Charge of Soybean Breeding Experiments

Year	Season	Japanese expert	Pedigree selection	Yield trail
1970	Rainy	Sanbuichi	Amnuay, Sripoon	
1971	Dry	Sanbuichi	Amnuay, Sripoon, Satit	
	Rainy	Sanbuichi	Rangsan, Suphachai Sripoon, Satit	
1972	Dry	Sanbuichi	Amnuay, Rangsan Sripoon, Satit	
	Rainy	Kokubun, Tanimura	Amnuay, Thanit Sripoon, Satit	
1973	Dry	Kokubu, Tanimura	Amnuay, Rangsan Sripoon, Satit	Suphachai, Khontong Surakit
	Rainy	Kokubun, Tanimura Knno	Amnuay, Rangsan Thanit, Sripoon, Satit	Suphachai, Khontong Surakit
1974	Dry	Kokubun, Hashimoto	Amnuay, Rangsan, Thanit, Sripoon, Satit	Suphachai, Khontong Surakit
	Rainy	Hashimoto	Amnuay, Rangsan, Thanit, Sripoon, Satit	Anek, Surakit
1975	Dry	Hashimoto, Sasaki	Amnuay, Rangsan, Thanit, Sripoon, Satit	Anek, Viroon, Surakit
	Rainy	Sasaki, Saito	Amnuay, Rangsan, Thanit, Sripoon, Satit	Anek, Surakit Suphachai (F), Vibul(F)

Note: 1 (F) : Farmer's

2 Terms of Japanese experts

Field Test

(1) Takashi Sanbuichi; May 18, 1970 - May 17, 1972
(2) Kijiro Kikubun; May 8, 1972 - May 7, 1974
(3) Yoshimitsu Tanimura; June 20, 1972 - June 19, 1973
(4) Shoshin Konno; May 25, 1973 - June 24, 1973, July 4, 1973 - Nov. 3, 1973
(5) Koji Hashimoto; Feb. 25, 1974 - Apr. 24, 1975
(6) Kouichi Sasaki; Jan. 11, 1975 - Jan. 10, 1976
(7) Masataka Saito; June 1, 1975 - July 31, 1975

Further, the project received visits of the survey and guidance teams from Japan and had advice given on the way of carrying out the experiments three times, viz. from August 15 to September 4, 1971 by the team headed by Mr. Kaoru Ozaki, Kyushu Agricultural Experiment Station, Ministry of Agriculture; from March 15 to April 10, 1973 by the team headed by Dr. Kanichi Murakami, National Institute of Agricultural Sciences, Ministry of Agriculture; and from March 19 to April 4, 1975 by the team headed by Dr. Shiro Okabe, National Institute of Agricultural Sciences, Ministry of Agriculture.

The breeding experiments thus carried out are summarized in the following.

(1) Breeding objectives

The soybean breeding experiments under the present project which were set out as the soybean improvement through introduction of good and highly productive varieties and selection out of the progeny derived from the artificial crossing were taken up as one of the programs for promotion of soybean cultivation in Thailand (and subsequent export of soybeans). Thus, importance was placed, at first, on the introduction of a number of varieties and the selection of them. But, most of them were hardly adaptable directly to the cultivating environment of soybeans in Thailand, and they were rather regarded as promising parents for cross breeding. From such situation, improvement of the lines through cross breeding was considered as one of the main targets of the subsequent experiments.

Artificial crossing was started soon after initiation of the soybean breeding experiments on August 25, 1970. In the initial stage, some of the indigenous lines in Thailand or those which had been introduced from Taiwan and presented good results were used as parents which were subjected to the artificial crossing between them or with the varieties introduced from Japan and noted of large size and excellent quality of seeds. Thereafter, with the accumulation of information on the soybean cultivation in Thailand and of the results of experiments, characters such as the number of growing days (early maturity), adaptation of the soybean lines to the planting season and to the infertile soil in the northeastern districts, resistance to rust disease, and size and components of the seeds were taken up as breeding objectives on one hand, and the materials as crossing parents were changed accordingly on the other.

Such breeding objectives are generally represented in Table 5. The objectives shown in Table 5 were clearly defined after "The actual investigation of soybean cultivation in Thailand" conducted in the rainy season of 1970 and in the dry and the rainy seasons of 1971.

In the table, the common and additional objectives are assigned to seven types of cultivation classified according to combination of the locations of soybean production and cropping season. As the common objectives, stable high yield (300 kg/rai or more at the experiment stations or 250 kg/rai at the farms, 1 rai = 0.16 hectare), excellent seed quality (14 g or more at 100 grains weight, yellow or yellowish white seed coat without cracking or creasing, and with smaller hilum of yellow or brown) and high oil content (at least 22 percent) were taken up, and as the additional objectives, resistance to shattering, to the rust and to lodging, nodule affinity to the native races of Rhizobuim bacteria and adaptability to the fields of low fertility were taken up.

When the situation of soybean cultivation in Thailand is taken into consideration in carrying out the breeding experiments actually, there are, however involved with many problems worthy of consideration such as apportionment of the weight to the respective types of planting, breeding objectives and method of selection (field, time and intensity of selection) and the spread of the damage due to subsequent diseases.

Table 5. Breeding Objectives of Soybean in Thailand.

Regions	Cropping season (cropping pattern)	Main objectives (common)	Additional objectives	Standard variety
Northern (Chiengmai)	dry (paddy rice-soybeans)	high and stable yield, high oil content, excellent seed quality	resistant to rust disease, shattering and lodging, vigorous growth with medium maturity	SJ-2
	early rainy (soybeans-maize, tobacco, mungbeans)		resistant to rust disease and lodging	SJ-1
Central Plain (Sukhothai)	rainy (soybeans -cotton, soybeans only)		resistant to lodging, excellent germination	SJ-1
(Chainat)	dry		resistant to shattering, vigorous growth	SJ-2
(Saraburi)	late rainy (maize-soybeans)		early maturity, vigorous growth	SJ-2
Northeastern	rainy (substitute soybeans for kenaf		affinity to the local Rhizobium strains, adaptability to poor level of fertility	SJ-2 SB-60
	dry		affinity to the local Rhizobium strains, adaptability to poor level of fertility	SJ-2

Note: Resistancy to insect damage is not included in the breeding objectives.

(2) Introduction and collection of breeding materials and experiments on it

Introduction and collection of the breeding materials had been carried out energetically since May 1970. Thus, through introduction of soybean varieties and lines from the National Institute of Agricultural Sciences of the Ministry of Agriculture and many other research institutions of soybean breeding in Japan, collection of the domestic and introduced varieties kept in the research institutions in Thailand, and introduction of varieties and lines through the experts dispatched from the Agency to various countries, as much collection as 1501 varieties and lines was attained by December 1970 (Report on the experiments, research and results of the survey for the joint development of Thai soybeans, Overseas Technical Cooperation Agency, February 1973). Introduction of the varieties and lines was continued thereafter to 1686 varieties and lines by October 1973. Thus, the number of soybean varieties and lines introduced so far exceeds 1700. These varieties and lines of collection were planted successively at the Mae Jo Agricultural Experiment Station, Srisamrong Agricultural Experiment Station (Sukhothai) and The Chainat Rice Experiment Station (Chainat) in and after the rainy season of 1970 and were then subjected to general observation and investigation, while their selection was made from the point of view as a parental material for crossing or practical variety. The results of such experiments were summarized for the respective seasons with those of the years of 1970 and 1971 reported in the "Introduced Soybean Varieties in Thailand" (Department of Agriculture, Thailand, January 1974).

Experiments for selection of the introduced varieties and lines were started from the rainy season of 1970 on those materials which were considered to be promising. Later, preliminary yield test of the introduced varieties from the dry season of 1971, and Regional Yield Trials and tests for adaptability to late planting of the introduced varieties from the rainy season of the same year had been conducted and from the results of such experiments, highly promissing lines were employed as crossing parents. In the dry season of 1975, Preliminary Yield Tests were carried out on 30 varieties and lines including the standard varieties "SJ-1" and "SJ-2" at the Mae Jo Agricultural Experiment Station and The Chainat Rice Experiment Station, and Regional Yield Trials on 13 varieties and lines including the foregoing standard varieties at the foregoing two experiment stations as well as The Kalasin Agricultural Experiment Station (Kalasin).

Further, pure line selections were conducted in use of exogamies of "SJ-2" collected from various parts and varieties formerly introduced such as "64-62", "64-64" and "64-104" as materials. Among them, the lines "Ro-11" and "Ro-15" collected as exogamies of "SJ-2" proved good setting of root nodules in the north-eastern districts and were used as crossing parents for the breeding of nodule affinity to local Rhizobuim strains desired in the north-eastern districts.

(3) Artificial crossing

Artificial crossing was started with a preliminary investigation of the time for crossing in one day, selection of parents and rate of successful crossing as a function of the meteorological condition, from the rainy season of 1970, and was made on 30 combinations during the season, followed by 3 combinations in 1971, 7 combinations in 1972, 34 combinations in 1973 and 22 combinations in 1975. In 1974, no artificial crossing was made in view of a number of successful combinations in the preceding year and in consideration of the balance of the progeny in late generations of crossing as a whole.

Now referring to what was used in such artificial crossing, "SJ-1" and "SJ-2" were used mainly among the standard varieties of Thailand, but when both were compared, it would be seen that "SJ-2" was used predominatly as it had noticeable characters such as elect stem, resistance to shattering and high oil contents. As a rust resistant parent, the variety "64-104" introduced from Taiwan was used from the onset, and crossing made to this parent concentratively were in 1973. Further, the breeding lines originating from combinations with the same line were used as crossing parents, and in 1975, crossing was newly made with "Kyushu 47", "PI 200492", "Kaoshung E 32" and "Ooura" as rust resistant parents. Varieties introduced from Japan were used extensively as they were generally of excellent quality with large seeds and the experts from Japan had full knowledge on their characters. Thus, there were used such varieties in 1970 as "Bonminori" (reputed in Thailand as relatively high in its productivity), "Takachinagaha", "Nemashirazu", "Hougyoku", "Shin no. 4", "Koganejiro", "Shirodaihachirin", "Karikachi", "Tousan no. 26", "Aki-yoshi" and "Fusanari", in 1973 such as "Jukkoku-mame", "Raiden", "Tousan No. 26", "Kinoshita-mame", "Nemashirazu" and "Yuuzuru", and in 1975 such as "Shin No. 4", "Kyushu 47" and "Ooura" (the latter two varieties were used as rust resistant parents).

Other important parents were "SB-60" and "Ro-15" used in 1972 and "Ro-11" ("Ro-15") used in 1973. "Ro-11" and "Ro-15" are the lines collected as exogamies of "SJ-2" with the relatively good setting of root nodules and excellent growth, pod setting and seed yield of these lines noted against inferiority of "SJ-2" in the setting of root nodules in the north-eastern districts. Including the crossings with "SB-60", those of which the setting of root nodules was considered as an important character for selection in the north-eastern districts were of 8 combinations. In 1973, a variety introduced from America, "Jupiter", was used in many crossings as it had vigorous growth and elect stem although the maturity was rather late. But, on account of green seedcoat of this variety most of the lines derived from the crossing with this variety were eliminated in the selection in early generations. There were also a number of breeding lines which were used as crossing parents. These were generally intended for introduction of the characters such as the rust resistance or vigorousness of the growth of them.

Table 6. The List of Crossing Parents until 1975

Crossing number	Crossing parents	No. of flowers crossed	No. of pods harvested	No. of seeds harvested	Percentage of succesful crossing
7001	Bon-minori x SJ-2	89	31	48	34.8
7002	SJ-2 x Tokachi-nagata	114	21	35	18.4
7003	SJ-2 x Nema-shirazu	103	13	20	12.6
7004	Hougyoku x K.S. 167 (Tall type)	73	12	20	16.4
7005	Shin no. 4 x SJ-2	63	10	17	15.9
7006	SJ-2 x Kogane-jiro	131	6	10	4.6
7007	SJ-1 x Nema-shirazu	43	5	7	11.6
7008	Taichung no. 12 x Nema-shirazu	171	8	14	4.7
7009	SJ-2 x Hougyoku	51	10	22	19.6
7010	SJ-2 x Shin no. 4	25	5	11	20.0
7011	Shirodaihachirin x Nema-shirazu	43	6	12	14.0
7012	Karikachi x SJ-2	71	7	10	9.9
7013	Tousan no. 26 x SJ-2	116	16	23	13.8
7014	Aki-yoshi x Taichung no. 12	53	8	11	15.1
7015	Lincoln x SJ-2	10	1	2	10.0
7016	E-27 x 7001 (F_1)	56	6	12	10.7
7017	7001 (F_1) x F27	42	11	22	26.2
7018	E-27 x 7002 (F_1)	53	17	34	32.1
7019	Acadian x 64-104	21	4	7	19.0
7020	SJ-2 x K.S. 252	80	22	43	27.5
7021	K.S. 252 x SJ-2	30	9	13	30.0
7022	L-356 x Acadian	59	19	37	32.2
7023	L-356 x SJ-2	30	7	7	23.3
7024	64-104 x SJ-2	49	8	12	16.3
7025	SJ-2 x 64-104	91	13	21	14.3
7026	SJ-2 x Acadian	86	24	41	27.9
7027	K.S. 252 x E-27	97	20	19	20.6
7028	0-38 (Large seed) x E-27	31	10	12	32.3
7029	Fusanari x SJ-2	45	5	6	11.1
7030	0-38 (Small seed) x SJ-2	17	4	5	23.5
	30 comb.	1943	338	553	17.4

Crossing number	Crossing parents	No. of flowers crossed	No. of pods harvested	No. of seeds harvested	Percentage of succesful crossing
7101	Ouhouju x SJ-2	8	0	0	0
7012	SJ-2 x Taichung no. 12	24	5	8	20.8
7013	SB60 x SJ-2	-	0	0	0
	3 comb.	-	5	8	-
7201	SB60 x SJ-2	114	64	107	56.1
7202	Ro-15 x SJ-2	94	25	44	26.6
7203	SJ-1 x 64-104	152	88	170	57.9
7204	64-104 x SJ-1	128	33	52	25.8
7205	SB60 x SJ-1	160	52	80	32.5
7206	K.S.252 x 64-104	149	89	134	59.7
7207	K.S.252 x 7024 (F_4)	175	15	25	8.6
	7 comb.	972	366	612	37.7
7301	SJ-2 x Jupiter	103	7		6.8
7302	SJ-2 x Lincoln	119	23		19.3
7303	SJ-2 x Tainung 3	155	41		26.5
7304	SJ-2 x Jukkoku-mame	126	12		9.5
7305	SJ-2 x Raiden	106	5		4.8
7306	IAC-2 x SJ-2	76	14		18.4
7307	SJ-1 x Jupiter	167	49		29.3
7308	SJ-1 x Jukkoku-mame	106	45		42.5
7309	64-104 x 7024 (F_6)	34	1		2.9
7310	64-104 x 7013 (F_6)	56	16		28.6
7311	64-104 x Jupiter	53	11		20.8
7312	64-104 x Lincoln	78	17		21.8
7313	Raiden x 64-104	104	47		45.2
7314	Tainung 3 x 64-104	81	15		18.5
7315	Tousan no. 26 x 64-104	232	50		21.6
7316	Kinoshita-mame x 64-104	84	31		36.9
7317	K.S.252 x Jupiter	127	44		34.7
7318	7001(F_7) x 7013 (F_6)	44	13		29.6
7319	7001(F_7) x 7024 (F_6)	26	11		42.3
7320	7001(F_7) x Nema-shirazu	19	7		36.8
7321	7013(F_6) x 7024 (F_6)	64	14		21.9
7322	7013(F_6)x Jupiter	23	9		39.1
7323	7013(F_6) x Sanjuan	56	22		39.3
7324	7013(F_6) x Yuuzuru	13	7		53.9
7325	7024(F_6) x Nema-shirazu	27	9		33.3
7326	Raiden x Jupiter	112	28		25.0
7327	Tainung 3 x Raiden	52	8		15.4
7328	Tainung 3 x Nema-shirazu	23	3		13.0
7329	Yuuzuru x Jupiter	55	4		7.3
7330	Ro-15 x 64-104	71	15		21.1
7331	K.S.252 x Ro-15	90	25		27.8
7332	Raiden x Ro-15	187	33		17.7
7333	K.S.252 x Ro-11	127	33		26.0
7334	Jukkoku-mame x Ro-11	70	35		50.0
	34 comb.	2864	704		24.6
7501	SJ-2 x PI 200492	115	3	4	2.6
7502	Kyushu 47 x SJ-2	113	16	24	14.2
7503	SJ-2 x Wayne	125	2	3	1.6
7504	SJ-2 x Shiryuou	105	13	19	12.4
7505	Shin no. 4 x SJ-2	102	39	83	38.2
7506	CES 16-103 x SJ-2	114	22	35	19.3
7507	Sanjuan x 7019. P_1. 24. 3. P_6. 1. P_8. P_9. P_{10}	106	6	7	5.7
7508	Williams x 7019. P_1. 24. 3. P_6. 1. P_8. P_9. P_{10}	91	18	37	19.8

Crossing number	Crossing parents	No. of flowers crossed	No. of pods harvested	No. of seeds harvested	Percentage of succesful crossing
7509	Wayne x 7024. P_3. 91. 2. P_6 P_7. P_8. P_9. P_{10}	132	13	15	9.9
7510	7021. P_3. FPs. 3. P_7. P_8. P_9 Kyushu 47	108	17	24	15.7
7511	7024. P_3. 91. 2. P_6. P_7. P_8. P_9. P10 x Clark 63	132	6	5	4.6
7512	SJ-2 x Kaoshung E32	133	5	8	3.8
7513	7019. P_3. 24. 3. P_6. 1. P_8. P_9. P_{10} x 7020. P_3. 65. 1. 5. P_7. P_8. P_9	121	1	1	0.8
7514	7019. P_3. 24. 3. P_6. 1. P_8. P_9. P_{10} x 7021. P_3. 33. FPs. 1. 5. P_8. P_9	134	5	9	3.7
7515	7012. P_3. 200. 50. 3. 6(S). P_7. P_8. P_9. P_{10} x Kyushu 47	-	3	4	-
7516	7020. P_3. 65. 1. 5. P_7. P_8. P_9 Kaoshung E32	137	16	24	11.7
7517	7020. P_3. 49. 2. 3. P_7. P_8. P_9. x Ooura	121	16	20	13.2
7518	7021. P_3. 33. FPs. 1. 5. P_8. P_9 x Ooura	150	9	13	6.0
7519	7012. P_3. 200. 50. 3. 6(S). P_7. P_8. P_9. P_{10} x Ooura	122	26	44	21.3
7520	7021. P_3. 33. FPs. 3. P_7. P_8. P_9 x Kaochung E32	112	7	9	6.3
7521	7019. P_3. 24. 3. P_6. 1. P_8. P_9. P_{10} x Kaochung E32	124	2	4	1.6
7522	7012. P_2. 200. 50. 3. 6(S). P_7. P_8. P_9 x Kaochung E32	137	16	24	11.7
	22 comb.	(2504)	(263)	(422)	(10.5)

The artifical crossing, when carried out in the dry season while the air temperature used to decline in the nighttime, often encountered difficulties in collecting pollens and sometimes resulted in fertilization without flowering or abnormal podding depending on the variety. Thus, it was carried out generally in the rainy season according to a system of planting the first generation of crossing and eliminating selfed plants in the following dry season. The experts from Japan were also engaged in such crossing works, and the rate of successful crossing was generally high at about 20 percent or more except the year of 1971 at a slightly lower rate.

At present the lines in the most advanced generation are in F_{11} in the dry season of 1975, and many of them in those generations are being tested in Preliminary Yield Tests and Regional Yield Trials.

The rust resistant lines from 7019 ("Acadian" x "64-104") and 7024 ("64-104" x "SJ-2") having "64-104" as one parent are not high in oil contents. Thus, in selection of the crossing parents to be carried out hereafter, importance should, of course, be attached to the resistance to the rust diseases but, at the same time, much consideration should be given to oil contents of parents.

(4) Pedigree selection

Selection of the progeny derived from crossings was carried out mainly at the Mae Jo Agricultural Experiment Station because the station was one for upland crops situated at the center of the soybean cultivation in the dry season and was relatively well equipped with irrigation facilities to permit experiments in the dry as well as rainy season and, although it is rather remote from the central districts of soybean cultivation in the rainy season or Sukhothai, was advantageous for breeding of rust resistant lines with heavy occurrence of the disease. Thus, at first, the selection was carried out at the Mae Jo Agricultural Experiment Station only, but later in and after 1972, the pedigree selection was also undertaken at The Srisamrong Agricultural Experiment Station located at the center of the soybean cultivation in the rainy season in that althouth no rust was observed on soybeans in the rainy season (occurrence of rust disease was reported later), the condition of growth in the rainy season (long stem and severe lodging) would be considered to be important for pedigree selection. However, sprinkling is, of course, required for the early stage of growth of the soybeans in the rainy season in order to enhance the accuracy of test. Thus, before the irrigation facilities were provided, it would be difficult to say that the pedigree selection was carried out successfully on account of the failure in poor germination owing to draught or heavy rainfall. Further, where the seeds for pedigree selection were divided and apportioned equally to The Mae Jo and Srisamrong Agricultural Experiment Stations, the selection should have been carried out for evaluation through comprehensive observation of the growth of the breeding lines at the respective stations. But, there was observed some aspects of selection carried out upon the concept as an individual selecting field.

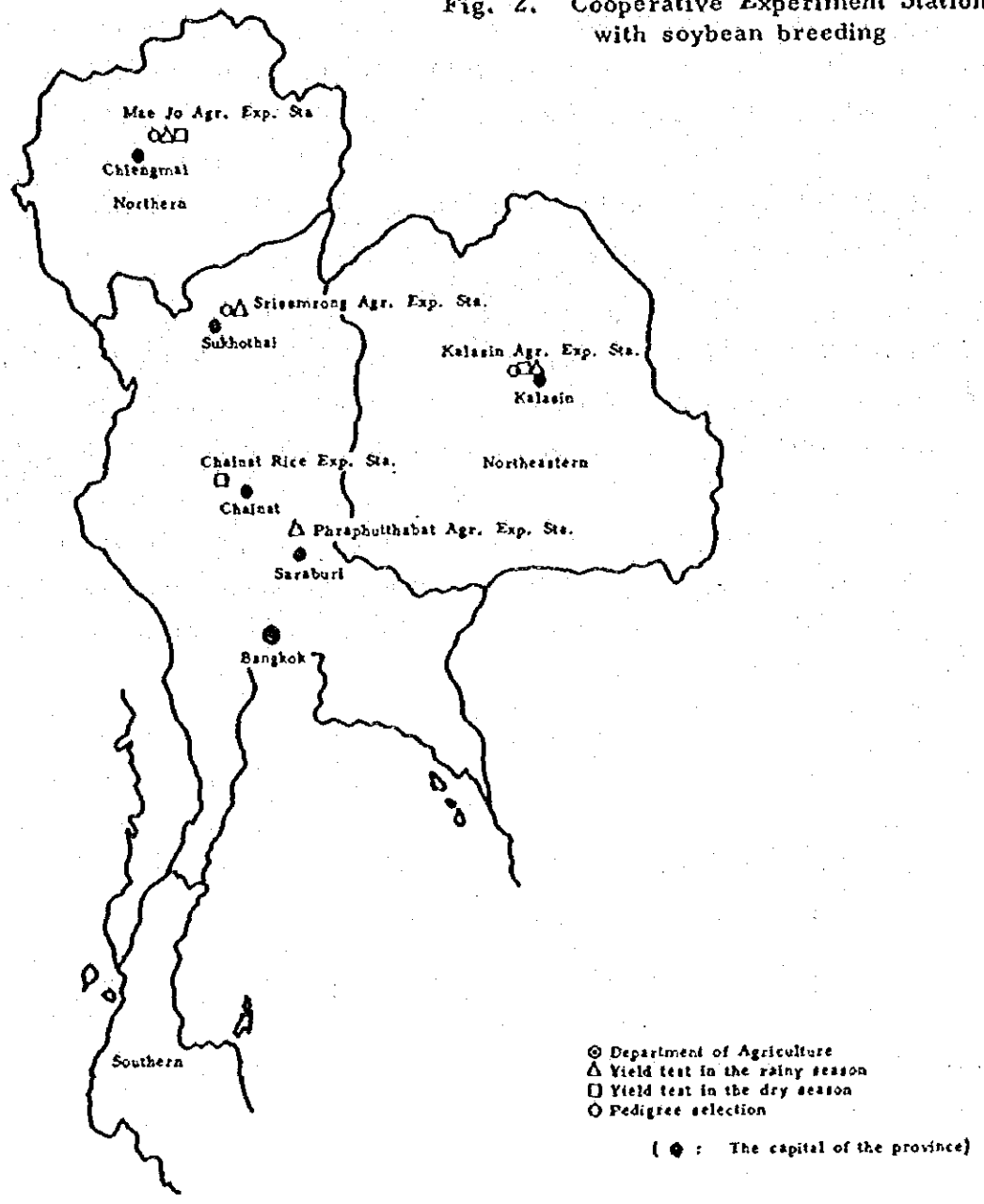
Selection concerning on the nodule affinity was carried out at the Kalasin Agricultural Experiment Station. That is, the experiments were intended to select lines (or individual plants) of good nodule setting out of the population of F_2 or following generations planted at the fields in the Kalasin Agricultural Experiment Station where the soybeans were scarecely planted in the past. However, there were instances of perfect lacking of uniform growth of soybeans even in the fields of the station and of total absence of noudle bacteria so that it could hardly be said that the selection was carried out satisfactorily. Since the rainy season of 1975, the selection has been carried out with the native race of nodule bacteria in the Kalasin district inoculated.

The selection conducted on breeding lines in and after 1972 are summarized in the "Report of the Circuit Survey Team under Thai Soybean

Development Project (March-April 1975)" at Table 4-2.

The agricultural experiment stations (including rice experiment stations) assuming the experiments on pedigree selection and yield trials on breeding lines are illustrated in Figure 2.

Fig. 2. Cooperative Experiment Stations with soybean breeding



(5) Yield trials on breeding lines

The yield trials in which the breeding lines were tested were initiated as Soybean Preliminary Yield Trial at The Mae Jo Agricultural Experiment Station in 1973 in the scale of preliminary yield tests. Such preliminary yield tests were also started at the other agricultural experiment stations at Srisamrong and Phraphutthabat (Saraburi) later in the rainy season

of the same year. In the dry season of 1974, the Chainat Rice Experiment Station was added as the site for preliminary yield tests. Thus, the tests have been carried out at two different places for the dry and rainy seasons respectively. The materials were comprised mainly of the lines from 7001 ("Bonminori" x "SJ-2") and 7005 ("Shin no. 4" x "SJ-2") initially. But, later, the lines from 7003 ("SJ-2" x "Nema-Shirazu"), 7013 ("Tousan no. 26" x "SJ-2"), 7016 ("E-27" x 7001 (F_3)), 7019 ("Acadian" x 64-104"), 7020 ("SJ-2" x "K.S.252"), 7021 ("K.S.252" x "SJ-2") and 7024 ("64-104" x "SJ-2") were added. And, since the rainy season of 1975, the lines from 7203 ("SJ-1" x "64-104"), 7204 ("64-104" x "SJ-1), 7206 ("K.S.252" x "64-104") and 7207 ("K.S.252" x 7024(F_4)) were added to the materials.

The Regional Yield Trials were started as Hybrid and Introduced Varieties Tests at the Srisamrong and Phraphutthabat Agricultural Experiment Stations since the rainy season of 1974. The trials were continued in the dry season of 1975 at the Mae Jo Agricultural Experiment Station, the Chainat Paddy Rice Experiment Station and the Kalasin Agricultural Experiment Station, and in the rainy season at the Mae Jo, Srisamrong, Phraphutthabat and Kalasin Agricultural Experiment Stations. Such yield trials were later designated as Regional Yield Trial. The materials are generally of the lines from combinations of 7019, 7020, 7021 and 7024.

The yield trials on breeding lines were carried out at many experiment stations as stated in the foregoing. But, the results are not always satisfactorily reliable for application to selection, and in Table 7 are shown the results of yield trials conducted at the various experiment stations with signs attached to indicate the reliability of the data.

Later, the reliability of the yield trails was enhanced greatly as the Thai researchers acquired the test procedures, while irrigation facilities became available at the Srisamrong Agricultural Experiment Station, and the fields were improved for tests in the dry season at the Kalasin Agricultural Experiment Station.

Farmer's field tests on the breeding lines were started from the rainy season of 1975.

2) Breeding Experiments

Here, the situation for the breeding experiments during the term of duty of the author in the dry and rainy seasons of 1975 are described.

It was after the planting of experiments in the dry season in 1975 that the author arrived at the place of assignment in Thailand (on January 11). Thus, the work assigned to the author started with selection of the materials subjected to the experiments in the season and included the layout or design and planting of the experiments in the dry season of 1976 as the planting of soybeans was started immediately before the return of the author to Japan.

Table 7. Locations of Yield Trials on Breeding Lines (by year and season) with signs for reliability of the data

Year	Season	Regional Yield Trial	Preliminary Yield Test
1973	Dry		○ Mae Jo (Chiengmai)
	Rainy		× Srisamrong (Sukhothai) × Phraphutthabat (Saraburi)
1974	Dry		○ Mae Jo (Chiengmai) △ Chainat (Chainat)
	Rainy	× Srisamrong (Sukhothai) ○ Phraphutthabat (Saraburi)	△ Srisamrong (Sukhothai) ○ Phraphutthabat (Saraburi)
1975	Dry	△ Mae Jo (Chiengmai) × Chainat (Chainat) ○ Kalasin (Kalasin)	○ Mae Jo (Chiengmai) △ Chainat (Chainat)
	Rainy	○ Srisamrong (Sikhothai) ○ Phraphutthabat (Saraburi) ○ Mae Jo (Chiengmai) ○ Kalasin (Kalasin)	○ Srisamrong (Sukhothai) ○ Phraphutthabat (Saraburi)

Note: ○ ; Fully reliable, △ ; Not much reliable,
× ; Not reliable

During the term of duty, the author was to receive a visit by the survey and guidance team headed by Dr. Shiro Okabe, National Institute of Agricultural Sciences belonging to the Ministry of Agriculture, Japan so that the author prepared a report, with collaboration of Mr. Koji Hashimoto (former expert), on the works during January and February 1975 or "Current Situation of Soybean Breeding Experiments". The report seems to be useful to explain what the author was thinking for selection on breeding materials in the future and is reproduced here with some additions made to the draft.

(1) Excerpts from "Current Situation of Soybean Breeding Experiments"

i. Scale of breeding experiments and the researchers in charge

Details of the breeding experiments at The Mae Jo Agricultural Experiment Station (Chiengmai), which are considered to be the center for pedigree selection, in the dry season of 1975, are shown in Table 9. The experiments, as a whole, are not of so large a scale. But, when the other experiments such as those on materials from (i) SEARCA (ii) Intsoy and (iii) AVRDC or those concerning the method of soybean cultivation are included, and the years of experience of the researchers are taken into account, the experiments are generally of an appropriate size. There seems no limitation in the area of fields to be used for experiments, however, the experiments are restricted by labor required for field management or investigation.

Presently, there are as many as 12 soybean researchers assigned in The Mae Jo Agricultural Experiment Station, and many of them are engaged in the soybean breeding experiments. From the Japanese sense of feeling, this staff seems to be large enough. However, such researchers include 3 assistant researchers, and the others consist mainly of the so-called dispatched researchers belonging to the Department of Agriculture so that they are apt to move to the other experiment stations with change of the subject of experiments, or season. Thus, the researchers of The

Table 8. List of Experimental Design of Yield Trials

Year	Season	Classification*	Original Names of Experiments	Location	No. of Materials** (Check varieties)	Plot Size m	Replication	Planting density cm x cm	Planting date
1973	Dry	PYT	Preliminary Yield Trial	Mae Jo	91 (22)	4.40 x 1.50	3	50 x 20, 2	Jan. 16
1974	Dry	PYT	Hybrid Test	Mae Jo	91 (2)	4.00 x 1.50	2	50 x 20, 2	Jan. 6
				Chainat	91 (2)	4.00 x 1.50	2	50 x 20, 2	Jan. 5
	Rainy	PYT	Evaluation of soybean lines in F_2 - F_5 follows hybridization	Srisamrong	45 (2)	4.00 x 1.50	2	50 x 20, 2	May 5
				Phrapbutthabat	45 (2)	4.00 x 1.50	2	50 x 20, 2	July 15
		RYT	Hybrid & introduced Variety Test	Phrapbutthabat	32 (6)	4.00 x 2.50	4	50 x 20, 2	July 16
1975	Dry	PYT	Preliminary Hybrid Yield Test	Mae Jo	40 (2)	4.40 x 2.00	3	50 x 20, 2	Dec. 31
				Chainat	40 (2)	4.40 x 2.00	3	50 x 20, 2	
		RYT	Hybrid Yield Test	Mae Jo	26 (2)	4.40 x 2.00	4	50 x 20, 2	Dec. 29
				Kaloein	24 (2)	4.40 x 2.00	4	50 x 20, 2	Jan. 19
	Rainy	PYT	Preliminary Yield Test	Srisamrong	35 (2)	4.40 x 2.00	3	50 x 20, 2	May 7
				Phrapbutthabat	35 (2)	4.40 x 2.00	3	50 x 20, 2	July 9
		RYT	Regional Yield Trial	Srisamrong	15 (2)	4.40 x 2.00	4	50 x 20, 2	May 8
				Phrapbutthabat	15 (2)	4.40 x 2.00	4	50 x 20, 2	July 9
				Mae Jo	15 (2)	4.40 x 2.00	4	50 x 20, 2	July
				Kaloein	15 (2)	4.40 x 2.00	4	50 x 20, 2	June 11

Note : * : PYT = Preliminary Yield Test, RYT = Regional Yield Trial

** : In the parentheses, the number of check varieties.

Mae Jo Experiment Station in severe sense are reduced to or few members. The soybean researchers of The Mae Jo Agricultural Experiment Station and the subjects of experiments assigned to them respectively are shown in Table 10.

Table 9. Soybean Breeding Experiments at The Mae Jo Agr. Exp. Sta. in the Dry Season, 1975

	Name of Experiment	Details of Experiment	Experimental Area
1.	Variety Collection	406 var. and lines, 1 var./ 1 row (3 m), 50 cm x 20 cm 2 plts.	684 m^2
2.	F_3 Bulk and Pedigree Selection	10 comb. 386 lines, 1 line/ 1 row (4 m), 50 cm x 10 cm 1 plt., 19 bulk populations	1664 m^2
3.	F_5 Pedigree Selection	4 comb. 22 fam. 83 lines, 1 line/1 row (4 m). 50 cm x 10 cm 1 plt.	256 m^2
4.	F_8 Pedigree Selection	5 comb. 12 fam. 60 lines, 1 line/1 row (4 m), 50 cm x 10 cm 1 plt.	256 m^2
5.	Preliminary Yield Test		
	1) Breeding lines	40 var. and lines, plot size; 4.4 m^2, 3 rep., 50 cm x 20 cm 2 plts.	480 m^2
	2) Introduced varieties	30 var. and lines, plot size; 6.6 m^2, 2 rep., 50 cm x 20 cm 2 plts.	400 m^2
6.	Regional Yield Trial		
	1) Breeding lines	28 var. and lines, plot size; 8.8 m^2, 4 rep., 50 cm x 20 cm 2 plts.	960 m^2
	2) Introduced varieties	13 var. and lines, plot size; 8.8 m^2, 4 rep., 50 cm x 20 cm 2 plts.	420 m^2
			5120 m^2

Table 10. Soybean Staff at The Mae Jo Agr. Exp. Sta. (Rainy Season, 1975)

Name		Responsible Working Field
Sunan La-ongsri		Chief of the station (former)
Amnuay Tongdee		Chief of the station
	Amnuay Manit	Crossing & early generations
	Rangsan Keereelavaep	Late generations & propagation of breeding lines
	Anek Chotayarnawong	Preliminary Yield Tests & Regional Yield Trials
	Viroon Sakoontab	(Trainee to Japan)
	Prateep Choengtoen	(Sriamrong Agr. Exp. Sta.)
	Pimporn Sema	Variety collections & preservation
	Sripoon Gong-int	(Assistant researcher)
	Satit Boonpang	(- do -)
	Surakit Em-o-cha	(- do -)
Vijit Thanomthin		(Entomology)
Umnuayporn		(Agricultural engineering, seed storage)
Montha Nunsapunt		(Pathology, rust deseases)

ii. Collection of varieties

For preservation of varieties, 406 lines were planted in The Mae Jo Agricultural Experiment Station in this dry season (1975). They showed normal growth, some being in the maturing stage and being measured and harvested. In general, the introduced varieties scarcely grow vigorously in the cultivating environment of Thailand so that the materials usable in the cross breeding are limited apparantly. While there are many aspects which the author is unable to understand presently, it seems that the variety collection is not yet fully utilized for breeding. Presently, emphasis is placed on the investigation of the individual introduced varieties and lines, equally and the consideration in the closer observation of promising materials or maintenance of pure seeds will be required in the future. Accumulation of the knowledge of the origin or history of the introduced varieties and lines will also be required.

iii. Artificial crossing

Artificial crossing is, so to speak, the first step of breeding by Hybridization, and we the Japanese researchers are carrying out the work everyday with hope to combine such-and-such lines with such-and-such lines and are alert for growth of new breeding lines or introduced varieties to us. Since the author has come to work at the Mae Jo Agricultural Experiment Station from this dry season (1975), one month and a little more has passed. During the period, the author has been asking opinions concerning parents of the crossing scheduled for the coming rainy season. As the materials used for the various experiments are not so much in kind, the prospective lines are limited as a matter of course so that selection of the crossing parents is not a matter of difficulty. Yet, the response in this respect is not much.

Further, while it is dependent on how the breeding is taken, if the breeding is taken as a successive work, excessive variation of the number of combinations tends to

induce a number of disadvantages. In this sense, the crossing of 30 combinations in 1970, 3 combinations in 1971, 7 combinations in 1972, 34 combinations in 1973 and no combination in 1974 are too much fluctuating in the number of combinations, apparently affecting the pedigree selection on the progeny. Now considering of the currently available area of breeding fields, an appropriate number of combinations will be 15 (20 combinations scheduled for the rainy season of 1975).

iv. Pedigree selection

By the imbalance of the number of combinations stated in the foregoing, the pedigree selection is affected greatly as typically illustrated by F_3 in the dry season of 1975. F_3 is of 28 combinations presently. With 10 combinations being subjected to pedigree selection, the number of lines totals 386. The remaining 19 combinations (one combination is subjected to two ways) are mass planted, and the field area for F_3 including all of these occupies a greater part of the breeding field. Thus, it is a very difficult problem of how to carry out the selection on these materials in and after the dry season of 1975. On the other hand, F_5 is very small in the number of combinations and that of lines at 4 and 83 respectively. While this may reflect strict selection conducted by the breeders, such small number of lines of this generation is indicative that the number of lines to be tested in the Preliminary Yield Tests in the future is limited. The F_8 generation is of 5 combinations and 60 lines most of which are being tested in the Preliminary Yield Tests. It may be said that the number of lines in this generation is adequate.

One of the problems related to pedigree selection is the relationship of The Mae Jo and Srisamrong (Sukhothai) Agricultural Experiment Stations as the selection sites of breeding lines in the rainy season. Presently, there is applied a system of selection in the early generations with, for example, 10 individual plants taken out of one selected line and the first 5 individual plants grown in the former

station and the remaining 5 individual plants grown in the latter station. But, there are many cases of failures of desired selection by poor germination occurring in The Srisamrong Agricultural Experiment Station so that it can hardly be said that the ideal selection was conducted in a smooth way.

v. Yield trials

Preliminary yield tests have been carried out successively since the dry season of 1973. These tests are carried out at the Mae Jo Agricultural Experiment Station and The Chainat Rice Experiment Station (Chainat) in the dry season of The Phraphutthabat Agricultural Experiment Station (Saraburi) and The Srisamrong Agricultural Experiment Station in the rainy season substantially in the same design so that they will also serve for the test of adaptability on breeding lines as generally called in Japan. But, on account of poor germination or failure in sprinkling at the suitable time, the currently available data are limited to those of The Mae Jo Experiment Station in the dry season of 1974 and of The Phraphutthabat Experiment Station in the rainy season of 1975.

Regional Yield Trials were started in the rainy season of 1974. The tests were carried out, at The Phraphutthabat and Srisamrong Agricultural Experiment Stations in the rainy seasons and at The Mae Jo Agricultural Experiment Station, Chainat Rice Experiment Station and The Kalasin Agricultural Experiment Station in the dry season of 1975. But, the reliable data are only those at The Phraphutthabat Agricultural Experiment Station in the rainy season of 1974.

While the progress has been described generally in the foregoing, lack of the releable data in the past has come to constitute a serious hazard to execution of the selection. In addition to such hazard, there are also the following three points noted as problems.

The materials used in the yield trials presently

covers the generations F_8 to F_{10}. But, the pedigree selection is terminated with F_8 so that the materials of F_9 and F_{10} are available only in the mass seeds. These lines are subjected limited times of selection and include those in which segregation on some character or mixture is observed.

The yield trials are carried out in two steps of Preliminary Yield Tests and Regional Yield Trials, and in such experiments, not a small number of materials are used duplicatedly, and such is hardly understandable for us. But, when the failures often encountered in the past experiments as described in the foregoing, are taken into consideration, it is understandable in the sense of dispersing the risks. The materials tested in this dry season (1975) are listed in Table 11.

The last point is that there are a very great number of materials tested in the yield trials. This may indicate that the past selections were very difficult or that some achievement was urged in one way or another. Now, it is desirable to reduce the number of lines to about 10 upon the results of examinations in this dry season (1975).

From the results of the experiments carried out in the past, the lines from the combinations which showed resistance to rust or 7019 ("Acadian" x "64-104") and 7024 ("64-104" x "SJ-2") were considered to be promising. However, so far as the growth in this dry season (1975) is concerned, there is observed an abnormality of frequent occurrence of leaf curling in many of such lines, and determination of whether the leaf curling is due to a virus disease or hereditary factor is urgently required, and the result will affect the subsequent selection greatly.
Besides the foregoing, there are observed some lines which have no resistance to rust but grow vigorously with little damage due to mildew disease and are thus highly productive.

Table 11. The List of Breeding Materials for Yield Trials in the Dry Season, 1975

	Material	Generation	Parents	Farmer's Field Test	Regional Yield Trial	Preliminary Yield Test
1.	7120. P_3. 2. FP_4. 3. P_7. P_8	F_8	SJ-2 x Taichung no. 12	-	o	o
2.	7003. P_3. P_6. P_8. 4. P_7. P_8	F_8	SJ-2 x Nema-shirazu	-	o	o
3.	7020. P_3. 20. 2. 1. P_7. P_8	F_8	SJ-2 x K.S. 252	-	-	o
4.	7020. P_3. 49. 2. 3. P_7. P_8	F_8	"	-	-	o
5.	7020. P_3. 65. 1. 5. P_7. P_8	F_8	"	-	-	o
6.	7021. P_3. 50. 4. 5. P_7. P_8	F_8	K.S. 252 x SJ-2	-	o	o
7.	7021. P_3. 79. 3. 2. P_7. P_8	F_8	"	-	o	o
8.	7021. P_3. 84. 4. 5. P_7. P_8	F_8	"	-	-	o
9.	7021. P_3. 88. 4. 2. P_7. P_8	F_8	"	-	o	o
10.	7021. P_3. 89. 5. 4. P_7. P_8	F_8	"	-	o	o
11.	7021. P_3. 33. FP_5. 1. P_7. P_8	F_8	"	-	o	o
12.	7021. P_3. 78. FP_5. 3. P_7. P_8	F_8	"	-	o	o
13.	7022. P_3. 7. 4. 4. P_7. P_8	F_8	L-356 x Acadian	-	-	o
14.	7026. P_3. 12. FP_5. 3. P_7. P_8	F_8	SJ-2 x Acadian	-	o	o
15.	7012. P_7. 200. 50. 3. 6(S). P_7. P8. P_8	F_8	Karikachi x SJ-2	-	-	o
16.	7013. P_3. P_6. 53. 5. 2. P_7. P_8	F_8	Tousan 60. 26 x SJ-2	-	-	o
17.	7016. P_3. P_6. 21. 4. 2. P_7. P_8	F_8	E-27 x 7001 (F_1)*	-	-	o
18.	7016. P_3. P_6. 29. 1. 5. P_7. P_8	F_8	"	-	-	o
19.	7016. P_3. P_6. 16. 6(S). P_7. P8. P_8	F_8	"	-	o	o
20.	7016. P_3. P_6. 28. 10(S). P_7. P_8. P_8	F_8	"	-	o	o
21.	7016. P_3. P_6. 84. 7(S). P_7. P_8. P_8	F_8	"	-	-	o
22.	7018. P_3. P_6. 65. 2. 5. P_7. P_8	F_8	E-27 x 7002 (F_1)**	-	o	o
23.	7019. P_3. 7. 2. P_6. 5. P_7. P_8	F_8	Acadian x 64-104	-	o	o
24.	7019. P_3. 24. 2. P_6. 3. P_7. P_8	F_8	"	-	o	o
25.	7019. P_3. 24. 3. P_6. 1. P_7. P_8	F_8	"	-	o	o
26.	7019. P_3. 24. 5. P_6. 5. P_7. P_8	F_8	"	-	o	o
27.	7019. P_3. 91. 5. P_6. 2. P_7. P_8	F_8	"	-	o	o
28.	7019. P_3. 99. 5. 2(S). P_7. P8. P_8	F_8	"	-	o	o
29.	7024. P_3. 30. 3. P_6. 5. P_8. P_8	F_8	64-104 x SJ-2	-	o	o
30.	7024. P_3. 30. 5. P_6. 4. P_7. P_8	F_8	"	-	o	o
31.	7024. P_3. 33. 4. P_6. 1. P_7. P_8	F_8	"	-	o	o
32.	7024. P_3. 64. 2. P_6. 3. P_7. P_8	F_8	"	-	o	o
33.	7024. P_3. 78. 6. P_6. 2. P_7. P_8	F_8	"	-	o	o
34.	7024. P_3. 89. 1. P_6. 3. P_7. P_8	F_8	"	-	o	o
35.	7024. P_3. 89. 4. P_6. 3. P_7. P_8	F_8	"	-	o	o
36.	7024. P_3. 76. 1. 2(S). P_7. P_8. P_8	F_8	"	-	o	o
37.	7024. P_3. 91. 2. P_6. P_7. P_8. P_8	F_8	"	-	-	o
38.	7001. P_3. 35. P_6. 4. 5. 4. P_7. P_8	F_8	Bon-minori x SJ-2	-	o	o
39.	SJ-1			-	o	o
40.	SJ-2			-	o	o

Note : * 7001 = Bon-minori x SJ-2

** 7002 = SJ-2 x Tokachi-nagaha

vi. Future direction

Presently, Regional Yield Trials are conducted on as many as 28 lines including "SJ-1" and "SJ-2" as standard varieties, and this makes it difficult to conduct various tests on breeding lines that are required for final selection. Thus, it is planned that the selection on breeding lines should be subjected along the direction of as follows, upon the results of experiments in this dry season (1975), selecting (i) 4 to 5 highly promising lines and (ii) 5 to 6 promising lines, (iii) bringing the remaining back to the Preliminary Yield Tests, (iv) incorporating into the variety preservation for use as parental materials for cross breeding, and (v) abandonment.

Further, many of the lines in late generations have

the pedigree selection suspended, but such lines include those in which segregation in some characters or mixture is observed. Such segregation of off type or mixture should be eliminated to insure breeder's seeds so that experiments would be carried out with confidence of the uniformity. Some trials for selecting lines should, therefore, be carried out on the selected lines referred to in (i) and (ii) above.

Reports of new variety in Japan usually contain some data concerning adaptability to various environmental conditions and there is a great difference between the conditions of the yield trials at the experiment stations and those of soybean cultivation of farmers. Thus, the tests concerning the cultivation without fertilizer, planting density (wide spacing or high density planting per hill), etc. with the lines (i) referred to above used as materials are being considered.

In Thailand, the seeds or, more specifically, germinating ability of seeds is a matter of concern as a problem or bottleneck for expansion of the soybean cultivation. Thus, in order for out breeding lines to be cultivated, it is required that they are by no means inferior in germination to the standard varieties and have the germinating power scarcely degraded during a certain period of storage. Accordingly, some germination tests will be required, and a germination test of a simple design in use of the selected lines (i) and (ii) are being planned.

Now the field tests are being conducted in farmer's fields for comparison with the varieties and testing the amount of fertilizer. In and after the next rainy season, such field tests should be conducted on the selected lines (i) mentioned above. However, such tests will involve a problem of available seeds so that the scale of such test will have to be reduced to such a degree as to be a demonstration.

(2) Subsequent development

When the experiments in the dry season of 1975 were completed, the author had a talk with Dr. Arwooth Na-Lampang, project leader of the Department of Agriculture, Thailand, concerning design of the experiments in the coming rainy season. In the following are reproduced the report presented at the time of the talk. As the result of the talk, (i) artificial crossing was approved, (ii) reducing the scale of Regional Yield Trial (or number of test materials) was authorized, (iii) the number of location for Regional Yield Trial was increased to 4 with addition of The Mae Jo and The Kalasin Agricultural Experiment Stations, and (iv) testing breeding lines at farmer's field was approve. But the approval was not obtained for the tests for adaptability on the breeding lines concerning planting density or amount of applying fertilizer in the experiment stations.

A Brief Report on Soybean Breeding for Rainy Season Trials

Thailand-Japan Soybean Development Project

Hybridization:

About 20 crossings will be made with breeding objectives such as early maturing type without a large reduction in yield, stable high yield, introduction of new gene sources of rust resistance and/or some other characters into our breeding materials. Number of flowers to be used for crossing should be more than 100 in each combination.

Selection schemes:

1. F_3 generation

   a) Nineteen bulk populations from 19 combinations which are mostly susceptable to rust were planted at The Mae Jo Agr. Exp. Sta. Three of them will be discarded because of their poor growth. About 500 plants have been selected from 16 combinations in the field. Final number of selected plants will be reduced to 300 by the secondary selection on seed yield, seed size, seed quality etc.

   b) There are 386 lines from 10 combinations at Mae Jo Agr. Exp. Sta. About half of them has been marked in the field. Final number of selected lines will be reduced to 110-130 by the secondary selection.

2. F_5 generation

There are 22 families, 83 lines, from 4 combinations at Mae Jo Agr. Exp. Sta. Fifteen families, 25 lines, are marked in the field.

3. F_8 generation

There are 12 families, 60 lines, from 5 combinations at Mae Jo Agr. Exp. Sta. All of them are tested for their yielding ability in "Preliminary Yielding Test" and "Hybrid Yielding Trial" using bulk seed. Therefore selections will be done on the basis of yielding trial data.

Table Breeding Materials for Coming Rainy Season Trials

	No. families	No. lines
F4 lines derived from F3 bulk populations		about 300
F4 lines derived from F3 lines	110-130	550 - 650
F6 lines	max. 25	max. 100
F9 lines	5-6	25 - 30

Preliminary hybrid yielding test (Preliminary yield test on breeding lines):

The yielding potential of hybrid lines will be tested in the "Preliminary Hybrid Yielding Test".

Number of lines to be tested	:	about 30
Location	:	Srisamrong, Prabdabaht
Cultural practice	:	Standard management at the Agr. Exp. Sta.
Plot size and replication	:	5 m^2, 3 replications

Hybrid yielding trial (Regional yield trial on breeding lines):

The most promising lines and promising lines can be selected for the hybrid yielding trial in coming rainy season on the basis of reliable results obtained from the dry season tests at The Mae Jo Agr. Exp. Sta. in 1974 and 1975, at The Kalasin Agr. Exp. Sta. in 1975, and the rainy season test at The Phraphutthabat Agr. Exp. Sta. in 1974. or farmer's fields.

Number of lines to be tested	:	about 10
Location	:	Srisamrong, Phraphutthabat Mae Jo, (Kalasin)

Cultural practice	:	Standard management at the Agr. Exp. Sta.
Plot size and replication	:	10 m^2, 4 replications

Supplement:

It is desired to test the adaptability of the most promising lines to a conventional cultural practice at the Agr. Exp. Sta. or in farmer's fields.

Soybean breeding experiments in the rainy season were carried out mainly at The Srisamrong and The Mae Jo Agricultural Experiment Stations. The subject of experiments, their details and experimental areas in these experiment stations are shown in Table 12.

Artificial crossing of scheduled combinations was carried out at The Mae Jo Agricultural Experiment Station with success through cooperation of a number of researchers. For F_4 lines, after checking the crossing parents the lines from the combinations susceptible to rust were all grown at The Srisamrong Agricultural Experiment Station, and those from the combinations which have a resistant variety to rust as a parent were all grown for selection at The Mae Jo Agricultural Experiment Station. For F_6, as all of 4 combinations were made with the breeding objective for resistancy to rust by using "64-104" as a crossing parent the lines from those combinations were planted at the Mae Jo Agricultural Experiment Station. Additionally, F_4 derived lines were planted at The Srisamrong Agricultural Experiment Station and then subjected to selection with observation of the growth at the station. F_9 was comprised mainly of the rust susceptible lines. For these lines, 10 individual plants were taken out of each line for selection and divided into two groups of 5 individual plants then grown at both stations respectively. F_{10} was comprised mostly of rust resistant lines which were planted at The Mae Jo Agricultural Experiment Station for selection depending on the rust resistancy or the degree of leaf-curlying. (For the lines from 7019 ("Acadian" x "64-104") and 7024 ("64-104" x "SJ-2), 15 to 20 individual plants had been selected out of the propagation field of the respective lines in the foregoing season and were subjected to pedigree selection from the rainy season.)

The materials used in the yield trials or Farmer's Field Tests are listed in Table 13.

Other experiments, such as analysis on the components of seed produced in the dry season (requested to Oil Seed Lab., Division of

Agricultural Chemistry, Department of Agriculture), the test of rust resistancy on breeding lines (assumed by Mrs. Montha Nuntapunt at The Mae Jo Agricultural Experiment Station), germination test of breeding lines (requested to Seed Technology Sec., Department of Agriculture) and multiplication of breeding lines (assumed by Mr. Rangsan Keereetaveep at The Mae Jo Agricultural Experiment Station) were carried out.

After completion of the experiments in the rainy season of 1975, a discussion was made with Dr. Arwooth Na-Lampung upon a brief report set forth hereinafter to determine the general design of the experiments in the coming dry season.

Table 12. Soybean Breeding Experiments in the Rainy Season, 1975

Mae Jo Agr. Exp. Sta.

	Name of Experiment	Details of Experiment	Experimental area
1.	Variety Collection	656 var. and lines, 1 var./ 1 row (3 m), 50 cm x 15 cm 1 plt.	1008 m^2
2.	Hybridization	32 var., planted 3 times at 20 days interval	1080 m^2
3.	F_4 Pedigree Selection	11 comb. 624 lines, 3 line/ 4 row (4 m), 50 cm x 10 cm 4 plt.	1392 m^2
4.	F_6 Pedigree Selection	4 comb. 29 fam. 145 lines, 1 line/1 row (4 m), 50 cm x 10 cm 4 plt.	350 m^2
5.	F_8 Pedigree Selection	5 comb. 12 fam. 60 lines, 1 line/1 row (4 m), 50 cm x 10 cm 1 plt. 1 bulk population	280 m^2
6.	F_{10} Pedigree Selection	3 comb. fam. 230 lines, 1 line/1 row (4 m), 50 cm x 10 cm 1 plt.	630 m^2
7.	Regional Yield Trial		
1)	Breeding lines	13 var. and lines, plot size; 8.8 m^2 4 rep., 50 cm x 20 cm 2 plts.	528 m^2
2)	Introduced varieties	15 var. and lines, plot size; 8.8 m^2 4 rep., 50 cm x 20 cm 2 plts.	528 m^2
			6136 m^2

Preliminary propagation of breeding lines : 1000 m^2

Srisamrong Agr. Exp. Sta.

	Name of Experiment	Details of Experiment	Experimental area
1.	Variety Collection	203 var. and lines, 1 var./ 1 row (3 m), 50 cm x 15 cm 1 plt.	360 m^2
2.	F_4 Pedigree Selection	15 comb. 386 lines, 1 line/ 1 row (4 m), 50 cm x 10 cm 1 plt.	1080 m^2
3.	F_6 Selection	8 comb. 29 F_5 derived lines, 1 line/1 row (4 m), 50 cm x 10 cm 1 plt.	320 m^2
4.	F_8 Pedigree Selection	5 comb. 12 fam. 60 lines, 1 line/1 row (4 m), 50 cm x 10 cm 1 plt.	240 m^2
5.	Preliminary Yield Test		
1)	Breeding lines	33 var. and lines, plot size; 6.4 m^2, 3 rep., 50 cm x 20 cm 2 plts.	360 m^2
6.	Regional Yield Trial		
1)	Breeding lines	13 var. and lines, plot size; 8.8 m^2 4 rep., 50 cm x 20 cm 2 plts.	528 m^2
2)	Introduced varieties	15 var. and lines, plot size; 8.8 m^2 4 rep., 50 cm x 20 cm 2 plts.	528 m^2
			3216 m^2

Table 13. The List of Breeding Materials for Yield Trial in the Rainy Season, 1975

	Material	Generation	Parents	Farmer's Field Test	Regional Yield Trial	Preliminary Yield Test
1.	7024. P_3. 1. FP_5. P_6	F_6	64-104 x SJ-1	-	-	o
2.	7204. P_3. 3(S). FP_5. P_6	F_6	"	-	-	o
3.	7204. P_3. 5(S). FP_5. P_6	F_6	"	-	-	o
4.	7206. P_3. 1. FP_5. P_6	F_6	K.S.252 x 64-104	-	-	o
5.	7206. P_3. 3. FP_5. P_6	F_6	"	-	-	o
6.	7206. P_3. 5. FP_5. P_6	F_6	"	-	-	o
7.	7206. P_3. 7. FP_5. P_6	F_6	"	-	-	o
8.	7207. P_3. 2. FP_5. P_6	F_6	K.S.252 x 7024(F4)*	-	-	o
9.	7207. P_3. 4. FP_5. P_6	F_6	"	-	-	o
10.	7207. P_3. 7. FP_5. P_6	F_6	"	-	-	o
11.	7207. P_3. 8. FP_5. P_6	F_6	"	-	-	o
12.	7207. P_3. 10. FP_5. P_6	F_6	"	-	-	o
13.	7102. P_3. 2. FP_5. 3. P_7. P_8. P_9	F_9	SJ-2 x Taichung no. 12	-	-	o
14.	7020. P_3. 20. 2. 1. 3. 1. P_8	F_8	SJ-2 x K.S.252	-	-	o
15.	7020. P_3. 49. 2. 3. P_7. P_8. P_9	F_9	"	-	o	-
16.	7020. P_3. 65. 1. 5. 1. 3. P_8	F_8	"	-	o	-
17.	7021. P_3. 79. 3. 2. 1. 5. P_9	F_9	K.S.252 x SJ-2	-	o	-
18.	7021. P_3. 84. 4. 5. 1(S). P_8. P_9	F_9	"	-		
19.	7021. P_3. 88. 4. 2. 1. 4. P_8	F_8	"	o	o	-
20.	7021. P_3. 33. FP_5. 3. P_7. P_8. P_9	F_9	"	o	o	-
21.	7021. P_3. 78. FP_5. 3. 4(S). 4. P_8	F_8	"	-	-	o
22.	7022. P_3. 7. 4. 4. P_7. P_8. P_9	F_9	L-356 x Acadian	-	-	o
23.	7012. P_3. 50. 3. 6(S). P_7. P_8. P_9. P10	F_{10}	Karikachi x SJ-2	-	-	o
24.	7013. P_3. P_4. 53. 5. 2. P_6. P_9. P_{10}	F_{10}	Tounan no. 26 x SJ-2	-	-	o
25.	7016. P_3. P_4. 16. 6(S). P_7. P_8. P9. P10	F_{10}	E-27 x 7001(F1)**	-	-	o
26.	7016. P_3. P_4. 28. 10(S). P_7. P8. P10	F_{10}	"	-	o	-
27.	7016. P_3. P_4. 84. 7(S). P_7. P_8. P9. P10	F_{10}	"	-	-	o
28.	7019. P_3. 7. 2. P_4. 5. P_6. P_9. P_{10}	F_{10}	Acadian x 64-104	-	-	o
29.	7019. P_3. 24. 2. P_6. 3. P_8. P_9. P_{10}	F_{10}	"	-	-	o
30.	7019. P_3. 24. 3. P_4. 1. P_5. P_9. P_{10}	F_{10}	"	o	o	-
31.	7019. P_3. 24. 5. P_6. 5. P_8. P_9. P_{10}	F_{10}	"	o	o	-
32.	7019. P_3. 99. 5. 2(S). P_7. P_8. P_9. P10	F_{10}	"	-	-	o
33.	7024. P_3. 30. 3. P_4. 5. P_6. P_9. P_{10}	F_{10}	64-104 x SJ-2	-	-	o
34.	7024. P_3. 30. 5. P_4. 4. P_6. P_9. P_{10}	F_{10}	"	-	-	o
35.	7024. P_3. 33. 4. P_4. 1. P_6. P_8. P_{10}	F_{10}	"	-	-	o
36.	7024. P_3. 78. 6. P_4. 2. P_6. P_9. P_{10}	F_{10}	"	-	o	-
37.	7024. P_3. 89. 1. P_4. 3. P_6. P_8. P_{10}	F_{10}	"	-	o	-
38.	7024. P_3. 93. 4. P_4. 3. P_6. P_8. P_{10}	F_{10}	"	-	-	o
39.	7024. P_3. 91. 2. P_4. P_7. P_8. P_9. P10	F_{10}	"	-	o	-
40.	7001. P_3. 83. P_4. 3. P_7. P_8. P_9. P10	F_{10}	Bon-minori x SJ-2	-	-	o
41.	7001. P_3. 35. P_4. 4. 5. 4. P_8. P_{10}. P11	F_{11}	"	-	-	o
42.	7001. P_3. 56. P_4. 1. P_7. P_8. P_9. P10. P_{11}	F_{11}	"	-	-	o
43.	SJ-1			o	o	o
44.	SJ-2			o	o	o

Note : * 7024 = 64-104 x SJ-2

** 7001 = Bon minori x SJ-2

A Brief Report on Soybean Breeding for Experiments in the Dry Season of 1976 Soybean Development Project (Thailand-Japan)

A. Summary of the rainy season trials

1. Hybridization:

During this rainy season, we made hybridizations of 22 proposed combinations using "Kaoshung E32", "Ooura" and "Kyushu 47" as rust resistant parents. "Shiryuou" "Shin 4" and "Kyushu 47" as early maturing parents, and "Wayne" "Clark 63" and "Williams" as the parents showing vigorous growth. Of course we mostly crossed them to our breeding lines such as "7012. P_3. 5. 3. 6(S). P_7. P_8. P_9. P_{10}", "7019. P_3. 24. 3. P_6. 1. P_8. P_9. P_{10}", "7020. P_3. 49. 2. 3. P_7. P_8. P_9", "7020. P_3. 65. 1. 5. P_7. P_8. P_9" and "7024. P_3. 91. 2. P_6. P_7. P_8. P_9. P10" is one of the parents, because of highly evaluated characteristics of them.

2. F_4 pedigree selection: We conducted pedigree selection of F_4 lines at two locations. One is at Srisomrong Agr. Exp. Sta. where we planted 386 lines from 15 combinations susceptable to rust disease and harvested 136 lines of them. Another one is at Mae Jo Agr. Exp. Sta. where we planted 624 lines from 11 combinations, and selected 126 lines mostly for resistancy to rust disease. Total number of selected lines will fall within 180 - 200 after final selection following observation of seed quality.

3. F_6 pedigree selection : 145 lines and 29 F_5 derived lines from 4 combinations were planted at Mae Jo Agr. Exp. Sta. and Srisomrong Agr. Exp. Sta. respectively, and 26 lines were harvested considering both the resistancy to the rust desease and the growth vigor at Srisomrong Agr. Exp. Sta.

4. F_9 pedigree selection : We planted 60 lines from 5 combination each at two locations, and roughly made the pedigree selection. Final selection of these lines should be performed on the data from "Preliminary Yield Test" or "Regional Yield Trial".

5. F_{10} pedgree selection : All lines of this generations were planted at Mae Jo Agr. Exp. Sta. and were selected saverely as for resistancy

to rust desease. But the number of selected lines will become somewhat larger because (1) we want to eliminate the lines which shows leaf-curling in the dry season. (2) we'd like to check their uniformity again.

B. Primary layout of the trials for coming dry season

1. F_1 generation : 22 combinations
2. F_5 pedigree selection : 34 combinations, 180 - 200 families, 900 - 1000 lines.
3. F_7 pedigree selection : 4 combs. 26 fams. 103 lines
4. F_{10} pedigree selection : 5 combs. 9 fams. 75 lines
5. F_{11} pedigree selection : 2 combs. 36 fams. 180 lines
6. Preliminary Yield Test :
   1) Material ; 31 breeding lines and 2 check varieties
   2) Experimental design, plot size; 1 plot size = 4.4 m^2 (2 rows), randomized design, 8 rep.
   3) Location; Mae Jo and Chainat.
7. Regional Yield Trial :
   1) Material ; 10 breeding lines and 2 check varieties
   2) Experimental design; 1 plot size = 8.8 m^2 (4 rows), randomized design, 4 rep.
   3) Location ; Mae Jo, Chainat, Kalasin
8. Farmer's Field Trial :
   1) Material ; 4 breeding lines and 2 check varieties
   2) Experimental design ; 1 plot size = 160 m^2, randomized design 2 rep.
   3) Location ; Lampun 1, Lamphung 1, Chiengmai 2, Nakhanrashima 1, Sinburi or Chainat 1, Total 6

3. Breeding Lines in Late Generations

1) Selection on the Breeding Lines in Late Generations

The following is a summary of what the author considered in selecting the breeding lines in late generations during the term of duty. Actually, it is a representation of what was reported already in the "Work Reports" submitted to JICA for the months of March and April and of November and December, with some additions. Now reading over the originals, there are noted some shortcoming points in it or some aspects of selection being carried out upon unsatisfactory results of experiments as some sort of achievement required urgently at the sixth year of the project. But, in order for what the author considered to be understood correctly, the expressions of the original reports are followed faithfully as far as practicable.

With the results of the experiments in the dry season, 1975 (actually the experiments were completed at the Mae Jo Agricultural Experiment Station but not yet at The Kalasin Agricultural Experiment Station), the materials to be tested at the experiments in the following rainy season were determined. This situation is described in the "Work Report" for March and April.

(1) Selection of materials for yield trials in rainy season (from "Work Report" for March and April)

The lines in the so-called late generations being tested in the yield trials presently include those from the combinations of 7001 ("Bonminori" x "SJ-2") (most advanced generation) - 7102 ("SJ-2" x "Taichung No. 12") (least advanced generation), totaling 38 lines. These lines in the late generations have been tested in the Preliminary Yield Tests since 1973, and the selection has been carried out mainly through choice of the lines within the same combinations, and there is only one case of abandonment of combination noted, that is, a combination of 7005 ("Shin No. 4" x "SF-2"). There were, of course, a number of combinations which were abandoned at pedigree selection before they were tested in the yield trials.

The selection on the lines in late generations was conducted mainly upon the results of yield trials up to the present dry season (1975). The layout, design and reliability of the results of such trials are listed up in Tables 7 and 8. As seen from the materials shown in Table 8, the

Preliminary Yield Test in 1973 is slightly different in the material and objectives from the subsequent tests. In the similar tests carried out in and after 1974 were included a limited number of varieties to "SJ-1" and "SJ-2" other than the breeding lines, while a number of introduced varieties and lines in addition to the breeding lines derived from 7001 ("Bon-minori" x "SJ-2") and 7005 ("Shin No. 4" x "SJ-2") were tested in the test in 1973. Many of the lines in late generations which have been tested are those which had put into the yield trials in and after 1974.

The yield trials are composed of Preliminary Yield Tests which were carried out initially and of Regional Yield Trials which were started later on a small number of the breeding lines from the rainy season of 1974, and both of the experiments were extended thereafter to the present situation. The Regional Yield Trials and Preliminary Yield Tests are carried out at the central experiment station for breeding as well as the other experiment stations such as Chainat Rice Experiment Station, The Phraphutthabat Agricultural Experiment Station (Saraburi), The Srisamrong Agricultural Experiment Station and The Kalasin Agricultural Experiment Station in the same design, and these are disposed in the same sense as that in the tests of adaptability for local condition, the performance tests and the tests for determination of the recommended varieties which are conducted in Japan. In Table 7, signs showing the degree of reliability of the test results are noted. As seen, reliable data up to this dry season (1975) are those of the Preliminary Yield Tests at the Mae Jo Experiment Station in the dry season of 1973, similar test at the same experiment station in the dry season of 1974, Preliminary Yield Test and Regional Yield Trial at the Phraphutthabat Experiment Station in the rainy season of the same year, and Preliminary Yield Tests at the Mae Jo Experiment Station in the dry season of 1975. The results of these yield tests and trials are shown in Table 14.

The results shown in Table 14 were arranged for the respective lines into Table 5, while the characters and yields of principal lines were listed, and upon such a table and list, selection was conducted. Additionally, the data on oil and protein contents obtained through analysis requested to Oil Seed Laboratory, Division of Agricultural Chemistry, Department of Agriculture, results of tests for the rust resistancy in the rainy season, and other data such as those concerning the disease of Downy mildew in the dry season and rust disease in the dry and rainy seasons, were used as references.

Table 14 A. The Result of Preliminary Yield Test at The Mae Jo Agr. Exp. Sta. in the Dry Season of 1973

	Name of var. or lines	Plant height	No. of nodes	No. of pods	Days to flowering	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging* score	Shattering** score	Dairy yield
		(cm)			(day)	(day)	(kg/rai)	(%)	(%)			(kg/rai/day)
1.	SJ-1	80.6	15.0	57.7	47.3	100.6	255	101	12.2	1	1	2.54
2.	SJ-2	51.9	11.5	53.4	42.0	97.0	253	100	11.2	1	1.7	2.61
3.	7001.Pz.122.3.P$_5$	83.1	15.5	38.0	49.0	102.3	252	100	13.7	1.3	1	2.46
4.	Ugo-daizu	28.1	9.6	36.2	40.3	90.0	249	98	18.0	1	5	2.77
5.	Jukkoku-mame	29.7	9.4	34.3	29.0	90.6	246	97	17.3	1	5	2.72
6.	7001.Pz.59.4.P$_5$	41.7	11.0	41.9	47.3	98.0	246	97	14.3	1	2	2.51
7.	7001.Pz.88.3.P$_5$	41.7	9.0	40.5	44.3	96.0	243	96	15.0	1	1.7	2.53
8.	San Juan	74.5	15.2	68.5	44.0	101.6	240	95	13.5	1	1.3	2.36
9.	Bon-minori	41.1	10.8	50.3	47.0	93.6	237	94	14.4	1	4	2.53
10.	7005.Pz.95.P$_4$	40.7	10.4	51.0	43.0	100.0	222	88	18.5	1	2	2.22
11.	Takiya	22.4	8.4	36.6	39.0	89.3	221	87	19.0	1	4	2.48
12.	7001.Pz.124.4	88.0	16.1	35.3	47.0	104.0	218	86	17.8	2.3	1	2.10
13.	7001.Pz.17.P$_4$	49.8	10.9	48.3	45.3	99.0	217	86	15.0	1	1.7	2.19
14.	7005.Pz.2.P$_4$	48.4	10.4	49.7	47.3	98.0	217	86	16.2	1.6	1.3	2.21
15.	7001.Pz.122.P$_4$	80.0	15.5	38.3	48.6	102.0	205	81	16.5	2	1	2.01
16.	7001.Pz.111.P$_4$	48.1	10.6	46.7	47.0	100.0	199	79	15.8	1	1.3	1.99
17.	7001.Pz.69.3.P$_4$	58.2	12.8	40.4	47.3	99.0	199	79	15.8	1	1	2.01
18.	7005.Pz.107.P$_4$	45.8	10.7	49.7	47.0	100.0	196	77	16.8	1	2	1.96
19.	7001.Pz.148.P$_4$	75.1	14.2	44.5	47.3	101.6	191	75	13.4	1.6	1.3	1.88
20.	0-38 (Small seed)	32.7	12.1	59.6	40.6	96.3	187	84	17.3	1	3	1.94
21.	A-456	41.7	9.9	41.7	36.6	88.3	181	72	13.2	1	1	2.05
22.	Darves	38.1	10.2	60.2	45.3	97.0	178	70	15.9	1	2.7	1.84
23.	NTU.KS.5	24.4	7.8	28.3	40.0	90.6	178	70	20.7	1	4.7	1.97
24.	7005.Pz.105.P$_4$	48.3	11.0	50.3	47.0	100.0	168	66	15.9	1	1.3	1.68
25.	Tsuru-no-tomo	30.4	9.1	39.7	43.0	92.3	167	66	18.8	1	4	1.81
26.	7001.Pz.104.P$_4$	49.0	10.3	41.9	45.3	99.0	167	66	18.7	1	1.7	1.67
27.	7001.Pz.81.P$_4$	53.6	10.8	36.0	46.3	101.0	166	66	15.5	1	1.7	1.64
28.	7001.Pz.113.P$_4$	54.6	11.4	44.8	44.6	99.0	166	66	15.5	1	1.7	1.68
29.	Akazaya-chusei	29.2	9.2	35.1	43.0	92.3	164	65	20.1	1	4	1.78
30.	Shinroku	30.7	8.9	41.6	44.3	93.6	159	63	19.6	1	4.5	1.70
31.	SB-60	79.4	15.1	51.0	58.6	102.3	148	58	9.2	4	1	1.45
32.	7005.Pz.72.P$_4$	39.8	9.8	44.4	47.0	100.0	139	55	15.3	1	1.7	1.39
33.	Kinoshita-mame	23.5	8.4	32.6	43.0	93.6	134	53	25.9	1	4.3	1.43
34.	Shinei-daizu	42.6	10.3	41.0	38.3	92.3	127	50	12.8	1	1	1.38
35.	Yoshinoki-mame	26.6	8.2	41.0	39.0	92.0	125	49	14.0	1	3.7	1.36
36.	Karikachi	19.1	7.9	31.4	40.0	92.0	116	46	18.9	1	4.7	1.26
37.	A-425	31.5	9.1	42.4	36.0	91.0	104	41	15.1	1	2	1.14
38.	Merapi	64.1	13.8	53.6	57.3	100.6	102	40	7.6	4	2	1.01
39.	IAC-2	69.4	18.0	102.0	43.0	103.5	102	40	16.5	1	4	0.99

Note: * ; 1 rai = 0.16 ha
** ; 0 - 5, elect-heavy lodging
*** ; 0 - 5, no shattering - heavy shattering

B. The Result of Preliminary Yield Test at The Mae Jo Agr. Exp. Sta. in the Dry Season of 1964

	Name of var. or lines	Plant height	No. of nodes	No. of pods	Days to flowering	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality	Dairy yield
		(cm)			(day)	(day)	(kg/rai)	(%)	(%)				(kg/rai/day)
1.	7001.P3.5.P5.3.1.P8	84.2	14.3	40.8	62	110	344	104	19.2	1.5	1	4	3.13
2.	7001.P3.11.P8.1.3.P8	84.3	14.7	42.7	61	109	365	111	17.1	1	1.5	4	3.35
3.	7001.P3.35.P5.4.5.P8	56.3	10.8	42.4	62	111	305	92	16.8	1	1.5	4	2.75
4.	7001.P3.56.P5.1.5.P8	57.2	12.8	30.9	66	108	298	90	14.1	1	1	4	2.76
5.	7001.P3.83.P5.3.5.P8	73.3	14.2	31.3	63	118	326	99	17.5	1	1.5	4	2.76
6.	7013.P3.P4.53.5.P7	80.0	14.9	48.9	61	112	360	109	16.8	2	1.5	4	5.21
7.	7016.P3.P4.16.1.P7	99.2	15.5	38.0	62	119	350	106	14.7	3.5	1	3	2.94
8.	7016.P3.P4.29.1.P7	83.3	14.9	50.2	62	113	376	114	16.6	2.5	1.5	4	3.33
9.	7016.P3.P4.49.5.P7	95.3	14.8	37.7	61	112	348	105	16.4	3	1.5	4	3.11
10.	7016.P3.P4.50.2.P7	92.2	16.4	28.6	72	119	277	94	11.9	2	1	4	2.33
11.	7016.P3.P4.74.2.P7	85.7	14.8	41.2	62	109	295	89	14.4	4	1.5	4	2.71
12.	7016.P3.P4.85.3.P7	54.7	9.8	20.6	61	106	289	88	20.7	2	1	4	2.73
13.	7018.P3.P4.65.2.P7	74.9	13.8	48.2	61	109	309	94	15.4	1	1	4	2.83
14.	7019.P3.24.2.P8.P7	90.8	15.3	34.7	69	120	215	65	14.2	2	1.5	4	1.79
15.	7019.P3.7.2.P8.P7	85.1	14.5	42.9	64	119	314	95	14.5	2	1.5	4	2.64
16.	7019.P3.24.3.P8.P7	87.1	14.8	34.3	66	119	387	117	13.8	1.5	1	4	3.25
17.	7019.P3.24.5.P8.P7	90.9	14.9	61.9	63	109	366	111	13.5	3	1	4	3.36
18.	7020.P3.20.2.P8	86.8	15.6	64.4	65	112	365	111	14.3	2	2	4	3.26
19.	7020.P3.49.2.P8	90.9	14.9	61.9	63	109	366	111	13.5	3	1	4	3.36
20.	7020.P3.65.1.P8	91.9	14.0	35.3	62	109	378	115	16.4	3	1	3	3.47
21.	7002.P3.15.4.P8	92.1	14.5	50.9	62	111	319	97	12.6	1.5	1.5	4	2.87
22.	7021.P3.35.4.P8	68.5	15.4	57.6	63	111	319	97	12.4	3	2	4	2.87
23.	7021.P3.50.4.P8	74.5	15.7	61.9	65	114	346	105	10.6	2.5	1	4	3.04
24.	7021.P3.79.3.P8	86.0	15.3	45.4	73	115	360	109	12.4	2	2	4	3.13
25.	7021.P3.84.4.P8	75.1	14.1	60.0	63	109	365	111	13.6	3	1	4	3.35
26.	7021.P3.88.4.P8	89.0	13.7	36.2	67	115	323	98	13.8	3	2	4	2.81
27.	7021.P3.89.5.P8	99.1	14.3	37.6	66	115	357	108	12.1	3	1	4	3.10
28.	7024.P3.30.3.P8.P7	66.7	13.7	52.2	64	112	306	93	12.0	3	1.5	3	2.73
29.	7024.P3.30.5.P8.P7	70.3	15.0	51.8	65	113	343	104	14.1	4	1	4	3.04
30.	7024.P3.33.4.P8.P7	95.6	15.2	32.9	64	119	327	99	13.4	3.5	1.5	3	2.75
31.	7024.P3.64.2.P8.P7	55.2	9.4	41.7	61	114	342	104	17.7	1	1	3	3.00
32.	7024.P3.78.6.P8.P7	65.9	14.2	38.1	66	120	355	108	14.1	1.5	1	4	2.96
33.	7024.P3.89.1.P8.P7	81.3	14.1	49.0	65	121	424	128	15.1	2	1	3	3.50
34.	7024.P3.89.4.P8.P7		13.2	49.6	65	121	322	98	13.6	1	1	4	2.16
35.	7024.P3.83.P5.3.5	78.4	14.9	44.3	66	120	382	116	13.7	2.5	1	4	3.18
36.	SJ-1	71.3	14.3	47.4	60	109	303	92	11.9	1.5	2	3	2.78
37.	SJ-2	83.7	15.4	34.9	66	119	330	100	11.5	2.5	1	3	2.77

C. The Result of Preliminary Yield Test at The Phraphutthabat Agr. Exp. Sta. in the Rainy Season of 1974

	Name of var. or lines	Plant height	No. of nodes	No. of pods	Days of flowering	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality	Dairy yield
		(cm)			(day)	(day)	(kg/rai)	(%)	(%)				(kg/rai/day)
1.	7003.P3.P6.P5.4.P7	64.5	14.4	48.4	36	81	227.	92	10.1	2	5.	2.5	2.80
2.	7003.P3.P6.P5.17.P7	77.3	15.5	49.8	40	88	192	77	11.6	2	2.5	3	2.18
3.	7003.P3.P6.P5.19.P7	67.7	15.2	68.6	37	85	250	101	10.7	1.5	1.5	3.5	2.94
4.	7020.P3.20.2.1.P7	65.0	14.2	46.9	35	83	241	97	10.3	1	2.5	2	2.90
5.	7020.P3.15.4.4.P7	71.3	13.5	55.1	34	83	230	93	8.9	1	1.5	2.5	2.77
6.	7020.P3.35.4.2.P7	63.1	15.0	66.5	35	86	217	88	7.8	1	1.5	3	2.52
7.	7021.P3.50.4.5.P7	79.4	15.4	60.5	38	84	275	111	11.1	2	5	3.5	3.27
8.	7021.P3.79.3.2.P7	74.3	15.8	69.0	38	85	255	103	8.2	2	1.5	3	3.00
9.	7021.P3.89.4.2.P7	87.0	15.5	49.0	38	85	270	109	12.1	2	3	2.5	3.18
10.	7021.P3.89.5.4.P7	82.6	15.5	70.0	38	94	346	140	9.0	1.5	1	4	3.68
11.	7021.P3.33.FP5.1.P7	72.3	15.1	69.6	40	91	299	121	9.8	1.5	1	4	3.29
12.	7021.P3.78.FP5.3.P7	78.5	14.7	73.4	40	94	258	104	8.6	1.5	1	4	2.74
13.	7022.P3.5.FP5.4.P7	94.2	16.9	45.8	41	91	203	82	9.3	2.5	1	4	2.23
14.	7022.P3.7.4.4.P7	109.2	17.5	52.3	41	91	233	94	9.4	2.5	1	4	2.56
15.	7026.P3.12.FP5.3.P7	88.8	15.9	57.2	40	84	254	102	9.1	2	1.5	3.5	3.02
16.	7102.P3.2.FP5.3.P7	97.2	16.9	68.3	41	94	242	98	7.8	2	1	3.5	2.57
17.	7016.P3.P6.21.4.2.P8	70.0	13.9	41.2	37	80	221	89	12.1	2	1.5	4	2.76
18.	7016.P3.P6.50.2.5.P8	69.3	15.5	46.2	40	82	205	83	10.4	1	1.5	3.5	2.50
19.	7016.P3.P6.74.2.5.P8	61.8	14.8	40.3	39	82	207	83	12.1	2	3	3.5	2.52
20.	7016.P3.P6.85.3.4.P8	41.0	10.6	38.6	33	79	208	84	13.8	1	3	3.5	2.63
21.	7016.P3.P6.16.6(S).P7.P8	68.4	15.1	39.7	39	86	257	104	13.7	1	1.5	3.5	2.99
22.	7016.P3.P6.28.10(S).P7.P8	55.0	12.5	37.8	35	82	282	114	14.1	1	2	3	3.44
23.	7016.P3.P6.84.7(S).P7.P8	67.1	14.2	42.6	35	82	247	100	12.7	1.5	3	3.5	3.01
24.	7018.P3.P6.65.2.5.P8	60.1	13.4	47.3	36	80	255	103	11.0	1	2	3.5	3.19
25.	7018.P3.P6.81.4(S).P7.P8	65.9	14.6	47.7	36	83	220	89	12.1	3	1.5	3	2.65
26.	7019.P3.7.2.P6.5.P8	77.2	14.7	53.3	40	96	289	117	13.8	2	2	4	3.01
27.	7019.P3.24.2.P6.3.P8	60.9	14.0	48.1	39	99	249	100	11.0	1.5	1	4	2.52
28.	7019.P3.24.5.P6.5.P8	72.4	14.4	51.5	40	91	329	133	12.3	1.5	1	3.5	3.62
29.	7019.P3.91.5.P6.2.P8	58.0	13.2	56.1	39	91	274	110	10.0	1.5	4	3.5	3.01
30.	7024.P3.99.5.2(S).P7.P8	37.4	12.8	47.8	40	85	273	110	11.0	1	5	3	2.21
31.	7024.P3.30.3.P6.5.P8	56.4	13.7	46.5	40	91	265	107	12.5	2	1	3.5	2.91
32.	7024.P3.30.5.P6.4.P8	61.0	15.1	54.3	40	85	245	99	10.9	2	1	2.5	2.98
33.	7024.P3.33.4.P6.1.P8	74.2	15.0	54.7	40	94	307	124	10.7	1	1	4	3.27
34.	7024.P3.64.2.P6.3.P8	57.1	12.8	45.8	38	99	294	119	12.7	1	2	4.5	2.97
35.	7024.P3.78.6.P6.2.P8	66.8	14.8	45.3	41	94	267	108	12.3	1	1	4	2.84
36.	7024.P3.89.4.P6.3.P8	59.3		48.2	41	94	277	112	13.5	1	1	3.5	2.95
37.	7024.P3.76.1.2(S).P7.P8	46.7	13.9	38.9	40	91	183	74	10.8	1	1.5	3	2.01
38.	7001.P3.5.P5.3.1.3.!9	57.8	13.0	36.7	35	83	213	86	16.5	1	2	2	2.57
39.	7001.P3.11.P5.1.3.4.P8	59.8	13.5	44.4	38	84	217	88	14.7	1	1	3.5	2.58
40.	7001.P3.35.P5.4.5.4.P8	58.1	13.5	47.5	41	91	266	107	13.4	1	3.5	4	2.92
41.	7001.P3.56.P5.1.4.5.P8	47.4	12.2	32.4	39	88	186	75	12.4	1	2.5	3	2.11
42.	7001.P3.83.P5.3.1.5.P8	65.0	14.2	43.1	40	91	234	94	13.2	1.5	1.5	4	2.57
43.	7001.P3.5.P5.5.9(S).P8.P8	52.9	12.6	35.1	36	85	201	81	15.8	1.5	2	3.5	2.36
44.	SJ-1	90.0	16.8	44.1	40	83	198	80	10.2	1.5	5	3	2.39
45.	SJ-2	67.8	15.5	58.7	41	94	248	100	10.1	1	1	3	2.64

D. The Result of Regional Yield Trial at The Phraphutthabat Agr. Exp. Sta. in the Rainy Season of 1974.

Name of var. or lines	Plant height	No. of nodes	No. of pods	Days to flowering	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality	Dairy yield
	(cm)			(day)	(day)	(kg/rai)	(%)	(g)				(kg/rai/day)
1. SJ-1	84.9	16.0	42.0	40	84	157	104	7.8	1.5	5	2.3	1.87
2. SJ-2	75.9	15.0	54.7	41	98	151	100	6.4	1	1	3	1.54
3. Jupiter	63.2	12.3	33.1	51	103	40	26	7.4	1	1	1	0.39
4. Clark 63	49.4	14.0	30.5	29	85	156	103	9.4	1.3	1	2.6	1.84
5. 7020.P3.49.2.3.P7	60.0	13.0	45.8	39	84	212	140	8.2	1.3	3.3	4	2.52
6. 7020.P3.65.1.5.P7	71.4	14.0	41.5	40	90	221	146	9.6	1.3	2.5	3	2.46
7. 7021.P3.84.4.5.P7	62.4	14.5	50.0	40	86	145	96	7.1	1.5	1.5	2.3	1.69
8. 7013.P3.P4.53.5.2.P8	62.1	13.3	36.3	40	90	151	100	10.3	1.3	3.3	3.2	1.68
9. 7016.P3.P4.29.1.5.P8	64.7	14.3	34.2	40	84	156	103	10.0	1.5	4	3.9	1.86
10. 7019.P3.24.3.P6.P7.P8	61.0	13.7	41.1	40	98	179	118	9.8	1	1.3	4	1.83
11. 7024.P3.89.1.P6.3.P8	61.7	13.6	38.6	42	103	174	115	9.1	1	1	3.9	1.69
12. KB112	61.1	14.7	45.7	40	86	160	106	10.4	1.3	2	3.7	1.86

E. The Result of Preliminary Yield Test at the Mae Jo Agr. Exp. Sta. in the Dry Season of 1975

	Name of var. or lines	Plant height	No. of nods	No. of pods	Days to flowering	Growing period	Speed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality	Dairy yield	Dun.	Rust
		(cm)			(day)	(day)	(kg/rai)	(%)	(g)				(day)		
1.	7003.P3.P4.P5.4.P7.P8	34.9	9.5	32.3	40	90	204	85	13.1	2	2.3	4	2.27	S-MS	
2.	7020.P3.20.2.1.P7.P8	48.9	11.1	45.6	43	92	271	113	11.7	1.7	2	4	2.93	R	
3.	7020.P3.49.2.3.P7.P8	52.6	11.7	41.1	42	92	267	112	13.7	2	2	4	2.90	MS	
4.	7020.P3.65.1.5.P7.P8	41.1	10.3	39.5	41	91	276	115	15.0	2.3	1.7	4	3.03	R	
5.	7021.P3.50.4.5.P7.P8	46.7	10.4	30.7	43	91	228	95	12.9	1.3	5	4	2.51	R	
6.	7021.P3.79.3.2.P7.P8	40.7	11.6	44.8	41	93	282	118	13.7	2	2	4	3.03	R	
7.	7021.P3.84.4.5.P7.P8	40.7	11.1	44.6	42	90	258	108	11.9	2.3	4.7	4	2.87	R	
8.	7021.P3.88.4.2.P7.P8	53.3	11.0	35.0	43	91	309	129	13.8	2	2	4	3.40	R	
9.	7021.P3.89.5.4.P7.P8	42.5	10.3	29.7	42	90	188	79	11.3	2	2	4	2.09	MR-R	
10.	7021.P3.33.FP8.3.P7.P8	46.6	11.5	48.4	42	91	313	131	12.3	2	1.7	4	3.41	R	
11.	7021.P3.78.FP8.3.P7.P8	44.6	11.1	45.0	43	92	263	110	11.2	1.3	1.7	4	2.86	R	
12.	7022.P3.7.4.4.P7.P8	42.8	10.7	33.1	42	90	267	112	12.7	1.3	1.3	4	2.97	VS-S	
13.	7026.P3.12.FP8.3.P7.P8	48.1	11.2	45.3	43	90	214	90	10.9	2.7	1	4	2.38	VS-S	
14.	7102.P3.2.FP8.3.P7.P8	39.1	10.6	40.4	41	91	216	90	11.1	1.3	2	3.5	2.37	MS	
15.	7012.P3.50.3.6(S).P7.P8.P9	50.0	10.3	28.5	40	91	315	132	20.5	2	1.3	4	3.46	R	
16.	7012.P3.P4.54.5.2.P8.P9	50.5	11.0	34.5	42	91	279	117	17.2	2.3	2	3	3.07	R	
17.	7016.P3.P4.21.4.2.P8.P9	40.2	10.3	36.1	40	90	237	99	13.8	2.3	3.3	4	2.63	R	
18.	7016.P3.P4.29.1.5.P8.P9	40.4	10.5	25.1	42	91	222	93	16.8	1	2	3.5	2.44	VS	
19.	7016.P3.P4.46.6(S).P7.P8.P9	47.3	10.9	36.6	44	91	265	111	14.5	4	1.3	4	2.91	MS	
20.	7016.P3.P4.28.10(S).P7.P8.P9	33.2	9.4	29.4	39	90	261	109	17.7	2	2.3	3.3	2.90	R	
21.	7016.P3.P4.84.7(S).P7.P8.P9	46.7	10.7	39.4	43	92	249	104	14.8	2.3	1.7	4	2.71	MS	
22.	7018.P3.P4.65.2.5.P8.P9	38.8	10.7	33.8	40	90	209	87	13.9	1.7	1.7	4	2.32	VS	
23.	7019.P3.7.2.P4.5.P8.P9	57.3	12.0	37.6	44	95	284	119	15.7	4.3	2.3	4	2.99	MS	1
24.	7019.P3.24.2.P4.3.P8.P9	51.8	10.7	44.6	41	97	251	105	14.4	2.7	1.3	4	2.59	R	0-1
25.	7019.P3.24.3.P4.1.P8.P9	55.6	11.5	42.7	44	98	271	113	13.9	2	1.3	4	2.77	MS	1
26.	7019.P3.24.5.P4.5.P8.P9	43.9	10.8	38.8	43	97	215	90	13.8	2	1.7	3.3	2.22	R	1
27.	7019.P3.91.5.P4.2.P8.P9	40.6	10.7	31.2	42	92	223	93	15.2	2	2	4	2.42	S-MS	1
28.	7019.P3.99.5.2(S).P7.P8.P9	25.7	10.0	29.9	41	90	268	112	14.8	1	2	3	2.98	MR	1-2
29.	7024.P3.30.3.P4.5.P8.P9	40.7	10.5	37.0	43	95	187	78	13.4	2	2	4	1.97	R	0-1
30.	7024.P3.20.5.P4.4.P8.P9	39.2	11.3	33.9	42	91	205	86	13.0	1.7	2	4	2.25	R	1
31.	7024.P3.33.4.P4.1.P8.P9	45.3	10.3	35.8	42	92	241	101	14.5	2.3	2	3.3	2.62	MS-R	1
32.	7024.P3.64.2.P4.3.P8.P9	33.6	8.9	30.4	39	93	198	83	16.4	1.7	1	2.8	2.13	R	1
33.	7024.P3.78.6.P4.2.P8.P9	48.9	11.8	48.6	43	98	275	115	13.7	1.3	1	3	2.81	R	0-1
34.	7024.P3.89.1.P4.3.P8.P9	35.0	10.0	30.7	42	91	248	104	15.3	1.3	1	3	2.73	MS-MR	1
35.	7024.P3.89.4.P4.3.P8.P9	37.8	10.5	28.7	42	93	252	105	18.1	1.7	1.7	4	2.71	R	1
36.	7024.P3.76.1.2(S).P8.P9	42.4	11.4	37.3	43	97	228	95	13.8	1	1	3	2.35	S-MS	1
37.	7024.P3.91.2.P4.P7.P8.P9	38.4	10.4	30.2	43	94	289	121	18.2	1.7	1	4	3.07	R	1
38.	7001.P3.35.P4.4.5.4.P8.P9	36.4	10.7	30.3	43	97	250	105	17.7	1	2	4	2.72	R	
39.	SJ-1	52.4	12.1	47.0	41	91	197	82	10.3	1.7	4	3	2.16	MR-R	1
40.	SJ-2	43.1	11.1	43.3	42	92	239	100	12.7	2	1.7	3	2.60	S-MS	1-2

Table 15. The Results of Yield Trials (Summarized by Lines)

A. 7001 (Bon-minori x SJ-2), 7003 (SJ-2 x Nema-shirazu), 7013 (Tousan no. 26 x SJ-2) and 7022 (L-35 x Acadian)

Name of lines	Year, season	Plant height	No. of pods	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 seeds weight	Lodging score	Shattering score	Seed quality
		(cm)		(day)	(kg/rai)	(%)	(g)			
7001.P_3.5.P_5.3.1.3	1974, Dry	84.2	40.8	110	344	104	19.2	1.5	1	4
	1974, Rainy	57.8	36.7	83	213	86	16.5	1	2	2
	1975, Dry	36.4	30.3	92	250	105	17.7	1	2	4
7003.P_3.P_4.P_5.4.P_7.P_8	1974, Dry									
	1974, Rainy	64.5	48.4	81	227	92	10.1	2	5	2.5
	1975, Dry	34.9	32.3	90	204	85	13.1	2	2.3	4
7013.P_3.P_4.535.2.P_8.P_9	1974, Dry	80.0	48.9	112	360	109	16.8	2	1.5	4
	1974, Rainy*	62.1	36.3	90	151	100	10.3	1.3	3.3	3.2
	1975, Dry	50.5	34.5	91	279	117	17.2	2.3	2	3
7022.P_3.7.4.4.P_7.P8	1974, Dry									
	1974, Rainy	109.2	52.3	91	233	94	9.4	2.5	1	4
	1975, Dry	42.8	33.1	90	267	112	12.7	1.3	1.3	4
SJ-2	1974, Dry	83.7	34.9	119	330	100	11.8	2.5	1	3
	1974, Rainy	67.8	58.7	94	248	100	10.1	1	1	3
	1974, Rainy*	75.9	54.7	98	151	100	6.4	1	1	3
	1975, Dry	43.1	43.3	92	239	100	12.7	2	1.7	3

Note : * Data of Regional Yield Trial at The Phraphutthabat Agr. Exp. Sta. in the rainy season, 1974.

B. 7016 (E-27 x 7001 (F1*)) and 7018 (E-27 x 7002 (F1**)

Name of lines	Year, season	Plant height	No. of pods	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 seeds weight	Lodging score	Shattering score	Seed quality
		(cm)		(day)	(kg/rai)	(%)	(g)			
7016.P3.P4.16(S).P7.P8.P9	1974, Dry	99.2	38.0	119	350	106	14.7	3.5	1	3
	1974, Rainy	68.4	39.7	86	257	104	13.7	1	1.5	3.5
	1975, Dry	47.3	36.6	91	265	111	14.5	4	1.3	4
7016.P3.P4.21.4.2.P8.P9	1974, Dry									
	1974, Rainy	70.0	41.2	80	221	89	12.1	2	1.5	4
	1975, Dry	40.2	36.1	90	237	99	13.8	2.3	3.3	4
7016.P3.P4.28.16(S). P7.P8.P9	1974, Dry									
	1974, Rainy	55.0	37.8	82	282	114	14.1	1	2	3
	1975, Dry	33.2	29.4	90	261	109	17.7	2	2.3	3.3
7016.P3.P4.29.1.5.P8.P9	1974, Dry	83.3	50.2	113	376	114	16.6	2.5	1.5	4
	1974, Rainy***	64.7	34.2	84	156	103	10.0	1.5	4	3.9
	1975, Dry	40.4	25.1	91	222	93	16.8	1	2	3.5
7016.P3.P4.84.7(S). P7.P8.P9	1974, Dry									
	1974, Rainy	67.1	42.6	82	247	100	12.7	1.5	3	3.5
	1975, Dry	46.7	39.4	92	249	104	14.8	2.3	1.7	4
SJ-2	1974, Dry	83.7	34.9	119	330	100	11.8	3.5	1	3
	1974, Rainy	67.8	58.7	94	248	100	10.1	1	1	3
	1974, Rainy***	75.9	54.7	98	151	100	6.4	1	1	3
	1975, Dry	43.1	43.3	92	239	100	12.7	2	1.7	3
7018.P3.P4.65.2.5.P8.P9	1974, Dry	74.9	48.2	109	309	94	15.4	1	1	4
	1974, Rainy	60.1	47.3	80	255	103	11.0	1	2	3.5
	1975, Dry	38.8	33.8	90	209	87	13.9	1.7	1.7	4

Note : * ; 7001 = Bon-minori x SJ-2

** ; 7002 = SJ-2 x Tokachi-nagaha

*** ; Data at Regional Yield Trial at Phraphutthabat Agr. Exp. Sta. in the rainy season, 1974

C. 7019 (Acadian x 64-104)

Name of lines	Year, season	Plant height	No. of pods	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 seeds weight	Lodging score	Shattering score	Seed quality
		(cm)		(day)	(kg/rai)	(%)	(g)			
7019.P_3.7.2.P_6.5.P_8.P_9	1974, Dry	90.8	34.7	120	215	65	14.2	2	1.5	4
	1974, Rainy	77.2	63.3	96	289	117	13.8	2	2	4
	1975, Dry	57.3	37.6	95	284	119	15.7	4.3	2.3	4
7019.P_3.24.2.P_6.3.P_8.P_9	1974, Dry	85.1	42.9	119	314	95	14.5	2	1.5	4
	1974, Rainy	60.9	48.1	99	249	100	11.0	1.5	1	4
	1975, Dry	51.8	44.6	97	251	105	14.4	2.7	1.3	4
7019.P_3.24.3.P_6.1.P_8.P_9	1974, Dry	87.1	34.3	119	387	117	13.8	1.5	1	4
	1974, Rainy*	61.0	41.1	98	179	118	9.8	1	1.3	3.4
	1975, Dry	55.6	42.7	98	271	113	13.9	2	1.3	4
7019.P_3.24.15.P_6.5.P_8.P_9	1974, Dry	90.9	61.9	109	366	111	13.5	3	1	4
	1974, Rainy	72.4	51.5	91	329	133	12.3	1.5	1	3.5
	1975, Dry	43.9	38.8	97	215	90	13.8	2	1.7	3
7019.P_3.91.5.P_6.2.P_8.P_9	1974, Dry									
	1974, Rainy	58.0	56.1	91	274	110	10.0	1.5	4	3.5
	1975, Dry	40.6	31.2	92	223	93	15.2	2	2	4
7019.P_3.99.5.2(S).P_7.P_8.P_9	1974, Dry									
	1974, Rainy	37.4	47.8	85	273	110	11.0	1	5	3
	1975, Dry	25.7	29.9	90	268	112	14.8	1	2	3
SJ-2	1974, Dry	83.7	34.9	119	330	100	11.8	2.5	1	3
	1974, Rainy	67.8	58.7	94	248	100	10.1	1	1	3
	1974, Rainy*	75.9	54.7	98	151	100	6.4	1	1	3
	1975, Dry	43.0	43.3	92	239	100	12.7	2	1.7	3

Note : * ; Data of Regional Yield Trial at Phraphatthabat Agr. Ex. Sta. in the Rainy Season, 1974.

D. 7020 (SJ-2 x K.S.252)

Name of lines	Year, season	Plant height	No. of pods	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 seeds weight	Lodging score	Shattering score	Seed quality
		(cm)		(day)	(kg/rai)	(%)	(g)			
7020.P3.20.2.1.P7.P8	1974, Dry	86.8	64.4	112	365	111	14.3	2	2	4
	1974, Rainy	65.0	46.9	83	241	97	10.3	1	2.5	2
	1975, Dry	48.9	45.6	92	271	113	11.7	1.7	2	4
7020.P3.48.2.3.P7.P8	1974, Dry	90.0	61.9	109	366	111	13.5	3	1	4
	1974, Rainy*	60.0	45.8	84	212	140	8.2	1.3	3.3	4
	1975, Dry	52.6	41.1	92	267	112	13.7	2	2	4
7020.P3.65.1.5.P7.P8	1974, Dry	91.9	35.3	109	378	115	16.4	3	1	3
	1974. Rainy*	71.4	41.5	90	221	146	9.6	1.3	2.5	3
	1975, Dry	41.1	39.5	91	276	115	15.0	2.3	1.7	4
SJ-2	1974, Dry	83.7	34.9	119	330	100	11.8	2.5	1	3
	1974, Rainy	67.8	58.7	94	248	100	10.1	1	1	3
	1974, Rainy*	75.9	54.7	98	151	100	6.4	1	1	3
	1975, Dry	43.1	43.3	92	239	100	12.7	2	1.7	3

Note : * ; Data of Regional Yield Trial at Phraphutthabat Agr. Exp. Sta. in the Rainy Season, 1974.

E. 7021 (K.S.252 x SJ-2)

		Plant height	No. of pods	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 seeds weight	Lodging score	Shattering score	Seed quality
		(cm)		(day)	(kg/rai)	(%)	(g)			
7021.P_3.33.FP_5.1.P_7.P_8	1974, Dry									
	1974, Rainy	72.3	69.6	91	299	121	9.8	1.5	1	4
	1975, Dry	46.6	48.4	91	313	131	12.3	2	1.7	4
7021.P_3.50.4.5.P_7.P_8	1974, Dry	74.5	61.9	114	346	105	10.8	2.5	1	4
	1974, Rainy	79.4	60.5	84	275	111	11.1	2	5	3.5
	1975, Dry	46.7	30.7	91	228	95	12.9	1.3	5	4
7021.P_3.28.FP_5.3.P_7.P_8	1974, Dry									
	1974, Rainy	78.5	73.4	94	258	104	8.6	1.5	1	4
	1975, Dry	44.6	45.0	92	263	110	11.2	1.3	1.7	4
7021.P_3.8.3.2.P_7.P_8	1974, Dry	86.0	45.4	115	360	109	12.4	2	2	4
	1974, Rainy	74.3	69.0	85	265	103	8.2	2	1.5	3
	1975, Dry	40.7	44.8	93	282	118	13.7	2	2	4
7021.P_3.88.4.4.P_7.P_8	1974, Dry	89.0	36.2	115	323	98	13.8	3	2	4
	1974, Rainy	87.0	49.0	85	270	109	12.1	2	3	2.5
	1975, Dry	53.3	35.0	91	309	129	13.8	2	2	4
7021.P_3.59.5.4.P_7.P_8	1974, Dry	99.1	37.6	115	357	108	12.1	3	1	4
	1974, Rainy	82.6	70.0	95	346	140	9.0	1.5	1	4
	1975, Dry	42.5	29.7	90	188	79	11.3	2	2	4
SJ-2	1974, Dry	83.7	34.9	119	330	100	11.8	2.5	1	3
	1974, Rainy	67.8	58.7	94	248	100	10.1	1	1	3
	1975, Dry	43.1	43.3	92	239	100	12.7	2	1.7	3

F. 7024 (64-104 x SJ-2)

Name of lines	Year, season	Plant height	No. of pods	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 seeds weight	Lodging score	Shattering score	Seed quality
		(cm)		(day)	(kg/rai)	(%)	(g)			
7024.P_3.20.3.P_5.5.P_8.P_9	1974, Dry	66.7	52.2	112	306	93	12.0	3	1.5	3
	1974, Rainy	56.4	46.5	91	265	107	12.5	2	1	3.5
	1975, Dry	40.7	37.0	95	187	78	13.4	2	2	4
7024.P_3.30.5.P_6.4.P_8.P_9	1974, Dry	70.3	51.8	113	343	104	14.1	4	1	4
	1974, Rainy	61.0	54.3	85	245	99	10.9	2	1	2.5
	1975, Dry	39.2	33.9	91	204	85	13.0	1.7	2	4
7024.P_3.30.4.P_6.1.P_8.P_9	1974, Dry	95.6	32.9	119	327	99	13.4	3.5	1.5	3
	1974, Rainy	74.7	54.7	94	307	124	10.7	1	1	4
	1975, Dry	45.3	35.8	92	241	101	14.5	2.3	2	3.3
7024.P_3.54.2.P_6.3.P_8.P_9	1974, Dry	55.2	41.7	114	342	104	17.7	1	1	3
	1974, Rainy	57.1	45.8	99	294	119	12.7	1	2	4.5
	1975, Dry	33.6	30.4	93	198	83	16.4	1.7	1	2.8
7024.P_3.76.1.2(S).P_7.P_8.P_9	1974, Dry									
	1974, Rainy	46.7	38.9	91	183	74	10.8	1	1.5	3
	1975, Dry	42.4	37.3	97	225	94	13.8	1	1	3
7024.P_3.78.6.P_6.2.P_8.P_9	1974, Dry	65.9	38.1	120	355	108	14.1	1.5	1	4
	1974, Rainy	66.8	45.3	94	267	108	12.3	1	1	4
	1975, Dry	48.9	48.6	98	275	115	13.7	1.3	1	3
7024.P_3.89.1.P_6.3.P_8.P_9	1974, Dry	81.3	49.0	121	424	128	15.1	2	1	3
	1974, Rainy*	61.7	38.6	103	174	115	9.1	1	1	3.9
	1975, Dry	35.0	30.7	91	243	104	15.3	1.3	1	3
7024.P_3.91.2.P_6.P_7.P_8.P_9	1974, Dry	77.2	49.6	121	322	98	13.6	1	1	4
	1974, Rainy	59.3	48.2	94	277	117	13.5	1	1	3.5
	1975, Dry	37.8	28.7	93	252	105	18.1	1.7	1.7	4
7024.P_3.89.4.P_6.3.P_8.P_9	1974, Dry									
	1975, Dry	38.4	30.2	94	286	120	18.2	1.7	1	4
SJ-2	1974, Dry	83.7	34.9	119	330	100	11.8	2.5	1	3
	1974, Rainy	67.8	58.7	94	248	100	10.1	1	1	3
	1974, Rainy*	75.9	54.7	98	151	100	6.4	1	1	3
	1975, Dry	43.0	43.3	92	239	100	12.7	2	1.7	3

Note : * ; Data of Regional Yield Trial at Phraphutthabat Agr. Exp. Sta. in the rainy season, 1974.

At first, the author would like to present various problems arising out of the current condition of soybean cultivation in Thailand. The present soybean cultivation comprises rainy season soybeans mainly in Sukhothai, followed by dry season soybeans in Chiengmai, and the degree of importance for breeding is understood to be put mainly to the soybeans in the rainy season. Of course, there is a possibility of growth of the soybean cultivation in the northeastern part of Thailand, but there the irrigation and other facilities are not yet fully provided, and presently the feasibility is only tested. In Thailand, there are some cases in which the same varieties are cultivated in the dry as well as rainy season. Further, when the circulation of seeds between the farmers in Sukhothai and Chiengmai is taken into consideration, there is a great possibility of the bred varieties being planted in both dry and rainy seasons. Thus, the selection was conducted upon a complex form giving a considerable weight to the results of experiments in the rainy seasons and, at the same time, taking the results of experiments in the dry seasons into consideration. At first, the breeding was carried out taking the limited cultivating systems of soybeans in the dry season and in the rainy season as the backgrounds. But, considering the current situation of cultivation or condition of the facilities for storage of seeds in Thailand, such limitation seems to be at variance with reality.

The selection was conducted in consideration of the foregoing, with the results shown in Table 16.

Table 16. List of Breeding Lines Selected for Testing at Farmer's Field Test and Regional Yield Trial in the Rainy Season, 1975

Farmer's Field Test	Regional Yield Trial
1. 7021. P3. 88. 3. 2. 1. 4. P9	1. 7020. P3. 49. 2. 3. P7. P8. P9
2. 7021. P3. 33. FP5. 3. P7. P8. P9	2. 7020. P3. 65. 1. 5. 1. 3. P9
3. 7019. P3. 24. 3. P6. 1. P8. P9. P10	3. 7021. P3. 79. 3. 2. 1. 5. P9
4. 7019. P3. 24. 5. P6. 5. P8. P9. P10	4. 7021. P3. 88. 4. 2. 1. 4. P9
5. SJ-1	5. 7021. P3. 33. FP5. 3. P7. P8. P9
6. SJ-2	6. 7016. P3. P4. 28. 10(S). P7. P8. P9. P10
	7. 7019. P3. 24. 3. P4. 1. P8. P9. P10
	8. 7019. P3. 24. 5. P6. 5. P8. P9. P10
	9. 7024. P3. 78. 6. P6. 2. P8. P9. P10
	10. 7024. P3. 89. 1. P4. 3. P8. P9. P10
	11. 7024. P3. 91. 2. P6. P7. P8. P9. P10
	12. SJ-1
	13. SJ-2

For Farmer's Field Tests, there were selected 2 lines from the combination 7021 ("K.S. 252" x "SJ-2") and 2 lines from the combination 7019 ("Acadian" x "64-104"), or a total of 4 lines. For Regional Yield Trials, there were chosen, in addition to the foregoing lines, 2 lines from the combination 7020 ("SJ-2" x "K.S. 252"), 1 line from the combination 7021, 1 line from the combination 7016 ("E-27" x 7001 (F_1)) and 3 lines from the combination 7024 ("64-104" x "SJ-2"), or total 11 lines. These lines are expected to be of high yield with stability. The lines showing the resistance to rust are limited to those from only 2 combinations of 7019 and 7024. Thus, in Farmer's Field Tests, 2 lines among the 4 lines were incorporated as such, and in Regional Yield Trials, 5 lines among the 11 lines incorporated as such. Here, the materials tested in the yield trials will now be described a little more in details. The lines from 7020 were vigorous in growing. They were not resistant to rust disease but gave a high yield in rainy season, and "7020.P_3.65.1.5.1.P_8" was noted particularly. However, this line had oil contents in the order of 17 percent according to the result of the analysis of seed components conducted in the preceding season, and this will be a problem. The 3 lines from 7021 also showed a very vigorous growth. They were not rust resistant to the rust but were distinguished in the yield even in the rainy season. For Farmer's Field Tests, 2 lines out of these 3 lines will be used, but what is apprehended is that "7021.P_3.88.4.2.1.P_8" gave a rather unsatisfactory result in the experiment of dry season, 1973. From the rust resistant 7019, 2 lines were selected. Particularly, "7019.P_3.24.3.P_6.1.P_8.P_9" is a highly productive line not only in the rainy season but in the dry season. The line "7019.P_3.24.5.P_6.5.P_8.P_9" was not so high in seed yield in Preliminary Yield Test conducted in the rainy season of 1975, but in view of the result of Regional Yield Trial in the dry season of the same year and the vigorous growth noted in the field for the pedigree selection and also in Regional Yield Trial at The Kalasin Agricultural Experiment Station and thus from the consideration that it would be in the rainy season experiment that its characters would be displayed, this line was selected. These 2 lines will be tested in Farmer's Field Tests. From 7024, 3 lines were chosen. Among such 3 lines, the line "7024.P_3.78.6.P_6.2.P_8.P_9" was noted from the initial stage with vigorous growth and long stem, but in the later stage, the leaf-curling symptom was observed generally, although in a slight degree, so that notwithstanding the high productivity, it was not chosen for Farmer's Field Tests. Investigation of the cause of the leaf-curling is urgently required, and the effect of selection of lines from the plants free from such

symptom is a target for the experiments in the rainy season of 1975. The other two lines had no leaf-curling phenomenon observed but were of a rather small scale of growth in the dry season. Thus the results in the rainy season are expected.

Preliminary Yield Tests of the rainy season of 1975 comprised 28 lines, or newly incorporated 15 lines plus 13 lines of relatively good results at the experiments in the dry season of the same year. Among the newly incorporated 15 lines, 12 lines are those of the F6 generation in the rainy season and from the rust resistant combinations.

(2) Selection of materials for yield trials in the dry season of 1976 (from "Work Report" for November and December)

With the results of the yield trials conducted at the various places provided in November, it was arranged to carry out the selection upon such data. In Table 17 are shown the results of Regional Yield Trial at The Kalasin Agricultural Experiment Station in the dry season of 1975, in Table 18 the results of Regional Yield Trials at the various places in the rainy season of the same year, and in Table 19 the results of Preliminary Yield Tests at the Srisamrong and Phraphutthabat Agricultural Experiment Stations in the rainy season of the same year. Outline of the growth of soybeans in the yield trials at the various places in the rainy season in 1975 will now be described. At The Srisamrong Agricultural Experiment Station located at the center of the soybean cultivation in the rainy season, both Preliminary Yield Test and Regional Yield Trial were carried out. In these trials, the soybeans showed moderate germination and excelling growth in the initial stage, and overgrowth and heavy lodging in the late stage. At The Phraphutthabat Agricultural Experiment Station, Preliminary Yield Test and Regional Yield Trial were carried out, with medium growth of stem and occurrence of rust disease observed immediately before the maturing stage but not to an appreciable extent of damage. At The Mae Jo Agricultural Experiment Station, Regional Yield Trial were carried out, with heavy occurrence of rust disease in the later stage of growth and difference between the rust susceptible lines and rust resistant lines noted clearly. At The Kalasin Agricultural Experiment Station, Regional Yield Trial was carried out, ending in a relatively short stem.

The following is taken as the base for selection, the F6 lines were tested, for the first time, for examination of the its yield in

this rainy season so that they were not put in Regional Yield Trials but were kept under Preliminary Yield Tests, strict selection being conducted upon the results of the tests in the coming dry season, while the F_9, F_{10} and F_{11} lines were subjected to strict selection without being left at Preliminary Yield Tests but discarded. Actually, however, exception had to be given to some of the F_9, F_{10} and F_{11} lines respectively. The result of selection is shown in Table 20.

Table 17. The Result on Regional Yield Trial at The Kalasin Agr. Exp. Sta. in the Dry Season, 1975

Name of var. or lines	Plant height	No. of pods	Day to flowering	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains score	Dairy yield
	(cm)		(day)	(day)	(kg/rai)	(%)		(kg/rai/day)
7021.P3.50.4.5.P7.P8	34.5	95.1	35	84	311	94	13.5	3.70
7021.P3.79.3.2.P7.P8	27.1	45.2	33	94	347	105	13.8	3.69
7021.P3.88.4.2.P7.P8	39.0	48.9	34	91	352	106	14.8	3.87
7022.P3.89.5.4.P7.P8	28.7	38.7	33	92	287	87	12.8	3.12
7021.P3.78.FP6.3.P7.P8	27.7	49.3	33	93	329	99	10.6	3.54
7026.P3.12.FP6.3.P7.P8	33.5	49.0	35	84	385	116	12.3	4.58
7026.P3.P6.16.6(S). P7.P8.P9	33.8	29.9	34	89	303	92	17.1	3.40
7026.P3.P6.28.10(S). P7.P8.P9	27.0	33.3	29	83	454	137	18.6	5.47
7019.P3.7.2.P5.5.P6.P9	32.1	44.6	34	93	354	107	13.8	3.81
7019.P3.26.2.P5.3.P6.P9	30.8	33.7	30	93	392	118	14.8	4.22
7019.P3.24.5.P6.5.P8.P9	32.2	38.7	36	90	352	106	15.5	3.91
7019.P3.91.5.P6.2.P8.P9	30.1	45.7	33	91	328	99	13.7	3.60
7019.P3.99.5.2(S).P7. P8.P9	22.4	36.6	30	84	290	88	13.8	3.45
7024.P3.30.3.P6.5.P8.P9	25.0	36.7	32	89	305	92	15.3	3.43
7024.P3.33.4.P6.1.P8.P9	35.4	44.0	33	93	262	79	14.7	2.82
7024.P3.64.2.P6.3.P8.P9	24.8	34.6	29	85	249	74	16.8	2.88
7024.P3.18.6.P6.2.P8.P9	26.1	33.5	35	86	291	88	14.2	3.38
7024.P3.89.6.P6.3.P8.P9	28.0	36.9	32	86	398	120	14.7	4.63
7024.P3.76.1.2(S).P7. P8.P9	29.3	45.7	33	86	318	96	13.5	3.70
7019.P3.24.3.P6.P7.P8. P9.	36.4	41.0	35	92	345	104	15.4	3.75
7024.P3.89.1.P6.3.P8 P9	23.3	32.8	31	95	289	87	14.4	3.04
7102.P3.2.FP6.3.P7.P8	34.5	41.7	33	91	312	94	11.0	3.43
SJ-1	53.8	40.1	35	96	333	101	13.5	3.47
SJ-2	29.8	43.2	33	95	331	100	12.7	3.48

Selection of the lines in the late generations will now be described in the following.

From the combination of 7020, 2 lines were tested in Regional Yield Trials and one line in Preliminary Yield Tests. These are all rust susceptible and are supposed to exhibit its productivity in the dry season. But, in consideration of higher oil contents, the line "7020.P_3.49.2.3.P_7.P_8" was chosen for Farmer's Field Tests. From the combination of 7021, 3 lines were tested in Regional Yield Trials and 2 lines in Preliminary Yield Tests. Among these, 1 line in Regional Yield Trials showed a low yield at The Srisamrong and Phraphutthabat Agricultural Experiment Stations although in the rainy season so that it was abandoned and substituted by 1 line

Table 18 The Results of Regional Yield Traisl on Breeding Lines in the Rainy Season, 1975

A. Mae Jo Agr. Exp. Sta.

	Name of var. of lines	Plant height	No. of nods	No. of pods	Days to planting	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality	Dairy yield
		(cm)			(day)	(day)	(kg/rai)	(%)	(g)				(kg/rai/day)
1.	7020.Ps.49.2.3.P7.Ps.P9	58.7	12.5	51.7	36	86	132	117	8.9	3	2	3	1.53
2.	7020.Ps.65.1.5.1.Ps.P9	69.3	15.8	52.2	39	91	112	99	8.8	3	1	3	1.23
3.	7021.Ps.79.3.2.1.Ps.P9	61.1	15.0	71.1	36	89	108	96	7.8	3.5	1	3	1.21
4.	7021.Ps.88.4.2.1.Ps.P9	64.8	13.0	47.9	37	86	148	131	9.3	4	2	3	1.72
5.	7021.Ps.33.FP8.3.P7.P8.P9	63.6	15.0	72.4	38	92	157	139	8.1	3	1	3	1.71
6.	7016.Ps.P4.28.10(S).P7.Ps. P9.P10	49.0	11.5	43.4	36	85	187	165	12.3	2	1	3	2.20
7.	7019.Ps.24.3.P6.1.Ps.P9.P10	63.9	13.6	60.2	39	99	241	213	12.6	3	1	3.5	2.43
8.	7019.Ps.24.5.P6.5.Ps.P9.P10	68.2	13.6	53.9	40	96	277	245	12.8	2.5	1	3.5	2.89
9.	7024.Ps.78.6.P6.2.Ps.P9.P10	68.4	16.1	60.0	43	105	226	200	12.9	4	1	3.5	2.15
10.	7024.Ps.89.1.P6.3.Ps.P9.P10	54.6	13.4	61.9	41	95	275	174	11.1	2	1	4	2.89
11.	7024.Ps.91.2.P6.P7.P8.P9 P10	57.1	12.4	63.4	41	99	197	174	12.2	4.5	1	3.5	1.99
12.	SJ-1	81.1	15.5	41.7	41	91	133	108	7.8	2.5	1.5	3	1.35
13.	SJ-2	67.4	14.8	59.6	40	95	113	100	7.6	3.5	1	3	1.19

B. Srisamrong Agr. Exp. Sta.

1.	7020.Ps.49.2.3.P7.Ps.P9	98.9	15.4	71.6	34	99	445	121	17.4	5	2	3	4.49
2.	7020.Ps.65.1.5.1.Ps.P9	96.8	15.8	70.0	36	106	400	109	16.4	5	1	3.5	3.77
3.	7021.Ps.79.3.2.1.Ps.P9	89.7	16.9	85.7	35	102	421	115	13.9	4.5	1.5	3.5	4.13
4.	7021.Ps.88.4.2.1.Ps.P9	113.4	10.3	57.3	35	101	377	103	17.9	5	2	3	3.73
5.	7021.Ps.33.FP8.3.P7.Ps.P9	103.4	17.5	100.1	38	105	333	91	13.4	5	1	3	3.17
6.	7016.Ps.P4.28.10(S).P7.Ps. P9.P10	70.6	13.2	54.9	35	99	454	121	22.1	4	1.5	3.5	4.59
7.	7019.Ps.24.3.P6.1.Ps.P9.P10	95.3	15.6	75.3	37	105	419	114	16.9	4	1	3	3.99
8.	7019.Ps.24.5.P6.5.Ps.P9.P10	75.7	14.7	70.1	36	102	331	90	16.8	5	1	3	3.25
9.	7024.Ps.78.6.P6.2.Ps.P9.P10	99.5	18.4	97.2	37	114	333	91	15.5	5	1	2.7	2.92
10.	7024.Ps.89.1.P6.3.Ps.P9.P10	78.0	15.6	68.5	37	107	385	105	16.7	2	1	2.5	3.60
11.	7024.Ps.91.2.P6.P7.Ps.P9. P10	85.8	14.9	80.9	37	110	398	108	16.6	3.5	1	3	3.62
12.	SJ-1	151.2	21.1	79.6	37	104	359	98	14.3	5	1.5	3.5	3.45
13.	SJ-2	102.2	16.8	104.6	37	110	367	100	13.2	5	1	3	3.34

C. Phraphutthabat Agr. Exp. Sta.

	Name of var. of lines	Plant height	No. of nods	No. of pods	Days to planting	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality	Dairy yield
		(cm)			(day)	(day)	(kg/rai)	(%)	(g)				(kg/rai/day)
1.	7020.P3.49.2.3.P7.P8.P9	67.9	14.5	50.0	34	93	387	105	13.3	2	1	3	4.16
2.	7020.P3.65.1.5.1.P8.P9	58.4	14.0	47.4	34	98	357	97	13.7	1	1	3	3.64
3.	7021.P3.79.3.2.1.P8.P9	59.7	15.3	65.9	34	98	383	104	11.4	1.5	1	3	3.91
4.	7021.P3.88.4.2.1.P8.P9	72.5	15.2	50.3	35	92	365	99	11.9	1.5	1	3	3.97
5.	7021.P3.33.FP5.3.P7.P8.P9	67.1	15.6	62.5	37	98	357	97	11.2	2	1	3	3.64
6.	7016.P3.P4.28.10(S).P7.P8 P9.P10	45.9	12.2	33.9	34	94	314	85	18.1	1	1	3.5	3.34
7.	7019.P3.24.3.P6.1.P8.P9.P10	57.4	13.9	50.5	36	100	368	100	13.4	1	1	3	3.68
8.	7019.P3.24.5.P6.5.P8.P9.P10	60.1	13.6	47.3	36	94	352	96	13.3	2	1	3	3.74
9.	7024.P3.78.6.P6.2.P8.P9.P10	71.3	16.3	40.7	37	105	301	82	13.1	2	1	3	2.87
10.	7024.P3.89.1.P6.3.P8.P9.P10	49.4	13.0	51.2	36	95	391	106	13.2	1	1	3	4.12
11.	7024.P3.91.2.P6.P7.P8.P9 P10	58.4	13.3	47.3	37	100	361	98	13.8	1.5	1	3	3.61
12.	SJ-1	110.2	18.5	57.2	36	98	381	104	12.0	3.5	1	3	3.89
13.	SJ-2	78.3	15.6	64.8	37	100	368	100	11.4	2.5	1	3	3.68

D. Kalasin Agr. Exp. Sta.

1.	7020.P3.49.2.3.P7.P8.P9	31.8	10	24	35	93	110	90	10.9	1	1.7	3.3	1.18
2.	7020.P3.65.1.5.1.P8.P9	35.2	13	34	37	105	170	139	12.1	1	1	4	1.62
3.	7021.P3.79.3.2.1.P8.P9	27.3	11	32	36	102	140	115	11.1	1	1	2.3	1.37
4.	7021.P3.88.4.2.1.P8.P9	35.6	11	24	36	92	123	101	10.3	1	1.3	4	1.34
5.	7021.P3.33.FP5.3.P7.P8.P9	31.9	12	45	39	104	146	120	10.1	1	1	4	1.40
6.	7016.P3.P4.28.10(S).P7.P8. P9.P10	29.1	9	18	36	95	109	89	15.7	1	1.3	3.3	1.15
7.	7019.P3.24.3.P6.1.P8.P9.P10	35.7	13	34	41	105	149	122	12.5	1	1	4.7	1.42
8.	7019.P3.24.5.P6.5.P8.P9.P10	31.6	12	26	39	102	68	56	11.7	1	1	3.7	0.67
9.	7024.P3.78.6.P6.2.P8.P9.P10	31.7	18	26	40	105	105	86	11.7	1	1	3.3	1.00
10.	7024.P3.89.1.P6.3.P8.P9.P10	24.8	11	25	39	104	117	96	11.0	1	1	3.7	1.13
11.	7024.P3.91.2.P6.P7.P8.P9 P10	30.3	12	31	41	105	133	109	11.8	1	1.3	3.7	1.27
12.	SJ-1	42.1	15	31	38	105	79	65	11.7	1	1	3.7	0.75
13.	SJ-2	31.9	12	32	39	105	122	100	10.3	1	1	3.7	1.16

Table 19. The Results of Preliminary Yield Tests on Breeding Lines in the Rainy Season, 1975

A. Srisamrong Agr. Exp. Sta.

	Name of var. or lines	Plant height	No. of nods	No. of pods	Days to planting	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality	Dairy yield
		(cm)			(day)	(day)	(kg/rai)	(%)	(g)				(kg/rai/day)
1.	7001. P_3. 35. P_5. 4. 5. 41. P9. P_{10}	82.8	15.3	83.3	37	109	502	143	16.7	1.7	1	4	4.61
2.	7001. P_3. 56. P_5. 1. 5. 4. 1. P_{10}. P_{11}	84.8	15.0	46.7	35	95	379	108	17.8	2	1.3	3.2	3.99
3.	7001. P_3. 83. P_5. 2. 5. 5. P_9. P_{10}	87.9	16.6	64.3	38	104	350	100	16.5	4	1	3.3	3.37
4.	7004. P_3. 1. P_5. P_6	68.4	13.3	57.2	37	94	376	107	17.1	3.7	1.3	3.2	4.00
5.	7206. P_3. 1. P_5. P_6	69.1	13.4	55.6	35	92	387	110	19.2	2	1.3	3.2	4.21
6.	7206. P_3. 3. P_5. P_6	73.8	14.3	62.8	36	97	397	113	17.0	3.7	1	2.7	4.09
7.	7206. P_3. 5. P_5. P_6	59.6	12.7	46.3	35	97	324	92	18.2	2.3	1.3	2.5	3.34
8.	7206. P_3. 7. P_5. P_6	70.5	15.0	61.8	37	98	347	99	19.3	3.3	1	2	3.54
9.	7207. P_3. 2. P_5. P_6	96.6	18.1	69.0	37	104	309	88	15.0	5	1.3	3.5	2.97
10.	7207. P_3. 4. P_5. P_6	94.6	17.4	62.9	38	110	373	106	15.3	4.7	1	3	3.39
11.	7207. P_3. 7. P_5. P_6	89.9	16.5	62.2	36	93	381	109	17.9	3.3	1	3	4.10
12.	7207. P_3. 8. P_5. P_6	76.7	14.3	49.9	34	96	366	104	17.9	3	1.7	2.8	3.81
13.	7207. P_3. 10. P_5. P_6	102.0	18.1	86.7	37	106	388	111	15.0	5	1	3.2	3.66
14.	7207. P_3. 3(S). P_5. P_6	123.9	18.4	56.0	37	97	290	83	16.1	5	1	3.2	2.99
15.	7207. P_3. 5(S). P_5. P6	119.4	18.6	44.5	36	102	299	85	15.2	4.7	1.3	3.2	2.93
16.	7020. P_3. 20. 2. 1. 3. P_6. P_9	89.6	16.1	59.2	33	93	363	103	16.7	4	1.3	3	3.90
17.	7021. P_3. 84. 4. 5. 1(S). P_5. P_6	83.4	16.7	69.1	36	103	336	96	13.8	5	1	3.3	3.26
18.	7021. P_3. 78. FP$_3$. 4(S). P_5. P_6	93.8	16.5	105.5	37	114	364	104	12.4	5	1.3	3	3.19
19.	7012. P_3. 50. 3. 6(S). P_7. P_8. P_9. P_{10}	68.5	13.0	46.4	31	99	348	99	18.9	2	1	3.3	3.52
20.	7013. P_3. P_5. 53. 5. 2. P_8. P_9. P_{10}	81.1	14.6	59.6	35	109	253	72	19.3	5	1	2.3	2.32
21.	7019. P_3. 7. 2. P6. 5. P_8. P_9. P_{10}	115.2	17.2	75.6	38	114	354	101	15.7	5	1	3.3	3.11
22.	7019. P_3. 4. 2. P6. 3. P_8. P_9. P_{10}	94.2	15.8	78.8	36	105	380	108	15.5	4.3	1	3	3.62
23.	7019. P_3. 99. 5. 2(S). P_7. P_8. P_9. P_{10}	69.0	15.2	92.0	35	101	386	110	16.7	3.3	1.3	2.7	3.82
24.	7024. P_3. 30. 3. P_6. 5. P_8. P_9. P_{10}	91.4	15.9	62.0	37	104	408	116	16.0	4.3	1	3.7	3.92
25.	7024. P_3. 30. 5. P_6. 4. P_8. P_9. P_{10}	79.2	17.1	89.4	37	101	363	103	14.6	5	1	3	3.59
26.	7024. P_3. 33. 4. P_6. 1. P_8. P_9. P_{10}	95.7	16.8	88.1	38	112	294	84	15.8	4.3	1	2.3	2.63
27.	7024. P_3. 89. 4. P_6. 3. P_8. P_9. P_{10}	89.4	15.0	80.9	38	111	423	121	16.2	3.7	1.3	3.3	3.81
28.	SJ-1	142.5	20.7	70.0	36	104	393	112	13.9	4.3	1.7	2.7	3.78
29.	SJ-2	93.7	17.2	89.5	37	109	351	100	12.7	4.3	1	3	3.22
30.	7102. P_3. 7. FP$_3$. 3. P_7. P_8. P_9	114.6	20.2	105.0	41	115	285	81	9.9	5	1	2.5	2.48
31.	7022. P_3. 7. 4. P_7. P_8. P_9	151.6	25.7	96.0	39	125	335	95	12.8	5	1	2.3	2.68
32.	7016. P_3. P_4. 16. 6(S). P_7. P_8 P_9. P_{10}	103.3	15.7	65.8	36	101	244	70	18.2	5	1.3	3.2	2.42
33.	7016. P_3. P_4. 84. 7(S). P_7. P_8 P_9. P_{10}	74.3	14.9	44.9	35	99	361	103	18.4	3.7	1.7	3	3.65

B. Phraphutthabat Agr. Exp. Sta.

	Name of var. or lines	Plant height	No. of nodes	No. of pods	Days to flowering	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality	Dairy yield
		(cm)			(day)	(day)	(kg/rai)	(%)	(g)				(kg/rai/day)
1.	7001.P3.35.P5.4.5.4.1.P10.P11	52.0	13.5	52.3	38	99	351	104	13.4	1	1	3.5	3.55
2.	7001.P3.56.P5.1.5.4.1.P10.P11.	53.6	13.0	39.8	35	94	367	109	15.3	1	1	3	3.90
3.	7001.P3.83.P5.3.5.5.P9.P10	70.1	14.5	42.0	37	99	340	101	15.0	1.7	1	3.5	3.43
4.	7204.P3.1.P5.P6	49.6	13.6	33.1	37	92	342	101	15.6	1	1	3	3.72
5.	7206.P3.1.P5.P6	40.7	12.8	36.6	34	98	291	86	12.8	1	2	3	2.97
6.	7206.P3.3.P5.P6	59.9	13.8	44.6	36	97	416	123	15.6	2	1	3	4.29
7.	7206.P3.5.P5.P6	46.4	12.7	34.7	35	96	337	100	17.8	1	1.3	3.5	3.51
8.	7206.P3.7.P5.P6	39.6	12.5	40.0	36	95	338	100	16.2	1.3	1.3	3.5	3.56
9.	7207.P3.2.P5.P6	68.9	15.6	58.0	38	100	445	137	14.0	2	1	3.5	4.45
10.	7207.P3.4.P5.P6	59.0	14.8	61.5	38	101	387	114	14.0	2	1	3	3.83
11.	7207.P3.7.P5.P6	49.9	14.4	43.9	34	92	326	96	13.7	1	1	3	3.54
12.	7207.P3.8.P5.P6	41.2	12.5	40.4	35	95	276	82	12.6	1.3	1	3	2.91
13.	7207.P3.10.P5.P6	59.1	15.6	52.2	38	100	372	110	13.2	2.3	1	3.5	3.72
14.	7207.P3.3(S).P5.P6	82.8	16.2	37.3	37	92	433	128	13.9	1.3	1	3	4.71
15.	7207.P3.5(S).P5.P6	74.8	15.9	38.3	38	98	318	94	14.2	2.3	1.3	3.5	3.24
16.	7020.P3.20.2.4.3.P5.P6	64.9	14.4	42.9	34	92	345	102	13.9	1	1	3	3.75
17.	7021.P3.84.4.5.1(S).P5.P6	45.0	14.1	46.9	36	96	328	97	11.2	1.7	1	3	3.42
18.	7021.P3.78.FP3 3.4(S).P5.P6	66.4	14.4	69.1	37	100	424	125	12.4	2.3	1	3	4.24
19.	7012.P3.50.3.6(S).P7.P8.P9.P10	51.0	12.1	37.6	32	95	305	90	14.5	1	1	3	3.21
20.	7013.P3.P4.53.5.2.P8.P9.P10	60.5	13.8	45.5	35	98	345	102	16.3	1.7	1	3	3.52
21.	7019.P3.7.2.P6.5.P8.P9.P10	64.2	14.7	42.3	38	101	368	109	15.4	2.3	1	3	3.64
22.	7019.P3.24.2.P6.3.P8.P9.P10	58.3	13.7	52.8	35	101	416	123	14.7	2	1	3	4.12
23.	7019.P3.99.5.2(S).P7.P8.P9.P10	42.0	12.9	39.2	35	97	303	90	13.1	1.7	1.3	3	3.12
24.	7024.P3.30.3.P6.5.P8.P9.P10	60.9	14.0	54.9	36	99	414	122	14.8	1.7	1	3.5	4.18
25.	7024.P3.30.5.P6.4.P8.P9.P10	55.7	14.9	48.1	37	94	318	94	12.6	1.7	1	3	3.38
26.	7024.P3.33.4.P6.1.P8.P9.P10	58.0	13.7	47.5	36	101	355	105	13.2	1.7	1	3	3.51
27.	7024.P3.89.4.P6.3.P8.P9.P10	48.4	12.6	43.1	37	99	305	90	13.5	1	1	3	3.08
28.	SJ-1	94.3	17.5	51.6	36	98	359	106	12.0	3	1	3	3.66
29.	SJ-2	67.4	14.4	60.7	38	100	338	100	11.6	2.3	1	3	3.38
30.	7102.P3.2.FP3.3.P7.P8.P9	67.8	15.0	72.2	37	101	399	118	10.1	2	1	3	3.95
31.	7022.P3.7.4.4.P7.P8.P9	103.1	20.2	52.3	38	100	392	116	13.1	3	1	3	3.92
32.	7016.P3.P4.16.6(S).P7.P8.P9.P10	65.2	14.4	43.6	35	94	375	111	16.3	2.3	1	3	3.99
33.	7016.P3.P4.84.7(S).P7.P8.P9.P10	43.0	13.4	31.3	35	93	307	91	15.2	1	1	3	3.30

C. Summarized Data on the Selected Characteristics

	Name of var. or lines	1. Seed yield (kg/rai)			2. Yielding ratio to "SJ-2" (%)			Primary evaluation	3. 100 grains weight (g)		
		Srisamrong Agr. Exp. Sta.	Phraphutthabat Agr. Exp. Sta.	Average	Srisamrong Agr. Exp. Sta.	Phraphutthabat Agr. Exp. Sta.	Average		Srisamrong Agr. Exp. Sta.	Phraphutthabat Agr. Exp. Sta.	Average
1.	7001. P_3. 35. P_5. 4. 5. 4. 1. P_{10}	502	351	427	143	104	124		16.7	13.4	15.1.
2.	7001. P_3. 56. P_6. 1. 5. 4. 1. P_{10}	379	367	373	108	109	109		17.8	15.3	16.6
3.	7001. P_3. 83. P_5. 3. 5. 5. P_8	350	340	345	100	101	101		16.5	15.0	15.8
4.	7204. P_3. 1. P_5. P_6	376	342	359	107	101	104		17.1	15.6	16.4
5.	7206. P_3. 1. P_5. P_6	387	291	339	110	86	98		19.2	12.8	16.0
6.	7206. P_3. 3. P_5. P_6	397	416	407	113	123	118		17.0	15.6	16.3
7.	7206. P_3. 5. P_5. P_6	324	337	331	92	100	96		18.2	17.8	18.0
8.	7206. P_3. 7. P_5. P_6	347	338	343	99	100	100		19.3	16.2	17.8
9.	7207. P_3. 2. P_5. P_6	309	445	377	88	132	110		15.0	14.0	14.5
10.	7207. P_3. 4. P_5. P_6	373	387	380	106	114	110		15.3	14.0	14.7
11.	7207. P_3. 7. P_5. P_6	381	326	354	109	96	103		17.9	13.7	15.8
12.	7207. P_3. 8. P_5. P_6	366	276	321	104	82	93		17.9	12.6	15.3
13.	7207. P_3. 10. P_5. P_6	388	372	380	111	110	111		15.0	13.2	14.1
14.	7207. P_3. 3(S). P_5. P_6	290	433	362	83	128	106		16.1	13.9	15.0
15.	7207. P_3. 5(S). P_5. P_6	299	318	309	85	94	90		15.2	14.2	14.7
16.	7020. P_3. 20. 2. 1. 3. P_5. P_9	363	345	354	103	102	103		16.7	13.9	15.3
17.	7021. P_3. 84. 4. 5. 1(S). P_5. P_9	336	328	332	96	97	97		13.8	11.2	12.5
18.	7021. P_3. 78. FP_5. 3. 4(S). P_5. P_9	364	424	394	104	125	115		12.4	12.4	12.4
19.	7012. P_3. 50. 3. 6(S). P_7. P_5. P_9. P_{10}	348	305	327	99	90	95		18.9	14.5	16.7
20.	7013. P_3. P_5. 53. 5. 2. P_5. P_9. P_{10}	253	345	299	72	102	87		19.3	16.3	17.8
21.	7019. P_3. 7. 2. P_6. 5. P_5. P_9. P_{10}	354	368	361	101	109	105		15.7	15.4	15.6
22.	7019. P_3. 24. 2. P_5. 3. P_5. P_9. P_{10}	380	416	398	108	123	116		15.5	14.7	15.1
23.	7019. P_3. 99. 5. 2(S). P_7. P_5. P_9. P_{10}	386	303	346	110	90	100		16.7	13.1	14.9
24.	7024. P_3. 30. 3. P_5. 5. P_5. P_9. P_{10}	408	414	411	116	122	119		16.0	14.8	15.4
25.	7024. P_3. 30. 5. P_5. 4. P_5. P_9. P_{10}	363	318	341	103	94	99		14.6	12.6	13.6
26.	7024. P_3. 33. 4. P_5. 1. P_5. P_9. P_{10}	294	355	325	84	105	95		15.8	13.2	14.5
27.	7024. P_3. 89. 4. P_5. 3. P_5. P_9. P_{10}	423	305	364	121	90	106		16.2	13.5	14.9
28.	SJ-1	398	359	376	112	106	109		13.9	12.0	13.0
29.	SJ-2	451	328	345	100	100	100		12.7	11.6	12.2
30.	7102. P_3. 2. FP_5. 3. P_7. P_5. P_9	285	399	342	81	118	100		9.9	10.1	10.0
31.	7022. P_3. 7. 4. 4. P_7. P_5. P_9	335	392	364	95	116	106		12.8	13.1	13.0
32.	7016. P_3. P_5. 16. 6(S). P_7. P_5. P_9. P_{10}	244	375	310	70	111	91		18.2	16.3	17.3
33.	7016. P_3. P_5. 84. 7(S). P_7. P_5. P_9. P_{10}	361	307	334	103	91	97		18.4	15.2	16.8

chosen from the results of Preliminary Yield Tests. Among these 3 lines, a line with relatively good results in the past experiments, that is, "7021. P_3. 88. 4. 2. 1. P_7. P_8. P_9", was chosen for Farmer's Field Tests. For the lines from 7019, there was no change except 1 line which was newly selected in Preliminary Yield Tests. From the combination of 7024, 3 lines were tested in Regional Yield Trials and 4 lines in Preliminary Yield Tests. They were of vigorous growth but involved a problem of leaf-curling, and the productivity at the experiment stations except Mae Jo where heavy occurrence of rust disease observed, was not high. Among the lines tested in Regional Yield Trials, the line "7024. P_3. 89. 1. P_6. 3. P_8. P_9" provided a relatively uniform yield throughout the experiment station, but the hilum color had a trend to diffuse on its seed coats. Such difficulty was persistent in the lines provided through individual plant selection out of the population in the rainy season of 1975. Thus, this line had to be discarded. For the other lines, those of vigorous growth were taken in consideration for the possiblity of pedigree selection with leaf-curling so that the development of the leaf-curling would be checked in the next dry season. The line from 7016 which gave a high yield at The Srisamrong Agricultural Experiment Station was short stemmed and rust susceptible so that it was dropped to Preliminary Yield Tests for examination of the possibility of use as podded soybeans.

Table 20. List of Breeding Lines Selected for Testing at Farmer's Field Test and Regional Yield Trial in the Dry Season, 1976

	Farmer's Field Test		Regional Yield Trial
1.	7020. P3. 49. 2. 3. P7. P8. P9. P11	1.	7001. P3. 35. P5. 4. 5. 4. 1. P11. P11. P12.
2.	7021. P3. 88. 4. 2. 1. 4. 4(S). P11	2.	7020. P3. 49. 2. 3. P7. P8. P9. P11
3.	7019. P3. 24. 3. P6. 1. P8. P9. P11. P12	3.	7020. P3. 65. 3. 5. 3. 3. 2(S). P11
4.	7019. P3. 24. 5. P6. 5. P8. P9. P11. P12	4.	7021. P3. 79. 3. 2. 1. 5. 1(S). P11
5.	SJ-1	5.	7021. P3. 88. 4. 2. 1. 4. 4(S). P11
6.	SJ-2	6.	7021. P3. 78. FP5. 3. 4(S). 4. 2(S). P11
		7.	7019. P3. 24. 2. P6. 3. P8. P9. P11 P12
		8.	7019. P3. 24. 3. P6. 3. P8. P9. P11. P12
		9.	7019. P3. 24. 5. P6. 5. P8. P9. P11. P12
		10.	7024. P3. 35. 3. P5. 5. P8. P9. P11 P12
		11.	7024. P3. 78. 6. P6. 2. P8. P9. P11. P12
		12.	7024. P3. 91. 2. P6. P7. P8. P9. P11. P12
		13.	SJ-1
		14.	SJ-2

As the result of the foregoing, there will be tested in Farmer's Field Tests one line from the combination 7020, one line from the combination 7021, and two lines from the combination 7019. Here, referring to the candidate of new varieties discussed at the time of talk with Dr. Arwooth (Project leader, Oil Crops), they will have to be reduced to one or two lines, and if two lines are to be taken, they will be one line from the combinations of 7019 and 7021 respectively.

One of such lines from the combination 7021 is "7021.P_3.88.4.2.1.2.P_9". This line is of the determinate type but with vigenous growth in the dry season, and has broad leaves, brown pubescence, purple flower, larger seeds with slightly dilute dark brown hilum than that of the standard variety "SJ-2". It is little affected by the Downy mildew disease seen in the dry season. From the other combination 7019, the line "7019.P_3.24.3.P_6.1.P_8.P_9.P_{10}" is chosen. The line also shows the determinate growth and is good in elongation of stem, with broad leaves, brown pubescence, purple flower, larger seeds with dark brown hilum that those of the standard varieties "SJ-1" and "SJ-2". It provided good results in the rainy season (particularly at The Mae Jo Agricultural Experiment Station where there was heavy occurrence of rust disease) on account of a rust resistance derived from one parent "64-104".

The results of these two lines will be summarized by the Thai side and be submitted to the Crop Variety Recommendation Committee.

Table 21. The Results of Yield Trials on Selected Lines until the Rainy Season, 1975

A. 7020.P3.49.2.3.P7.P8.P9. and SJ-2

Name of line	Year, Season	Experiment*	Location	Plant height	No. of pods	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality
				(cm)		(day)	(kg/rai)	(%)	(g)			
7020.P3.49.2.3.P7.P8.P9	1974, Dry	PYT	Mae Jo	90.9	61.9	109	366	111	13.5	3	1	4
	1974, Rainy	RYT	Phraphutthabat	60.0	45.8	84	212	140	8.2	1.3	3.3	4
	1975, Dry	PYT	Mae Jo	52.6	41.1	92	267	112	13.7	2	2	4
	1975, Rainy	RYT	Mae Jo	58.7	51.7	86	132	117	8.9	3	2	3
	1975, Rainy	RYT	Srisamrong	98.9	71.6	99	445	121	17.4	5	2	3
	1975, Rainy	RYT	Phraphutthabat	67.9	50.0	93	387	105	13.3	2	1	3
	1975, Rainy	RYT	Kalasin	31.8	24	93	110	90	10.9	1	1.7	3.3
		Average		65.8	44.4	94	274	(114)	12.3	2.5	1.9	3.5
SJ-2	1974, Dry	PYT	Mae Jo	83.7	34.9	119	330	100	11.8	2.5	1	3
	1974, Rainy	RYT	Phraphutthabat	75.9	54.9	98	151	100	6.4	1	1	3
	1975, Dry	PYT	Mae Jo	43.1	43.3	92	239	100	12.7	2	1.7	3
	1975, Rainy	RYT	Mae Jo	67.4	59.6	95	113	100	7.6	3.5	1	3
	1975, Rainy	RYT	Srisamrong	102.2	104.6	110	367	100	13.2	5	1	3
	1975, Rainy	RYT	Phraphutthabat	78.3	64.8	100	368	100	11.4	2.5	1	3
	1975, Rainy	RYT	Kalasin	31.9	32	105	122	100	10.3	1	1	3.7
		Average		68.9	56.3	103	241	(100)	10.5	2.5	1.1	3.1

Note : * ; PYT = Preliminary Yield Test, RYT = Regional Yield Trial

B. 7021.P3.88.4.2.1.4.P9 amd SJ-2

7021.P3.88.4.2.1.4.P9	1974, Dry	PYT	Mae Jo	89.0	36.2	115	323	98	13.8	3	2	4
	1974, Rainy	PYT	Phraphutthabat	87.0	49.0	85	270	109	12.1	2	3	2.5
	1975, Dry	PYT	Mae Jo	53.3	35.0	91	309	129	13.8	2	2	4
	1975, Dry	RYT	Kalasin	39.0	48.9	91	352	106	14.8			
	1975, Rainy	RYT	Mae Jo	64.8	47.9	86	148	131	9.3	4	2	3
	1975, Rainy	RYT	Srisamrong	113.4	57.3	101	377	103	17.9	5	2	3
	1975, Rainy	RYT	Phraphutthabat	72.5	50.3	92	365	99	11.9	1.5	1	3
	1975, Rainy	RYT	Kalasin	35.6	24	92	123	101	10.3	1	1.3	4
		Average		69.3	43.6	94	283	(113)	13.0	2.6	1.9	3.4
SJ-2	1974, Dry	PYT	Mae Jo	83.7	34.9	119	330	100	11.8	2.5	1	3
	1974, Rainy	PYT	Phraphutthabat	67.8	58.7	94	248	100	10.1	1	1	3
	1975, Dry	PYT	Mae Jo	43.1	43.3	92	239	100	12.7	2	1.7	3
	1975, Dry	RYT	Kalasin	29.8	43.2	95	.11	100	12.7			
	1975, Rainy	RYT	Mae Jo	67.4	59.6	95	113	100	7.6	3.5	1	3
	1975, Rainy	RYT	Srisamrong	102.2	104.6	110	367	100	13.2	5	1	3
	1975, Rainy	RYT	Phraphutthabat	78.3	64.8	100	368	100	11.4	2.5	1	3
	1975, Rainy	RYT	Kalasin	31.9	32	105	122	100	10.3	1	1	3.7
		Average		63.0	55.1	101	251	(100)	11.2	2.5	1.1	3.1

Note : * PYT = Preliminary Yield Trials, RYT = Regional Yield Trial

C. 7019.P3.24.3.P6.1.P8.P9.P10, SJ-1 and SJ-2

Name of line	Year, Season	Experiment*	Location	Plant height	No. of pods	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality
				(cm)		(day)	kg/rai	(%)	(g)			
7019.P3.24.3.P6.1.P8.P9.P10	1974, Dry	PYT	Mae Jo	87.1	34.3	119	387	117	13.8	1.5	1	4
	1974, Rainy	RYT	Phraphutthabat	61.0	41.1	98	179	118	9.8	1	1.3	3.4
	1975, Dry	PYT	Mae Jo	55.6	42.7	98	271	113	13.9	2	1.3	4
	1975, Dry	RYT	Kalasin	36.4	41.0	92	345	104	15.4			
	1975, Rainy	RYT	Mae Jo	63.9	60.2	99	241	213	12.6	3	1	3.5
	1975, Rainy	RYT	Srisamrong	95.3	75.3	105	419	114	16.9	4	1	3
	1975, Rainy	RYT	Phraphutthabat	57.4	50.5	100	368	100	13.4	1	1	3
	1975, Rainy	RYT	Kalasin	35.7	34	105	149	122	12.5	1	1	4.7
		Average		61.6	47.4	102	295	(117)	13.5	1.9	1.1	3.7
SJ-1	1974, Dry	PYT	Mae Jo	71.3	47.4	109	303	92	11.9	1.5	2	3
	1974, Rainy	RYT	Phraphutthabat	75.9	54.7	98	151	100	6.4	1	1	3
	1975, Dry	PYT	Mae Jo	52.4	47.0	91	197	82	10.3	1.7	4	3
	1975, Dry	RYT	Kalasin	53.8	40.1	96	333	101	13.5			
	1975, Rainy	RYT	Mae Jo	81.1	41.7	91	123	108	7.8	2.5	1.5	3
	1975, Rainy	RYT	Srisamrong	151.2	79.6	104	359	98	14.3	5	1.5	3.5
	1975, Rainy	RYT	Phraphutthabat	110.2	57.2	98	381	104	12.0	3.5	1	3
	1975, Rainy	RYT	Kalasin	42.1	31	105	79	65	11.7	1	1	3.7
		Average		79.8	49.8	99	241	(95)	11.0	2.3	1.7	3.2
SJ-2	1974, Dry	PYT	Mae Jo	83.7	34.9	119	330	100	11.8	2.5	1	3
	1974, Rainy	RYT	Phraphutthabat	75.9	54.7	98	151	100	6.4	1	1	3
	1975, Dry	PYT	Mae Jo	43.1	43.3	92	239	100	12.7	2	1.7	3
	1975, Dry	RYT	Kalasin	29.8	43.2	95	331	100	12.7			
	1975, Rainy	RYT	Mae Jo	67.4	59.6	95	113	100	7.6	3.5	1	3
	1975, Rainy	RYT	Srisamrong	102.2	104.6	110	367	100	13.2	5	1	3
	1975, Rainy	RYT	Phraphutthabat	78.3	64.8	110	368	100	11.4	2.5	1	3
	1975, Rainy	RYT	Kalasin	31.9	32	105	122	100	10.3	1	1	3.7
		Average		64.0	54.6	103	253	(100)	10.8	2.5	1.1	3.1

Note : * ; PYT = Preliminary Yield Test. RYT = Regional Yield Trial

D. 7019.P3.24.5.P6.5.P8.P9.P10, SJ-1 and SJ-2

Name of line	Year, Season	Experiment*	Location	Plant height	No. of pods	Growing period	Seed yield	Yielding ratio to "SJ-2"	100 grains weight	Lodging score	Shattering score	Seed quality
				(cm)		(day)	(kg/rai)	(%)	(g)			
7019.P3.24.5.P6.5.P8.P9.P10	1974, Dry	PYT	Mae Jo	90.9	61.9	109	366	111	13.5	3	1	4
	1974, Rainy	PYT	Phraphutthabat	72.4	51.3	91	329	133	12.3	1.5	1	3.5
	1975, Dry	PYT	Mae Jo	43.9	38.8	97	215	90	13.8	2	1.7	3
	1975, Dry	RYT	Kalasin	32.2	38.7	90	352	106	15.5			
	1975, Rainy	RYT	Mae Jo	68.2	53.9	96	277	245	12.8	2.5	1	3.5
	1975, Rainy	RYT	Sriaamrong	75.7	70.1	102	331	90	16.8	5	1	3
	1975, Rainy	RYT	Phraphutthabat	60.1	47.3	94	352	96	13.3	2	1	3
	1975, Rainy	RYT	Kalasin	31.6	26	102	68	56	11.7	1	1	3.7
		Average		59.4	48.5	98	286	(108)	13.7	2.4	1.1	3.4
SJ-1	1974, Dry	PYT	Mae Jo	71.3	47.4	109	303	92	11.9	1.5	2	3
	1974, Rainy	RYT	Phraphutthabat	90.9	44.1	83	198	80	10.2	1.5	5	3
	1975, Dry	PYT	Mae Jo	52.4	47.0	91	197	82	10.3	1.7	4	3
	1975, Dry	RYT	Kalasin	53.8	40.1	96	333	101	13.5			
	1975, Rainy	RYT	Mae Jo	81.1	41.7	91	123	108	7.8	2.5	1.5	3
	1975, Rainy	RYT	Sriaamrong	151.2	79.6	104	359	98	14.3	5	1.5	3.5
	1975, Rainy	RYT	Phraphutthabat	110.2	57.2	98	381	104	12.0	3.5	1	3
	1975, Rainy	RYT	Kalasin	42.1	31	105	79	65	11.7	1	1	3.7
		Average		81.6	48.5	97	247	(93)	11.5	2.4	2.3	3.2
SJ-2	1974, Dry	PYT	Mae Jo	83.7	34.9	119	330	100	11.8	2.5	1	3
	1974, Rainy	PYT	Phraphutthabat	67.8	58.7	94	248	100	10.1	1	1	3
	1975, Dry	PYT	Mae Jo	43.1	43.3	92	239	100	12.7	2	1.7	3
	1975, Dry	RYT	Kalasin	29.8	43.2	95	331	100	12.7			
	1975, Rainy	RYT	Mae Jo	67.4	59.6	95	113	100	7.6	3.5	1	3
	1975, Rainy	RYT	Sriaamrong	102.2	104.6	110	367	100	13.2	5	1	3
	1975, Rainy	RYT	Phraphutthabat	78.3	64.8	100	368	100	11.4	2.5	1	3
	1975, Rainy	RYT	Kalasin	31.9	32	105	122	100	10.3	1	1	3.7
		Average		63.0	55.1	101	265	(100)	11.2	2.5	1.1	3.1

Note : * : PYT = Preliminary Yield Test. RYT = Regional Yield Trial

2) The Symptom of Leaf-curling on the Lines in the Late Generations

(1) Beginning

The yield trials on the breeding lines in the dry season of 1975 comprised Preliminary Yield Tests conducted of 40 lines including check varieties at The Mae Jo Agricultural Experiment Station (Chiengmai) and Chainat Rice Experiment Station (Chainat) and Regional Yield Trials conducted of 28 lines also including check varieties at The Mae Jo Agricultural Experiment Station, Chinat Rice Experiment Station and The Kalasin Agricultural Experiment Station (Kalasin). The experts from Japan as well as Thailand researchers attached importance to these trials and observed them carefully. In the course of observation, it was noted that among the materials in Preliminary Yield Tests, the line disposed at Test No. 32 or "7024.P_3.64.2.P_6.3.P_8.P_9" showed a symptom of the leaf at the top of the main stem being bent half generally, and this was noted in the field notebook as virus symptom with mark "x". Later, upon careful observation of the materials of the same tests, such symptom was noted in some of the breeding lines, although in a slight degree. Such lines were "7019.P_3.7.2.P_6.5.P_8.P_9", "7019.P_3.91.5.P_6.2.P_8.P_9", "7019.P_3.24.2.P_6.3.P_8.P_9", "7024.P_3.76.1.2(S).P_7.P_8.P_9", "7024.P_3.78.6.P_6.2.P_8.P_9" and "7024.P_3.91.2.P_6.P_7.P_8.P_9".

The symptom in the said "7024.P_3.64.2.P_6.3.P_8.P_9" was earliest in development and was observed on January 22 soon after flowering. Thereafter, the symptom advanced with leaf-curling observed on top two or three leaves. But, in the case of "7024.P_3.78.6.P_6.2.P_8.P_9", the symptom was very slight with only the tip end of the top leaf bent down in the thickening stage of the pod.

Later, all of the breeding lines were checked for such leaf-curling. As the result of such investigation at The Mae Jo Agricultural Experiment Station, it was found (i) that similar symptoms were observed on the lines in the F3 and F5 generations, (ii) that in the lines in late generations, such symptom was observed only on the lines derived from the combinations of 7019 ("Acadian" x "64-104") and 7024 ("64-104" x "SJ-2"), and (iii) that with the introduced varieties, such symptoms were observed only in part of the propagation field of "Bon-minori".

It was also found that in the experiments in the rainy season of 1974, similar symptoms were observed such as "Shrinking of upper leaves" (by Expert Hashimoto) of "7019.P_3.7.2.P_6.5.P_8" and "7019.P_3.91.5.P_6.2.P_8"

in the field for pedigree selection at The Mae Jo Agricultural Experiment Station, and of "7024.P_3.89.1.P_6.3.P_8 (7024-28" in the yield trial at The Phraphutthabat Agricultural Experiment Station (Saraburi).

Thereafter, in The Kalasin Agricultural Experiment Station and The Chainat Rice Experiment Station where yield trials in the dry season of 1975 were carried out, development of the leaf-curling symptom was reported on some of the lines stated above.

(2) Result of general observation

This leaf-curling symptom was first observed as abnormal at the time of investigation of Preliminary Yield Test on Test No. 32 or "7024.P_3.64.2.P_6.3.P_8.P_9" as stated above, and it was soon after flowering. At such time, only a slight degree of leaf-curling was recorded in the cases of the other lines. But, later in the pod thickening stage, similar symptoms were observed in a considerable number of lines and then in the other tests which were planted later successively. In the rainy season of 1975, the symptom was not observed before the flowering but it spreaded later in the stage of pod thickening. Thus, it would be appropriate to assume that the development of this symptom would occur in the later stage of growth after flowering. But, on some lines the F4 generation in the rainy season of 1975, exceptional cases showing similar leaf-curling symptoms before flowering were observed.

The leaf-curling symptom will now be described in detail. In general, abnormality is observed only on one or two leaves at the top of the main stem, and the lower leaves are normal in almost all cases. As noted as "shrinking of upper leaves" initially, the leaves have waving edges and are curved as if bent down at the point about half of the length from the tip end, and on the back of the affected leaf, the part at which the main vein is bent has changed to brown in many cases. Thus, it seems apparently that the growth of main vein has stopped due to brown coloration of it so that there is produced a difference in the rate of growth between the mesophyll l and the veins to cause bending. While the symptom is generally such as that described in the foregoing, it is copresent in many cases with the symptom of soybean mosaic virus or yellowing virus and, in the more developed stage, similar to the soybean dwarf disease in Hokkaido. The leaves showing a symptom of leaf shrinking is not generally subject to change of the color, although those showing a developed symptom similar to that of the soybean dwarf

disease in Hokkaido have the color darkened somewhat. But, so far as the lines from the combinations of 7019 ("Acadian" x "64-104") and 7024 ("64-104" x "SJ-2") are concerned, there is no appreciable change observed in the color of the leaves.

From the foregoing, it is questionable if the development of the leaf-curling symptom has actually an influence upon the productivity. A great influence may be presumed from the fact that in the case of "7024. P_3. 64. 2. P_6. 3. P_8. P_9" with a noticeable symptom in Preliminary Yield Test in the dry season, 1975, there were apparently less (or no) pods produced at the top of the main stem. But, it is also reported that upon comparison of the yield of the normal plants selected from Bon-minori planted for seed multiplication with that of abnormal (leaf-curling) plants, there was no difference observed between them.

Though such curling symptoms were also observed uently subsequently in the rainy season of 1975, but in the same line, the extent of development in the rainy season seems to be different from that in the dry season of 1975. That is, with respect to the combination 7019, the line "7019. P_3. 7. 2. P_6. 5. P_8. P_9" had a slight degree of affection generally in the dry season of 1975 but had a very great number of affected cases observed in the rainy season of the same year, and the line "7019. P_3. 99. 5. 2(S). P_7. P_8. P_9" substantially free from the leaf-curling in the 1975 dry season had a considerable extent of abnormality observed, while with respect to 7024, the line "7024. P_3. 64. 2. P_6. 3. P_8. P_9" was affected greatly in the dry season of 1975 but little in the pedigree field and slightly in the field for seed multiplication in the rainy season of the same year. It may be said that the leaf-curling develops less in rainy season than in dry season. For details, note Tables 22 and 24.

(3) Selection of lines from 7019 and 7024

i. Yield trials

The lines in late generations subjected to the yield trials in the dry season of 1975 were those from the combinations 7003, 7020, 7021, 7022, 7026, 7102, 7012, 7013, 7016, 7018, 7019 and 7024, but the lines in which the said leaf-curling symptom was seen were limited to those from the combinations 7019 ("Acadian" x "64-104") and 7024 ("64-104" x "SJ-2"). It should be noted that these

lines have "64-104" introduced from Taiwan as a common parent. In the F3 and F5 generations the breeding objectives of which had been designed mainly for resistance to rust, the said "64-104" had been often as a crossing parent, and in the breeding lines of these generations, similar symptoms were observed frequently. Thus, there will be an opinion of the cause of leaf-curling that such symptom may be taken as an abnormal development of leaves due to a hereditary factor rather than a disease. But, such a leaf-curling symptom is not seen on "64-104", and further, the occurring of leaf-curling on the breeding lines has some different aspect from that due to a hereditary factor. Anyway, at the time of the dry season of 1975, (i) it was exactly the time of reducing the breeding lines in one way or another upon the results of the yield trials, (ii) the lines from the combinations 7019 and 7024 showed a more or less resistance to rust disease and were evaluated as highly promising, but (iii) the said leaf-curling symptom was seen only on the lines derived from these two combinations. Thus, emphasis was placed on selection of lines of no or little curling symptom and of high yield through general evaluation and investigation of the leaf-curling symptom of the said lines. Table 22 shows the result of such investigation.

The selection was thus carried out according to the same table and upon the results of Preliminary Yield Tests and Regional Yield Trials. As the result, there were chosen the lines "7019.P_3.24.3.P_6.1.P_8.P_9" and "7019.P_3.24.5.P_6.5.P_8.P_9" from the combination 7019 ("Acadian" x "64-104"), the former having the leaf-curling symptom observed only in a slight degree in some of the fields and the latter having such symptom scarcely recorded. On the other hand, there were chosen from the combination 7024 ("64-104" x "SJ-2") such lines as "7024.P_3.78.6.P_6.2.P_8.P_9", "7024.P_3.89.1.P_6.3.P_8.P_9" and "7024.P_3.91.2.P_6.P_7.P_8.P_9". All of such lines had the leaf-curling symptoms recorded, and this was a matter of concern. This combination, such lines as "7024.P_3.30.3.P_6.5.P_8.P_9" and "7024.P_3.30.5.P_6.4.P_8.P_9"

Table 22. Scores of Evaluation of Growth Vigor and Leaf-curling on Breeding Lines Derived from the Crossing 7019 and 7024 (The Mae Jo Agr. Exp. in Drv Season, 1975)

Name of line	Evaluation in PYT	Evaluation in RYT	Evaluation in pedigree field	Evaluation in propagation field	Evaluation in RYT at Kalasin Agr. Exp. Sta.
7019. P_3. 7. 2. P_6. 5. P_8. P_9	Slightly curling O ~ ◎	Slightly curling O	○	Heavily curling ○	○ ~ ◎
7019. P_3. 24. 2. P_6. 3. P_8. P_9	Slightly curling	Slightly curling ○ ~ ◎	△ ~ ○	○ ~ ○	○ ~ ○
7019. P_3. 24. 3. P_6. 1. P_8. P_9	○	Slightly curling	○	○	○
7019. P_3. 24. 5. P_6. 5. P_8. P_9	○		○	○	◎
7019. P_3. 91. 5. P_6. 2. P_8. P_9	△ ~ ◎ Slightly curling △ ~ ○	○ ○ ~ ◎	○	○	◎
7019. P_3. 99. 5. 2(S). P_7. P_8. P_9	△	△ ~ ○	△	△	○
7024. P_3. 30. 3. P_6. 5. P_8. P_9	○ ~ ◎	◎	○ ~ ◎	△ ~ ○	△ ~ ◎
7024. P_3. 30. 3. P_6. 5. P_8. P_9	○ ~ ◎	◎		○	
7024. P_3. 33. 4. P_6. 1. P_8. P_9	○		△ ~ ○	Slightly curling ○	◎ —
7024. P_3. 64. 2. P_6. 3. P_8. P_9	Curling △	Curling △		Curling △ ~ ○	Curling △ ~ ◎
7024. P_3. 76. 1. 2(S). P_7. P_8. P_9	Slightly curling ◎	Curling ~ ◎	Curling ~ ◎	○ ~ ◎	◎
7024. P_3. 78. 6. P_6. 2. P_8. P_9	Curling ○ ○ ~ ◎	Curling △ ~ ○ △ ~ ○	△ ~ ○	Curling ◎	Curling △ ~ ◎
7024. P_3. 89. 1. P_6. 3. P_8. P_9	○	△		Slightly curling ○ ~ ◎	Curling △ ~ ◎ △ ~ ○
7024. P_3. 91. 2. P_6. P_7. P_8. P_9	Curling ○		△	—	—

Note : ◎ = promising ○ = medium △ = poor

Table 23. Allocation of Breeding Lines From the Crossing of 7019 and 7024 to Field Trials in the Rainy Season, 1975

	Experiment	Pedigree Number
1.	Farmer's Field Test	7019. P_3. 24. 3. P_6. 1. P_8. P_9. P_{10}
		7019. P_3. 24. 5. P_6. 1. P_8. P_9. P_{10}
2.	Regional Yield Trial	7019. P_3. 24. 3. P_6. 1. P_8. P_9. P_{10}
		7019. P_3. 24. 5. P_6. 5. P_8. P_9. P_{10}
		7024. P_3. 78. 6. P_6. 2. P_8. P_9. P_{10}
		7024. P_3. 89. 1. P_6. 3. P_8. P_9. P_{10}
		7024. P_3. 91. 2. P_6. P_7. P_8. P_9. P_{10}
3.	Preliminary Yield Test	7019. P_3. 7. 2. P_6. 5. P_8. P_9. P_{10}
		7019. P_3. 24. 2. P_6. 3. P_8. P_9. P_{10}
		7019. P_3. 99. 5. 2(S). P_7. P_8. P_9. P_{10}
		7024. P_3. 30. 3. P_6. 5. P_8. P_9. P_{10}
		7024. P_3. 30. 5. P_6. 4. P_8. P_9. P_{10}
		7024. P_3. 33. 4. P_6. 1. P_8. P_9. P_{10}
		7024. P_3. 89. 4. P_6. 3. P_8. P_9. P_{10}

from the same combination had no record of the leaf-curling symptom, but they showed low yields in the yield trials. Further, it was arranged so far as these two combinations were concerned that the selected lines would be incorporated in the yield trials and that those lines which were not selected would not be discarded but be subjected to the preliminary yield tests for further examination of the yielding ability. Allocation of the breeding lines in the rainy season of 1975 is illustrated in the following table.

ii. Pedigree selection

In the dry season of 1975, there happened to be a test field where bulk seeds were planted to permit comparison in addition to the yield trials where the lines from combinations 7019 and 7024 were planted. As the leaf-curling symptom was moderately observed in this field. it was decided to start the selection of lines again. That is, upon field selection of 30 individual plants for the line, "7019. P_3. 99. 5. 2(S). P_6. P_7. P_8. P_9" including two types apparently different in the plant type and 20 individual plants from the other lines, they were screened to 20 and 15 plants respectively at the final selection. In the field selection, the plants of no or little leaf-curling symptom were chosen, but there were some lines in which it was difficult to select the plants free of the leaf-curling symptom, These materials were subjected to the selection of lines at The Mae Jo Agricultural Experiment Station in the next rainy season. The results are shown in the following table.

For the lines from the combination 7019, it was confirmed that the lines of relatively vigorous growth were selected for the yield trials, and in these lines, no leaf-curling was observed. With respect to the lines from the combination 7024, the leaf-curling symptoms were observed in the lines of relatively vigorous growth. This was a matter of concern in the selection, and it would be a future problem that the lines chosen for testing in the yield trials were rather of short stem for the purpose of avoiding the leaf-curling symptom.

Table 24 General Evaluation and Primary Selection on the Lines from 7019 and 7024 (The Mae Jo Agr. Exp. Sta. in the Rainy Season, 1975)

Lines		Rust, leaf-curling, etc.	General evaluation	No. of harvested lines
7019. P3. 7. 2. P6. 5. P8. P9	1 - 15	Not much rust but heavy leaf-curling with little difference among the lines.	△	1
7019. P3. 24. 2. P6. 3. P8. P9	1 - 15	Little rust and no leaf-curling with difference in lodging among the lines.	◎	10
7019. P3. 24. 3. P6. 1. P8. P9	1 - 15	Segregating at the resistivity to rust with lines, no leaf-curling and varied growth among lines.	◎	10
7019. P3. 24. 5. P6. 1. P8. P9	1 - 15	Slightly greater rust than the line given immediately above, no leaf-curling, and good growth but with lodging.	◎	10
7019. P3. 91. 5. P6. 2. P8. P9	1 - 15	Slightly less rust but different with lines, and leaf-curling observed with difference among the lines.	×	0
7019. P3. 99. 5. 2(S). P7. P8. P9	1 - 15	Different in resistance to rust with lines, leaf-curling also different with lines, and plant type mixed.	○	6
7024. P3. 30. 3. P6. 5. P8. P9	1 - 15	Relatively heavy rust, good growth but with lodging, and no leaf-curling.	○	10
7024. P3. 30. 5. P6. 4. P8. P9	1 - 15	Much rust with score at 5, no leaf-curling, and not uniform no maturity among lines.	△～○	2
7024. P3. 33. 4. P6. 1. P8. P9	1 - 15	Heavy leaf-curling with difference among the lines.	◎	5
7024. P3. 64. 2. P6. 3. P8. P9	1 - 15	Rust with score at 5, and no leaf-curling.	△～○	2
7024. P3. 78. 6. P6. 2. P8. P9	1 - 15	Relatively less rust with difference among the lines, and no leaf-curling.	○	10
7024. P3. 89. 1. P6. 3. P8. P9	1 - 15	Little rust, leaf color different with lines, no leaf-curling.	○～◎	14
7024. P3. 89. 4. P6. 3. P8. P9	1 - 15	Relatively heavy rust, no leaf-curling, good growth with lodging seen partially.	◎	10
7024. P3. 76. 1. 2(S). P7. P8. P9	1 - 15	Little rust, but much leaf-curling with difference among the lines.	◎	5
7024. P3. 91. 2. P6. P7. P8. P9	1 - 15	Little rust, no leaf-curling, heavy lodging.	○	10

(4) Other responses

Selection of the lines from 7019 and 7024 discussed in the foregoing was an attempt to see if it would be possible to eliminate such leaf-curling by pedigree selection. As a general impression, if the symptom is considered as one of the virus diseases although there is a difference seen presently, its development is subject largely to the environmental conditions, and the variation among the lines may be a reflection of the difference in the minute environmental conditions. Further, when such late generation as F11

is taken into account, the selection seems to be a very difficult task. It is noteworthy that on the pregeny of the lines on which the leaf-curling symptoms were observed in the dry season of 1975, the same symptom was observed in the rainy season of the same year.

To check this, a test was carried out. It was started from the fields of "Bon-minori" to somewhere in the foregoing. As the leaf-curling symptom was seen in part of the field of "Bon-minori" for seed multiplication in the dry season of 1975, 20 abnormal (leaf-curling) plants were taken in addition to 20 normal plants. The result of the test is shown in the following table.

Table 25. A Comparison of Normal and Leaf-curling Plants from (Bon-minori)

Group	Plant height cm	No. of nodes	No. of pods	Seed yield g/plt	100 grains weight g
Leaf-curling plts.	26.4	9.0	14.7	4.5	19.6
Normal plts	26.0	8.9	15.2	3.9	18.8

From these two classes of selected individuals, 10 individuals were planted respectively in the rainy season of 1975, but no leaf-curling was observed throughout the whole lines, and all of the 20 lines showed a uniform and normal growth. This result is totally contrary to those concerning the lines from 7019 and 7024 discussed in the foregoing, and whether the leaf-curling seen in "Bon-minori" should be taken as a heterogenous one to that seen in the lines from 7019 and 7024 or be attributable to some delicate difference in the environmental condition of the fields, is a very difficult question.

Further, possibility of juice infection (assumed as a virus disease) was tested. With leaves collected from the line "7024.P_3.64.2.P_6.3.P_8.P_9" which presented the leaf-curling symptom most evidently in the seed multiplication fields in the dry season of 1975, they were homogenized to give the juice which was inoculated by the carborandum method into 20 indivicuals of SB 60 (variety assessed as highly susceptible to virus diseases; planted on December 20, 13 nodes, and pods at about 4 cm at the time of inoculation) on February 27. Thereafter, observation was continued until March 3, but the leaf-curling symptom such as seen in the line from which the juice was

taken was not observed. This test was carried out through all-out cooperation of Mrs. Monta in charge of the disease. For such tests, there were comments that inoculation of the virus disease should be made on young plants. Thus, a similarinoculation test was carried out separately from the foregoing test with "SB 60 " planted, and the carborandum method employed at the stage of 2 to 3 leaves. No leaf-curling symptom was observed.

Apart from the foregoing tests, samples were taken from the fields in the dry season of 1975, and they were forwarded to the Thai and Japanese experts for investigation. So far, there has not been obtained any evidence which supports that the leaf-curling symptom is a disease due to virus.

3) Analysis of the Seed Components of the Lines in the Late Generations

(1) Materials and procedure

In Thailand, analysis of the seed components has been carried out of the introduced varieties and the breeding lines in use of the samples from the products of yield trials. Here, the results of analysis conducted of the lines tested in Preliminary Yield Tests in and after 1974 will be discussed.

Preliminary Yield Test on the breeding lines were started in the dry season of 1973, and the breeding lines tested in the same season consisted mainly of those from 7001 ("Bon-minori" x "SJ-2"), but their yields were not so high generally. In the rainy season of the same year, Preliminary Yield Tests on the breeding lines were conducted at The Srisamrong (Sukhothai) and The Phraphutthabat (Saraburi) Agricultural Experiment Stations, but they failed to collect reliable data because of poor germination caused by a result of draught. The subsequent Preliminary Yield Tests could be said to be of higher reliability than those of the previous year, although there were some cases of the difficulty of poor germination due to draught or insufficient sprinkling.

Thus, using samples obtained from these preliminary yield tests, analysis of the seed components was carried out at the Oil Seed Laboratory, Division of Agricultural Chemistry, Department of Agriculture. In the analysis, oil contents was determined by the Soxhlet either extraction, and protein contents calculated by multiplying the total nitrogen by the Kjeldahl method by a constant 6.25, each expressed in percentage in an air dried base.

The materials for the analysis are listed in the following table.

Table 26. Materials for Chemical Analysis

Materials	Details of the Sample	No. of the Sample
M-1	Preliminary Yield Test at Mae Jo Agr. Exp. Sta. in the dry season, 1974	37
M-2-a	Preliminary Yield Test at Srisamrong Agr. Exp. Sta. in the rainy season, 1974	45
M-2-b	Preliminary Yield Test at Phraphutthabat Agr. Exp. Sta. in the rainy season, 1974	43
M-3-a	Preliminary Yield Test at Mae Jo Agr. Exp. Sta. in the dry season, 1975	40
M-3-b	Preliminary Yield Test at Chainat Rice Exp. Sta. in the dry season, 1975.	40

(2) Results of the analysis and discussion

The results of the analysis of the respective materials is shown in Table 27. As seen, the seed components vary greatly by the lines or locations and seasons of cultivation. Thus, choosing 17 varieties and lines common in the materials specified as M-1, M-2-b and M-3-b in the foregoing table which seemed to be of normal growth and of relatively high reliability of the yield data, variation of oil or protein contents of lines by locations, and seasons of cultivation was discussed. The seed components of these 17 varieties and lines are shown in Table 28.

Now taking the means of the lines, the protein contents is highest with M-1 at 40.1%, followed by M-3-a at 37.5% and M-2-b at 32.3%, while the oil contents is highest with M-2-b at 21.2%, followed by M-1 at 18.5% and M-3-a at 18.0%. According to the result of analysis of the variance for oil and protein contents, the variance among the location and season was significant for both components. M-1 and M-3-b are of the sample produced in the dry season (at The Mae Jo Agricultural Experiment Station in Chiengmai, and at the Chainat Rice Exp. Sta., and M-2-b is of the sample produced in the rainy season (late rainy season at The Phraphutthabat Agricultural Experiment Station). According to the result of analysis of the native and introduced varieties by the former expert, the soybeans in the rainy season in the central district produce higher protein and lower oil than the ones in the dry season in the northern district. But, the result given in the foregoing table was to the contrary. Therefore, for analysis of the variation of the seed components

by the planting season, a comprehensive consideration of the meteorological conditions as well as the soil condition and yield will be required.

The seed components vary with the locations and seasons, but the variation among lines is also great in view of the significant variance among the lines in the analysis of variance for values of the common 17 varieties and lines. Now referring to the foregoing table, the lines from the combination 7021 ("K.S.252" x "SJ-2") are generally high in oil contents and contain oil approximately in the order of the standard variety "SJ-2". But, the lines from 7024 ("64-104" x "SJ-2") are higher in protein contents conversely with lower contents of oil than "SJ-2". The lines from 7019 ("Acadian" x "64-104") are positioned between the foregoing two with a relatively high contents of protein and a relatively low contents of oil.

In the following will be noted the values of analysis of the principal breeding lines.

Table 27

A. The result of chemical analysis on M-1 (Dry season in 1974)

Name	Mae Jo Atr. Exp. Sta.			
	Seed Yield (kg/rai)	100 grains weight (g)	Protein content (%)	Oil content (%)
7001. P_3. 5. P_5. 3. 1. P_8	344	19.1	36.5	19.5
7001. P_3. 11. P_5. 1. 3. P_8	365	17.1	41.6	17.5
7001. P_3. 35. P_5. 4. 5. P_8	305	16.8	41.2	18.8
7001. P_3. 56. P_5. 1. 5. P_8	298	14.1	41.4	19.2
7001. P_3. 88. P_5. 3. 5. P_8	326	17.5	43.6	17.6
7013. P_3. P_4. 53. 5. P_8	360	16.8	37.5	17.4
7016. P_3. P_4. 16. 1. P_7	350	14.7	40.5	18.1
7016. P_3. P_4. 29. 1. P_7	376	16.6	41.0	17.9
7016. P_3. P_4. 49. 5. P_7	348	16.4	40.4	17.2
7016. P_3. P_4. 50. 2. P_7	277	11.9	38.5	19.0
7016. P_3. P_4. 74. 2. P_7	295	14.4	40.0	17.9
7016. P_3. P_4. 85. 3. P_7	289	20.7	40.9	19.7
7018. P_3. P_4. 65. 2. P_7	309	15.4	39.9	18.5
7019. P_3. 7. 2. P_4. P_7	215	14.2	40.4	18.9
7019. P_3. 24. 2. P_4. P_7	314	14.5	41.1	18.2
7019. P_3. 24. 3. P_4. P_7	387	13.8	41.8	18.5
7019. P_3. 24. 5. P_4. P_7	366	13.5	37.1	19.5
7020. P_3. 20. 2. P_4	365	14.3	37.7	20.0
7020. P_3. 49. 2. P_4	366	13.5	37.1	19.5
7020. P_3. 65. 1. P_4	378	16.4	38.9	22.4
7021. P_3. 15. 4. P_6	319	12.6	38.5	21.1
7021. P_3. 35. 4. P_6	319	12.4	37.8	19.6
7021. P_3. 50. 4. P_6	346	10.8	38.7	20.3
7021. P_3. 79. 3. P_6	360	12.4	37.9	17.8
7021. P_3. 84. 4. P_6	365	13.6	40.6	19.6
7021. P_3. 88. 4. P_6	323	13.8	38.4	18.8
7021. P_3. 89. 5. P_6	357	12.1	37.5	20.2
7024. P_3. 30. 3. P_6. P_7	306	12.0	40.9	17.2
7024. P_3. 30. 5. P_6. P_7	343	14.1	40.4	17.2
7024. P_3. 33. 4. P_6. P_7	327	13.4	39.1	18.2
7024. P_3. 64. 2. P_6. P_7	342	17.7	42.0	18.9
7024. P_3. 78. 6. P_6. P_7	355	14.1	42.8	17.5
7024. P_3. 89. 1. P_6. P_7	424	15.1	41.7	17.4
7024. P_3. 89. 4. P_6. P_7	322	13.6	43.0	17.2
7024. P_3. 83. P_6. 3. 5	382	13.7	40.2	17.8
SJ-1	303	11.9	39.4	17.9
SJ-2	330	11.8	36.9	19.7

B. The result of chemical analysis on M-2-a and M-2-b (Rainy season in 1974)

Name	Phraphutthabat Agr. Exp. Sta.				Srisamrong Agr. Exp. Sta.	
	Seed yield (kg/rai)	100 grains weight (g)	Protein content (%)	Oil content (%)	Protein content (%)	Oil content (%)
7003. P_3. P_4. P_5. 4. P_7	227	10.1	29.0	21.8	37.1	22.9
7003. P_3. P_4. P_5. 17. P_7	192	11.6	33.3	21.5	30.7	21.8
7003. P_3. P_4. P_5. 19. P_7	250	10.7	32.2	20.7	33.0	19.0
7020. P_3. 20. 2. 1. P_7	241	10.3	32.6	22.6	32.7	20.9
7020. P_3. 15. 4. 4. P_7	230	8.9	31.0	22.4	32.2	21.4
7020. P_3. 25. 4. 2. P_7	217	7.8	32.1	20.7	34.5	20.5
7021. P_3. 50. 4. 5. P_7	275	11.1	32.4	22.6	34.2	19.8
7021. P_3. 79. 3. 2. P_7	255	8.2	34.1	20.8	33.2	19.8
7021. P_3. 88. 4. 2. P_7	270	12.1	32.7	23.5	34.6	19.8
7021. P_3. 89. 5. 4. P_7	346	9.0	31.3	22.6	30.3	21.4
7021. P_3. 33. FP_5. 1. P_7	299	9.8	35.0	22.0	-	-
7021. P_3. 78. FP_5. 3. P_7	258	8.6	33.0	23.1	34.4	22.2
7022. P_3. 5. FP_5. 4. P_7	203	9.3	33.4	24.8	35.5	21.7
7022. P_3. 7. 4. 4. P_7	233	9.4	33.0	20.4	-	-
7026. P_3. 12. FP_5. 3. P_7	254	9.1	33.3	22.5	36.4	19.5
7102. P_3. 2. FP_5. 3. P_7	242	7.8	34.0	24.5	39.9	20.4
7016. P_3. P_4. 21. 4. 2. P_8	221	12.1	30.0	20.6	33.0	17.7
7016. P_3. P_4. 50. 2. 5. P_8	205	10.4	32.8	19.9	37.0	17.2
7016. P_3. P_4. 74. 2. 5. P_8	207	12.1	31.7	18.3	38.5	17.1
7016. P_3. P_4. 85. 3. 4. P_8	208	13.8	29.9	23.4	36.7	19.3
7016. P_3. P_4. 16. 6(S). P_7. P_8	257	13.7	33.2	19.2	36.0	17.8
7016. P_3. P_4. 28. 10(S). P_7. P_8	282	14.1	33.2	19.4	29.4	19.2
7016. P_3. P_4. 84. 7(S). P_7. P_8	247	12.7	31.7	18.6	37.2	19.4
7018. P_3. P_4. 65. 2. 5. P_8	225	11.0	31.6	17.6	33.5	20.6
7018. P_3. P_4. 81. 6(S). P_7. P_8	220	12.1	30.9	16.4	35.8	18.7
7019. P_3. 7. 2. P_6. 5. P_8	289	13.8	33.0	21.1	34.5	20.7
7019. P_3. 24. 2. P_6. 3. P_8	249	11.0	32.6	22.0	37.0	21.2
7019. P_3. 24. 5. P_6. 5. P_8	329	12.3	34.8	19.9	37.0	21.5
7019. P_3. 91. 5. P_6. 2. P_8	274	10.0	31.2	19.0	34.7	22.6
7019. P_3. 99. 5. 2(S). P_7. P_8	273	11.0	29.4	20.2	37.4	20.8
7024. P_3. 30. 3. P_6. 5. P_8	265	12.5	33.5	20.6	38.0	20.8
7024. P_3. 30. 5. P_6. 4. P_8	245	10.9	26.9	21.6	39.8	21.1
7024. P_3. 33. 4. P_6. 1. P_8	307	10.7	35.0	19.5	31.8	20.5
7024. P_3. 64. 2. P_6. 3. P_8	294	12.7	32.8	20.6	38.2	19.8
7024. P_3. 78. 6. P_6. 2. P_8	267	12.3	32.3	22.3	36.9	19.9
7024. P_3. 89. 4. P_6. 3. P_7	277	13.5	32.5	20.3	36.9	19.5
7024. P_3. 76. 1. 2(S). P_7. P_8	183	10.8	29.5	21.1	37.3	18.6
7001. P_3. 5. P_6. 3. 1. 3. P_8	213	16.5	33.7	23.1	36.4	21.1
7001. P_3. 11. P_5. 1. 3. 4. P_5	217	14.7	32.7	21.7	38.8	18.4
7001. P_3. 35. P_5. 4. 5. 4. P_5	266	13.4	34.1	21.3	34.8	19.2
7001. P_3. 4. P_5. 1. 4. 5. P_5	186	12.4	34.2	20.9	37.4	18.7
7001. P_3. 83. P_6. 3. 5. 5. P_5	234	13.2	36.1	20.6	35.9	18.6
7001. P_3. 5. P_6. 5. 9(S). P_5. P_5	201	15.8	31.7	25.0	35.3	20.4
SJ-1	198	10.2	29.5	21.5	36.0	18.3
SJ-2	248	10.1	32.2	23.5	35.1	20.7

C. The result of chemical analysis on M-3-a and M-3-b (Dry season in 1975)

Name	Mae Jo Agr. Exp. Sta.				Chainat Rice Exp. Sta.	
	Seed yield (kg/rai)	100 grains weight (g)	Protein content (%)	Oil content (%)	Protein content (%)	Oil content (%)
7003. P_3. P_4. P_5. 4. P_7. P_8	204	13.1	36.1	17.5	38.2	19.9
7020. P_3. 20. 2. 1. P_7. P_8	271	11.7	32.9	22.8	31.9	22.8
7020. P3. 49. 2. 3. P_7. P_8	267	13.7	33.7	22.1	33.2	22.4
7020. P_3. 65. 1. 5. P_7. P_8	276	15.0	38.9	18.4	36.8	19.1
7021. P_3. 50. 4. 5. P_7. P_8	228	12.9	32.7	22.0	33.2	20.5
7021. P_3. 79. 3. 2. P_7. P_8	282	13.7	37.4	21.6	33.4	21.6
7021. P_3. 84. 4. 5. P_7. P_8	258	11.9	36.4	21.6	36.3	20.0
7021. P_3. 88. 4. 2. P_7. P_8	309	13.8	36.3	19.9	36.1	20.3
7021. P_3. 89. 5. 4. P_7. P_8	188	11.3	34.0	22.5	36.4	21.8
7021. P_3. 33. FP_5. 1. P_7. P_8	313	12.3	36.1	20.4	36.6	19.5
7021. P_3. 78. FP_5. 3. P_7. P_8	263	11.2	34.8	21.5	35.8	20.5
7022. P_3. 7. 4. 4. P_7. P_8	267	12.7	33.6	21.0	33.6	20.8
7026. P_3. 12. FP_5. 3. P_7. P_8	214	10.9	34.4	19.9	39.8	19.5
7102. P_3. 2. FP_5. 3. P_7. P_8	216	11.1	37.6	21.4	39.4	19.9
7012. 200. 50. 3. 6(S). P_7. P_8. P_9	315	20.5	33.5	20.1	37.5	21.2
7013. P_3. P_4. 53. 5. 2. P_8. P_9	279	17.2	36.4	17.5	34.9	20.1
7016. P_3. P_4. 21. 4. 2. P_8. P_9	237	13.8	36.3	16.5	35.7	17.9
7016. P_3. P_4. 29. 1. 5. P_8. P_9	222	16.8	42.9	15.4	39.0	17.4
7016. P_3. P_4. 16. 6(S). P_7. P_8. P_9	265	14.5	38.2	16.3	37.9	20.4
7016. P_3. P_4. 28. 10(S). P_7. P_8. P_9	261	17.7	40.4	13.9	39.0	17.7
7016. P_3. P_4. 84. 7(S). P_7. P_8. P_9	249	14.8	38.5	16.4	38.6	17.0
7018. P_3. P_4. 65. 2. 5. P_8. P_9	209	13.9	37.9	14.7	39.2	17.6
7019. P_3. 7. 2. P_6. 5. P_8. P_9	284	15.7	36.3	17.9	41.3	18.8
7019. P_3. 24. 2. P_6. 3. P_8. P_9	258	14.4	39.7	16.8	41.0	17.9
7019. P_3. 24. 3. P_6. 1. P_8. P_9	271	13.9	40.5	16.7	42.1	17.8
7019. P_3. 24. 5. P_6. 5. P_8. P_9	215	13.8	39.1	15.0	41.9	17.8
7019. P_3. 91. 5. P_6. 2. P_8. P_9	223	15.2	39.1	17.4	39.0	19.3
7019. P_3. 99. 5. 2(S). P_7. P_8. P_9	268	14.8	39.4	14.6	40.1	18.6
7024. P_3. 30. 3. P_6. 5. P_8. P_9	187	13.4	40.8	16.2	37.4	18.4
7024. P_3. 30. 5. P_6. 4. P_8. P_9	205	13.0	36.9	16.6	37.5	20.5
7024. P_3. 33. 4. P_6. 1. P_8. P_9	241	14.5	40.3	16.5	39.8	18.0
7024. P_3. 64. 2. P_6. 3. P_8. P_9	198	16.4	38.6	16.3	39.6	18.5
7024. P_3. 78. 6. P_6. 3. P_8. P_9	275	13.7	39.8	17.0	39.1	18.8
7024. P_3. 89. 1. P_6. 3. P_8. P_9	248	15.3	39.8	15.9	42.3	18.0
7024. P_3. 89. 4. P_6. 3. P_8. P_9	252	18.1	38.7	17.0	39.1	18.6
7024. P3. 76. 1. 2(S). P_7. P_8. P_9	228	13.8	38.4	17.3	39.7	18.9
7024. P_3. 91. 2. P_6. P_7. P_8. P_9	289	18.2	39.3	17.1	40.5	18.4
7001. P_3. 35. P_5. 4. 5. 4. P_8. P_{10}	250	17.7	37.7	15.7	40.0	18.9
SJ-1	197	10.3	35.6	16.1	38.6	17.4
SJ-2	239	12.7	35.0	19.9	38.4	20.7

Table 28. Protein and Oil Contents of Selected Lines (Commonly analyzed lines)

Name	Protein content (%)				Oil content (%)			
	M-1	M-2-b	M-3-a	Average	M-1	M-2-b	M-3-a	Average
7021. P3. 84. 4. 5. P7. P8	40.6	32.2	36.4	36.4	19.6	20.7	21.6	20.6
7021. P3. 50. 4. 5. P7. P8	38.7	32.4	32.7	34.6	20.3	22.6	22.0	21.6
7021. P3. 79. 3. 2. P7. P8	27.9	34.1	37.4	36.5	17.8	20.8	21.6	20.1
7021. P3. 88. 4. 2. P7. P8	38.4	32.7	36.3	35.8	18.8	23.5	19.9	20.7
7021. P3. 89. 5. 4. P7. P8	37.5	31.3	34.0	34.3	20.2	22.6	22.5	21.8
7018. P3. P4. 65. 2. 5. P6. P9	40.4	31.6	27.9	36.6	18.9	17.5	14.7	17.0
7019. P3. 7. 2. P6. 5. P8. P9	40.4	33.0	36.3	36.6	18.9	21.1	17.9	19.3
7019. P3. 24. 2. P6. 3. P8. P9	41.1	32.6	39.7	37.8	18.2	22.0	16.8	19.0
7019. P3. 24. 5. P6. 5. P8. P9	41.7	34.8	39.1	38.5	17.6	19.9	15.0	17.5
7024. P3. 30. 3. P6. 5. P8. P9	40.9	33.5	40.8	38.4	17.2	20.6	16.2	18.0
7024. P3. 30. 5. P6. 4. P8. P9	40.4	26.9	36.9	34.7	17.2	21.6	16.6	18.5
7024. P3. 33. 4. P6. 1. P8. P9	39.1	35.0	40.3	38.1	18.2	19.5	16.5	18.1
7024. P3. 64. 2. P6. 3. P8. P9	42.0	32.8	38.6	37.8	18.9	20.6	16.3	18.6
7024. P3. 78. 6. P6. 2. P8. P9	42.8	32.3	39.8	38.3	17.5	22.3	17.0	18.9
7024. P3. 89. 4. P6. 3. P8. P9	43.0	32.5	39.8	38.4	17.2	20.3	15.9	17.8
SJ-1	39.4	29.5	35.8	34.9	12.9	21.5	16.1	18.5
SJ-2	36.9	32.2	35.0	34.7	19.7	23.5	19.9	21.0
Average	40.1	32.3	37.5	36.6	18.5	21.2	18.0	19.2

Table 29. Summary of Chemical Analysis on Breeding Lines

Name	Parents	Generation	Protein content (%)						Oil content (%)					
			M-1	M-2-a	M-2-b	M-3-a	M-3-b	Average	M-1	M-2-a	M-2-b	M-3-a	M-3-b	Average
7018. P4. 40. 8. 5. P7. P8	SJ-2 x K. 8. 252	F4	37.1	(33.6)	-	33.3	33.8	35.0	19.5	(19.5)	-	22.6	22.6	20.9
7018. P3. 65. 8. 5. P6		F4	38.9	(35.6)	-	38.8	36.8	37.5	22.4	(17.9)	-	18.4	19.9	19.5
7021. P3. 79. 3. 5. P7	K. 8. 252 x SJ-2	F4	37.9	34.1	33.2	37.6	33.4	35.2	19.8	20.8	19.8	21.6	21.6	20.5
7021. P3. 88. 4. 2. P7		F4	38.4	32.7	36.6	36.3	36.1	35.6	18.8	23.5	19.8	19.9	20.5	20.5
7021. P3. 33. 725. 3. P7. P8		F4	-	35.0	-	36.1	36.6	35.9	-	22.0	-	20.4	19.5	20.6
7018. P3. P4. 70. 10. 5. P7. P8. P9	K-27 x 7001-F1)*	F4	-	33.2	39.6	40.8	39.0	38.0	-	18.0	19.2	13.8	17.2	17.6
7018. P3. P4. 8. P6. 5. P8. P9	Acc.No.x 64-104	F4	41.0	(33.5)	-	40.5	42.1	39.5	19.5	(22.2)	-	17.6	17.0	18.1
7018. P3. P4. 8. P6. 8. P8. P9		F4	37.1	34.8	39.0	39.3	41.9	38.4	19.5	19.0	21.5	13.0	17.0	18.2
7018. P3. 55. 4. P6. 3. P8. P9	64-104 x SJ-2	F3	39.1	35.8	36.8	40.3	39.8	38.2	18.4	19.5	20.5	24.5	18.0	20.5
7024. P3. 78. 8. P6. 2. P8. P9		F3	42.8	32.2	38.9	39.8	39.1	38.2	17.5	22.3	19.9	19.0	18.0	19.1
7024. P3. 91. 8. P6. P7. P8. P9		F4	-	-	-	39.3	40.5	39.9	-	-	-	17.4	18.4	17.9
SJ-1			39.4	29.5	35.8	35.8	36.6	35.8	12.9	21.5	16.1	16.1	17.6	16.8
SJ-2			36.9	32.2	35.1	35.0	36.6	35.5	19.7	23.5	20.2	19.4	20.7	20.9

Note : 1. * 7001 = Sun mineral x SJ-2)

2 In the parenthesis, the data of Hybrid & Introduced Variety Test at Phraphutthabat Agr. Exp. Sta.

Table 30. Analysis of Variance for Oil Contents

Source	D. F.	S. S.	M. S.	F-value
Total	50	265.062		
Location & season	2	100.918	50.459	26.998 **
Lines	16	104.335	6.520	3.488 **
Error	32	59.809	1.869	

Table 31 Analysis of Variance for Protein Contents

Source	D. F.	S. S.	M. S.	F-value
Total	50	725.947		
Location & season	2	529.046	264.523	205.694**
Lines	16	155.754	9.735	7.570**
Error	32	41.147	1.286	

Table 32. Corelation Coefficients Between Seed Components and Selected Characteristic

Materials	No. of sample		Protein content	Yield	100 grains weight	Growing period
M-1	37	Oil content	-0.508**	0.024	-0.083	-0.387
		Protein content		-0.256	0.304	0.289
M-2-b	45	Oil content	0.016	-0.121	-0.109	0.192
		Protein content		0.294*	0.026	0.424**
M-3-a	40	Oil content	-0.760**	0.233	-0.459**	-0.213
		Protein content		-0.118	0.388*	0.402**

Note : * ; significant at 5% level
** ; significant at 1% level

Next, using the materials M-1, M-2-b and M-3-a, the correlation coefficients between protein and oil contents and between these components and seed yield, 100 grains weight and growing period were calculated. The correlation coefficients calculated with M-1 and M-3-a were of the same sign and of similar value between any of the characters, and the significant correlation coefficients were observed between oil contents and protein contents or growing period in M-1, and between oil contents and

protein contents or 100 grains weight or between protein contents and 100 grains weight or growing period in M-3-a. On the other hand, what was significant among the correlation coefficients calculated with M-2-b were those of protein contents, with seed yield and growing period. It should be noted that the correlation coefficient between protein and oil contents is of a somewhat low value. In general, it was found that these two components were negatively correlated and were related to the growing period.

4) Process of Breeding of the Lines in the Late Generations

While in Thailand on the term of duty, the author checked, togther with the Thai researchers, the processes of breeding of several lines which were assumed to be highly promising, and found that some of the pedigree numbers used so far were not representing the process of selection properly. As the result, the author asked the succeeding expert to change the pedigree numbers (at an appropriate time after planting of the experiments in the dry season).

Here, the process of selection which the author et al. have examined of the progeny from the combinations 7019 ("Acadian" x "64-104"), 7020 ("SJ-2" x "K.S.252"), 7021 ("K.S.252" x "SJ-2") and 7024 ("64-104" x "SJ-2") will be discussed.

(i) Representation of the breeding processes

In Table 33 are listed the processes of breeding of the progeny from the foregoing four combinations. From the list, the following will be noted.

i) For advancement of the generation, the planting of materials has been conducted steadily at a rate of twice a year. This is related to the breeding objectives being designed for the rainy as well as dry season type from the beginning with the intensity of selection apportioned to the respective seasons such that, for example, for the lines from the combinations designed for the dry season type, the selection intensity in the rainy season is reduced, with the result that the selection is not so far advanced as the generation is.

ii) Handling of the F5 generation and after is very complicated. This is due to the fact that the pedigree selection

in the rainy season was carried out at two different fields, viz. The Mae Jo Agricultural Experiment Station (Chiengmai) and The Srisamrong Agricultural Experiment Station (Sukhothai) in and after 1973, with the seeds of a breeding line divided equally or the test individuals of a line apportioned to the experiment Stations, each 5 individuals, and further with the results at these experiment stations examined not integrally but independently in carrying out the selection. It should also be taken into considration that with advanced generations, many lines are tested in Preliminary Yield Tests and Regional Yield Trials and are evaluated at The Srisamrong and several other agricultural experiment stations.

The process of breeding seen in the foregoing list will now be described with reference to the progeny from 7019 ("Acadian" x "64-104").

The parents used for this combination are the "Acadian" having long stem and indeterminate growth with medium maturity introduced from America and the rust resistant, moderate in the stem length and medium maturing "64-104" introduced from Taiwan. With artificial crossing made on 21 flowers at The Mae Jo Agricultural Experiment Station on November 27, 1970, there was obtained seeds of 4 pod. The seeds were planted at the same experiment station on January 28, 1971, and there was obtained 1908 seeds from 6 plants of F_1 generation. Identification of the F_1 plants (determination whether they were the crossing plants or selfing) was made by observing their plant type. In the rainy season of the same year, about 1000 plants of F_2 population were grown at The Mae Jo Agricultural Experiment Station.

Table 33. Pedigree Selection Conducted on the Promising Combinations

A. Crossing No. 7019 Parents : Acadian x 64-104

Year		Generation	Season	Location	Date of planting	Planted			Selected			Note
A.D.	B.E.					Fam.	Lines	Plts/line	Fam.	Lines	Plts.	
1970	2513	Crossing	Dry	Mae Jo	(Nov. 27)			21 flws		4 pods	7 seeds	( ) : Date of crossing
1971	2514	F_1	Dry	Mae Jo	Jan. 28			7 seeds		6 plts.	1,908 seeds	Plant type
		F_1	Rainy	Mae Jo	June 18			1000			208	
1972	2515	F_3	Dry	Mae Jo	Jan. 31		208	40		110	mass	
		F_4	Rainy	Mae Jo	July 14		110	40		27	135	Planted F2 derived lines
1973	2516	F_5	Dry	Mae Jo	Jan. 20	27	135	40	17	36	Best 3 plts mixed	
											72	
		F_4	Rainy	Mae Jo			36			5	23	Planted F4 derived line in 3 rep.
				Srisamrong	June 12	36	72	40	10	10	mass	
1974	2517	F_7	Dry	Mae Jo	Dec. 4	5	23	40	5	5	50	
					Dec. 6		10	40		1	10	Planted F5 derived lines
		F_6	Rainy	Mae Jo	June 25	6	30	40	6	mass	mass	
				Srisamrong	May 17	6	30	40	6	mass	mass	
1975	2518	F_8	Dry	Mae Jo	Dec. 12		6	250		6	95	
		F_{10}	Rainy	Mae Jo	July 4	6	95	40	3	11	55	

B. Crossing No. 7020 Parents SJ-2 x K.S.252

Year		Generation	Season	Location	Date of planting	Planted			Selected			Note
A.D.	B.E					Fam.	Lines	Plts/line	Fam.	Lines	Plts.	
1970	2513	Crossing	Dry	Mae Jo	(Dec. 4-5) (Dec. 16)			80 flws		22 pods	43 seeds	( ) : Date of crossing
1971	2514	F1	Dry	Mae Jo	Feb. 25			43 seeds		17 plts	5,661 seeds	Seadcoat color
				Rainy								
1972	2525	F2	Dry	Mae Jo	Jan. 28			1,780			mass	
		F3	Rainy	Mae Jo	July 21			6,400			133	
1973	2526	F4	Dry	Mae Jo	Jan. 20		133	40		7	35	
		F5	Rainy	Mae Jo	July 5	4	20	40	3	3	15	
				Srisamrong	June 8	3	15	40	1	1	mass	
1974	2527	F6	Dry	Mae Jo	Dec. 4	3	15	40	3	3	30	
							1	40				Planted F4 derived line
		F7	Rainy	Mae Jo	June 25	3	15	40	2	2	10	
							(1)			(1)		( ) : Included in Yield Trial
				Srisamrong	May 17	3	15	40				
1975	2528	F8	Dry	Mae Jo	Dec. 12	2	10	40	2	2	20	
							(1)			(1)		( ) : Included in Yield Trial
		F9	Rainy	Mae Jo	July 4	2	10	40				
							1	1,200		1	15	
				Srisamrong	May 12	2	10	40	2	4	20	

Crossing No. 7021 Parents K.S.252 x SJ-2 x SJ-2

Year		Genera-tion	Season	Location	Date of planting	Planted			Selected			Note
A.D.	B.E					Fam.	Lines	Plts/ line	Fam.	Lines	Plts.	
1970	2513	Crossing	Dry	Mae Jo	(Nov. 27)			30 flws		9 pods	13 seeds	( ) : Date of crossing
1971	2514	F_1	Dry	Mae Jo	Feb. 25			13 seeds		11 plts	4,058 seeds	Plant type
			Rainy									
1972	2515	F_2	Dry	Mae Jo	Jan. 28			1,580			mass	
		F_3	Rainy	Mae Jo	July 21			6,400			109	
		F_4	Dry	Mae Jo	Jan. 20		109	40		22	165	
		F_5	Rainy	Mae Jo	July 5	17	85	40	10	10	50	
				Srisamrong	June 8	16	80	40	11	11	mass	
1974	2517	F_6	Dry	Mae Jo	Dec. 4	10	50	40	9	9	90	
							11	40				Planted F4 derived lines
		F_7	Rainy	Mae Jo	June 25	9	45	40	3	3	15	
				Srisamrong	May 17	9	45	40	4	4	20	
1975	2518	F_8	Dry	Mae Jo	Dec. 12	7	35	40	7	7	70	
		F_9	Rainy	Mae Jo	July 4	7	35	40				
				Srisamrong	May 12	7	35	40	3	6	30	

D. Crossing No. 7024 Parents 64-104 x SJ-2

Year A.D.	Year B.E.	Generation	Season	Location	Date of planting	Planted Fam.	Planted Lines	Planted Plts/line	Selected Fam.	Selected Lines	Selected Plts.	Note
1970	2513	Crossing	Dry	Mae Jo	(Nov. 25 & 1971 Jan. 2)			49 flws.		8 pods	12 seeds	( ) : Date of crossing
1971	2514	F_1	Dry	Mae Jo	Feb. 25			12		10 plts	3,416 seeds	Plant type
		F_2	Rainy	Mae Jo	June 18			1,700			314	
1972	2515	F_3	Dry	Mae Jo	Feb. 2		314	40		82	mass	
		F_4	Rainy	Mae Jo	July 14		82	40		20	78	Planted F_2 derived lines
1973	2516	F_5	Dry	Mae Jo	Jan. 20	20	78	40	11	23	Best 3 plts mixed 46	
		F_6	Rainy	Mae Jo	July 7		23			7	35	Planted F_4 derived lines in 3 rep.
				Srisamrong	June 12	23	46	40	2	2	mass	
1974	2517	F_7	Dry	Mae Jo	Dec. 4	7	35	40	7	7	70	
					Dec. 6		2	40		1	10	Planted F_5 derived lines
							(1)			(1)		( ) : Included in Yield Trial
		F_8	Rainy	Mae Jo	June 25	8	40	40	8	mass	mass	
							(1)			(1)		( ) : Included in Yield Trial
				Srisamrong	May 17	8	40	40	8	mass	mass	
1975	2518	F_9	Dry	Mae Jo	Dec. 12		9	250		9	135	
		F_{10}	Rainy	Mae Jo	July 4	9	135	40	6	23	115	

Table 34. The List of Pedigree Numbers of Breeding Lines

	The Former	The New
1.	7019. P3. 24. 2. P6. 3. P8. P9. P10. P11	7019. P2. 49. P4. 2. P6. 3. FP8. P9. 7. P11
2.	7019. P3. 24. 3. P6. 1. P8. P9. P10. P11	7019. P2. 49. P4. 3. P6. 1. FP8. P9. 4. P11
3.	7019. P3. 24. 5. P6. 5. P8. P9. P10. P11	7019. P2. 49. P4. 5. P6. 5. FP8. P9. 12. P11
4.	7020. P2. P3. 20. 2. 1. 3. 1. 1(S). P10	
5.	7020. P2. P3. 49. 2. 3. P7. P8. P9. P10	
6.	7020. P2. P3. 65. 1. 5. 1. 3. 2(S). P10	
7.	7021. P2. P3. 78. FP5. 3. 4(S). 4. 2(S). P10	
8.	7021. P2. P3. 79. 3. 2. 1. 5. 1(S). P10	
9.	7021. P2. P3. 88. 4. 2. 1. 4. 4(S). P10	
10.	7024. P3. 30. 3. P6. 5. P8. P9. P10. P11	7024. P2. 86. P4. 3. P6. 5. FP8. P9. 2. P11
11.	7024. P3. 78. 6. P6. 2. P8. P9. P10. P11	7024. P2. 286. P4. 6. P6. 2. FP8. P9. 9. P11
12.	7024. P3. 89. 4. P6. 3. P8. P9. P10. P11	7024. P2. 310. P4. 4. P6. 3. FP8. P9. 14. P11
13.	7024. P3. 91. 2. P6. P7. P8. P9. P10. P11	7024. P2. 286. P4. 2(S). P6. P7. P8. P9. 14. P11

In the same rainy season, there were heavy occurrence of rust disease at the latter stage of growth. Thus, from mainly the rust registant plants, 208 plants were selected. In the dry season of the next year, the seeds from these selected plants were planted as F_3 lines, each on one row, in The Mae Jo Agricultural Experiment Station. As the offspring from this combination were considered to be rust resistant and of rainy season type, severe selection was not conducted, but 110 lines were harvested as mass respectively. In the rainy season of the same year, F_4 110 lines derived from F_2 were planted at The Mae Jo Agricultural Experiment Station for selection with respect to the general characters and, particularly, rust resistancy. As the result, 27 lines and 135 individuals were selected. In the dry season of the next year, 1973, these selected lines were planted as F_5 27 families, 135 lines, each family comprising of 5 lines, at The Mae Jo Agricultural Experiment Station, and 36 lines were selected out of 17 families. Each line had about 10 plants harvested out of the whole plants, and each plant was threshed individually. In the rainy season of the same year, pedigree selection of F_6 was carried out at two places or The Mae Jo and Srisamrong Agricultural Experiment Stations. At the former station, 3 individual of high yields were taken out of about

10 plants for each line, and thus 36 derived lines of F_4 were planted for tests of 3 replications. At the latter station, additional 2 plants were selected out of the same 10 plants, and thus 36 families, 72 lines, each family comprising of 2 lines, were planted.

Thereafter, selection of these lines was carried out independently. From the test at The Mae Jo Agricultural Experiment Station, 5 lines, 23 plants were selected. In the test at The Srisamrong Agricultural Experiment Station, no individual plant selection was made because of the lack of uniformity in the growth, but 10 families, 10 lines (1 line from each family) were harvested and threshed as a mass respectively. In the next 1974 dry season, there were planted at The Mae Jo Agricultural Experiment Station 5 families, 23 lines selected at The Mae Jo Experiment Station in the preceding season and 10 F_5 derived lines selected at The Srisamrong Experiment Station. In the 1974 dry season, highly promising 4 lines among the breeding lines were tested in Preliminary Yield Tests, and in the rainy season of the same year, all of the selected 6 lines were tested in the yield trials, so that it was arranged that the selection would be carried out upon results of these trials. That is for the F_8 generation in the rainy season of 1974, the 6 lines, 60 individuals selected at The Mae Jo Agricultural Experiment Station in the preceding season were taken as the lines to be tested, and the individuals in each line were divided into groups of 5 individuals, and thus 6 families, 30 lines were planted at The Mae Jo and Srisamrong Agricultural Experiment Stations respectively, and each family was harvested and threshed as a mass. In the dry season of 1975, these lines were subjected to the yield trials, but there were lines of relatively uneven growth or having leaf-curling symptoms observed. Thus, from the fields on which the seeds of the family mass were planted, 15 individuals were selected for each line, and thus in the rainy season of the same year, 6 families, 95 lines of the F_{10} generation were planted at The Mae Jo Agricultural Experiment Station.

The foregoing is the process of breeding on the progeny from 7019 ("Acadian" x "SJ-2") up to the rainy season of 1975. The progeny from the other three combinations were handled similarly so that their processes of breeding could be read from the list.

(2) Pedigree number

In pedigree selection, it is customary to assign a pedigree number to the respective lines for discrimination of the lines from one another. This pedigree number is different from the test number or number of test plots. It should be comprised of crossing number, signs and numerals so that the process of selection could be surmised to some extent. In Thailand, breeding names (such as, for example, Tokei number and then Toiku number at the Soybean Breeding Sec. of Tokachi Agricultural Experiment Station, Hokkaido) is not assigned, but such pedigree number is often used for discrimination of the breeding lines. But, with advancement of the generation, the pedigree number becomes long in its spelling and thus involves various inconveniences.

In reviewing the pedigree numbers used conventionally, the following two points were the subjects of discussion. The first is: When was the start of individual plant selection of the respective progeny from the combination 7019 ("Acadian" x "64-104") and 7024 ("64-104" x "SJ-2"). By reading the conventional pedigree numbers, it would be the time of individual plant selection at the F_3 population. Actually, however, the F_2 population was planted at The Mae Jo Agricultural Experiment Station in the rainy season of 1971, and as the heavy occurrence of the rust disease was observed in the later stage of growth, selection was conducted mainly of the rust resistant plants. Further, these two populations were evaluated as "promising" as they included rust resistant plants. The second is: The selection was carried out with assumption of the season to which the breeding line was adaptable so that with the material assumed as dry season type, derived lines were often used in the succeeding generation, with only gentle of line selection made in the rainy season and no individual plant selection made. Then how does one incorporate the cases in use of such derived lines in the pedigree number. The author used the expression "P" attached to the pedigree number up to the preceding season to indicate the population from the selected line.

The other signs used in the pedigree numbers are "FP" and "S", the former indicating that the family was harvested and threshed as a mass and the latter indicating selection from the lines grown in The Srisamrong Agricultural Experiment Station.

In Table 34 are shown the new pedigree numbers against the conventional ones, and in Figure 3 are illustrated the processes of breeding of the principal lines among them.

Fig. 3. Figure of the Pedigree Selection on the Promising Lines

A. 7019.P3.24.2.P8.3.P8.P9.P10

Crossing Dry season 1970	F1 Dry season 1971	F2 Rainy season 1971	F3 Dry season 1972	F4 Rainy season 1972	F5 Dry season 1973	F6 Rainy season 1973	F7 Dry season 1974	F8 Rainy season 1974	F9 Dry season 1975	F10 Rainy season 1975
7019 (Acadian x 64-104)	7 plts.	1000 plts.	1 / 49 / 208		1 / 2 / 5		1 / 3 / 5	1 / 1 / 5		1 / 7 / 15
Crossing 21 flws.	6 plts.									
Harvested 4 pods	1,908 seeds	208 plts.								

B. 7019.P3.24.3.P8.1.P8.P9.P10

Crossing Dry season 1970	F1 Dry season 1971	F2 Rainy season 1971	F3 Dry season 1972	F4 Rainy season 1972	F5 Dry season 1973	F6 Rainy season 1973	F7 Dry season 1974	F8 Rainy season 1974	F9 Dry season 1975	F10 Rainy season 1975
7019 (Acadian x 64-104)	7 plts.	1000 plts	1 / 49 / 208		1 / 3 / 5		1 / 1 / 5	1 / 1 / 5		1 / 4 / 15
Crossing 21 flws.	6 plts.	208 plts.								
Harvested 4 pods	1,908 seeds									

C. 7019.P3.24.5.P8.5.P8.P9.P10

Crossing Dry season 1970	F1 Dry season 1971	F2 Rainy season 1971	F3 Dry season 1972	F4 Rainy season 1972	F5 Dry season 1973	F6 Rainy season 1973	F7 Dry season 1974	F8 Rainy season 1974	F9 Dry season 1975	F10 Rainy season 1975
7019 (Acadian x 64-104)	7 plts	1000 plts	1 / 49 / 208	1	1 / 5		1	1 / 1 / 5		1 / 12 / 15
Crossing 21 flws.	6 plts	208 plts.								
Harvested 4 pods	1,908 seeds									

D. 7020.P3.20.2.1.3.1.1(S)

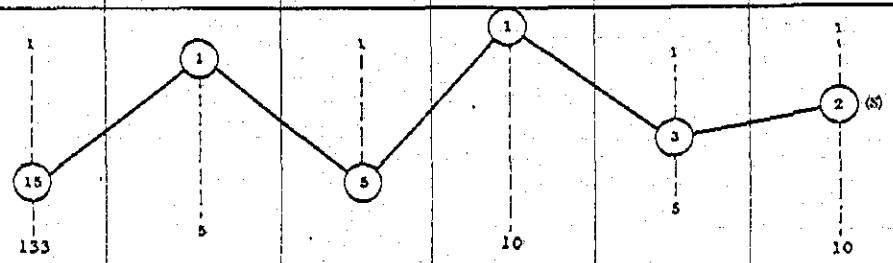
Crossing Dry season 1970	F_1 Dry season 1971	F_2 Dry season 1972	F_3 Rainy season 1972	F_4 Dry season 1973	F_5 Rainy season 1973	F_6 Dry season 1974	F_7 Rainy season 1974	F_8 Dry season 1975	F_9 Rainy season 1975
7020 (SJ-2 x K.S. 252)	43 plts.	1780 plts.	6400 plts.	1 / 20 / 133	1 / 2 / 5	1 / 1 / 5	1 / 3 / 10	1 / 1 / 5	1 / 1 (S) / 10
Crossing 80 flws.	17 plts.	mass	133 plts.						
Harvested 22 pods	5,661 seeds								

E. 7020.P3.49.2.3.F7.P8.P9

Crossing Dry season 1970	F_1 Dry season 1971	F_2 Dry season 1972	F_3 Rainy season 1972	F_4 Dry season 1973	F_5 Rainy season 1973	F_6 Dry season 1974	F_7 Rainy season 1974	F_8 Dry season 1975	F_9 Rainy season 1975
7020 (SJ-2 x K.S. 252)	43 plts.	1780 plts.	6400 plts.	1 / 49 / 133	1 / 2 / 5	1 / 3 / 5			
Crossing 80 flws.	17 plts.	mass	133 plts.						
Harvested 22 pods	5,661 seeds								

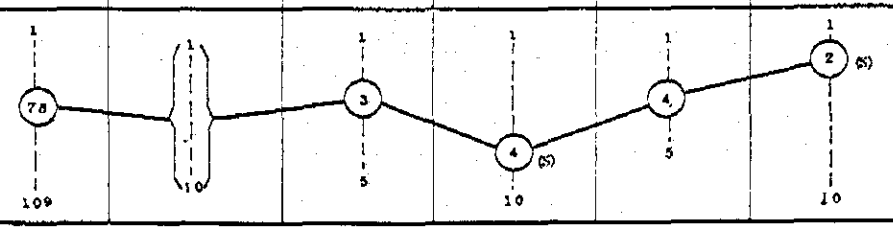
F. 7020.P3.65.1.5.1.3.2(S)

Crossing Dry season 1970	F1 Dry season 1971	F2 Dry season 1972	F3 Rainy season 1972	F4 Dry season 1973	F5 Rainy season 1973	F6 Dry season 1974	F7 Rainy season 1974	F8 Dry season 1975	F9 Rainy season 1975
7020 (SJ-2 x K.S. 252)	43 plts.	1780 plts.	6400 plts.						
Crossing 80 flws	17 plts.	mass	133 plts.						
Harvested 22 pods	5,661 seeds								



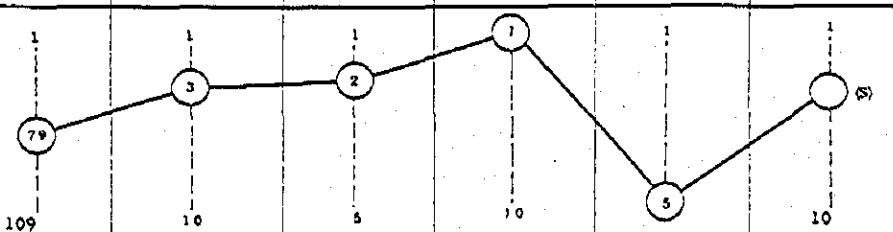
C. 7021.P3.78.FPs.3.4(S).4.2(S)

Crossing Dry season 1970	F1 Dry season 1971	F2 Dry season 1972	F3 Rainy season 1972	F4 Dry season 1973	F5 Rainy season 1973	F6 Dry season 1974	F7 Rainy season 1974	F8 Dry season 1975	F9 Rainy season 1975
7021 (K.S. 252 x SJ-2)	13 plts.	1,580 plts.	6,400 plts						
Crossing 30 flws.	11 plts.	mass	109 plts.						
Harvested 9 pods	4,058 seeds								



H. 7021.P3.79.3.2.1.5.1(S)

Crossing Dry season 1970	F1 Dry season 1971	F2 Dry season 1972	F3 Rainy season 1972	F4 Dry season 1973	F5 Rainy season 1973	F6 Dry season 1974	F7 Rainy season 1974	F8 Dry season 1975	F9 Rainy season 1975
7021 (K.S. 252 x SJ-2)	13 plts.	1,580 plts.	6,400 plts.						
Crossing 30 flws.	11 plts.	mass	109 plts.						
Harvested 9 pods	4,058 seeds								



I. 7021.P3.88.4.2.1.4.4(S)

Crossing Dry season 1970	F1 Dry season 1971	F2 Dry season 1972	F3 Rainy season 1972	F4 Dry season 1973	F5 Rainy season 1973	F6 Dry season 1974	F7 Rainy season 1974	F8 Dry season 1975	F9 Rainy season 1975
7021.(K.S. 252 x SJ-2)	13 plts.	1,580 plts.	6,400 plts.						
Crossing 30 flws.	11 plts.		109 plts.						
Harvested 9 pods	4,052 seeds	mass							

J. 7024.P3.30.3.P6.5.P8.P10

Crossing Dry season 1970	F1 Dry season 1971	F2 Rainy season 1971	F3 Dry season 1972	F4 Rainy season 1972	F5 Dry season 1973	F6 Rainy season 1973	F7 Dry season 1974	F8 Rainy season 1974	F9 Dry season 1975	F10 Rainy season 1975
7024 (64-104 x SJ-2)	12 plts.	1,700 plts.								
Crossing 49 flws.	10 plts.	314 plts.								
Harvested 8 pods	3,416 seeds									

K. 7024.P3.78.6.P6.2.P8.P10

Crossing Dry season 1970	F1 Dry season 1971	F2 Rainy season 1971	F3 Dry season 1972	F4 Rainy season 1972	F5 Dry season 1973	F6 Rainy season 1973	F7 Dry season 1974	F8 Rainy season 1974	F9 Dry season 1975	F10 Rainy season 1975
7024 (64-104 x SJ-2)	12 plts.	1,700 plts								
Crossing 49 flws.	10 plts.	314 plts.								
Harvested 8 pods	3,416 seeds									

L. 7024. P3. 89. 4. P6. 3. P8. P9. P10

Crossing Dry season 1970	F1 Dry season 1971	F2 Rainy season 1971	F3 Dry season 1972	F4 Rainy season 1972	F5 Dry season 1973	F6 Rainy season 1973	F7 Dry season 1974	F8 Rainy season 1974	F9 Dry season 1975	F10 Rainy season 1975
7024 (64-104 x SJ-2) Crossing 49 flws. Harvested 8 pods	12 plts. 10 plts. 3,416 seeds	1,700 plts. 314 plts.	1 310 314		1 4 5		1 3 5	1 5		1 14 15

M. 7024. P3. 91, 2. P8. P7. P8. P9. P10

Crossing Dry season 1970	F1 Dry season 1971	F2 Rainy season 1971	F3 Dry season 1972	F4 Rainy season 1972	F5 Dry season 1974	F6 Rainy season 1974	F7 Dry season 1975	F8 Rainy season 1975	F9 Dry season 1976	Rainy season 1976
7024 (64-104 x SJ-2) Crossing 49 flws. Harvested 8 pods	12 plts. 10 plts. 3,416 seeds	1,700 plts. 314 plts.	1 286 314		1 7					14

4. My Impressions on the Soybean Breeding in Thailand

The following paper titled "My Impressions on the Soybean Breeding in Thailand" is a report which the author presented to Dr. Arwooth Na-Lampang, leader of the Oil Crops Project of Thailand and through him to Mr. Tomya Boonyakeku, Director of the Upland Crops Division, Department of Agriculture, at the occasion of departure from Thailand back to Japan. During my term of duty in Thailand, I had two occasions to receive advice, one in 1975 from March 19 to April 4 when the survey and guidance team headed by Dr. Shiro Okabe, the National Institute of Agricultural sciences, Ministry of Agriculture, visited Thailand, and instructed us on the way of carrying out the soybean breeding experiments, from a higher level, and more advice the same year for two months from June 1 to July 31 from Mr. Masataka Saito, Central Agricultural Experiment Station, Hokkaido, who visited Thailand as an expert. These were published in reports respectively (Report of Survey, and Guidance Team, March-April 1975, Soybean Development Project in Thailand by Agricultural Development Cooperation Division, Japan International Cooperation Agency, and Brief Report of Soybean Breeding Expert (M. Saito), Soybean Development Project in Thailand, October 1975 by Japan International Cooperation Agency). In this paper are summarized some problems which the author felt or discussed with the Thai researchers in the course of carrying out the soybean breeding experiments.

With respect to this report, the author had an opportunity to talk with Dr. Arwooth, Project Leader. The major subjects were (i) handling of soybean variety preservation and (ii) naming of breeding lines. For preservation of the soybean varieties, as there were a number of soybean varieties and lines introduced with their general investigation completed, the author proposed to carry out the tests designed primarily for preservation of the varieties and lines and also those designed for comparison in higher accuracy on the highly promising varieties and lines and, at the same time, for seed multiplication, whereas against such consideration, there was a way of thinking of placing emphasis upon introduction of as large a number of soybean varieties and lines as possible and investigation of their adaptability to the Thai environment but not immediately on the preservation of introduced varieties and lines as it would involve difficult problems such as investment and assignment of researchers. For naming of the breeding lines, it was proposed to assign simple breeding names to the breeding lines so that they would be identified with ease as the presently employed pedigree number system

for the promising lines was long in its spelling and complex and was felt to be rather inconvenient at the fields of breeding experiments, but this point fell short of complete understanding because of its relationship with variety names.

My Impressions on the Soybean Breeding in Thailand

January 8, 1976

Kouichi Sasaki
Japanese Expert on Soybean Breeding
Tokachi Agricultural Experiment Station
Hokkaido, Japan

First of all, I wish to express my appreciation for the support given me from many individuals who are concerned in this project. Among these are the leader of Oil Crops Project and researchers at the Department of Agriculture, officers at D.T.E.C., and many researchers at The Mae Jo and several other Agricultural Experiment Stations. I am also very grateful for your kindness extended to me during my stay of one year as an expert on soybean breeding.

The more I worked closely with the researchers working in this project, the more I learned and much wondered that they were making a big progress in many fields. Especially in the soybean breeding, they would be able to release new varieties upon accumulation of a little more additional data on breeding lines. These must be a reflection of the eagerness and highly trained ability of the researchers.

It was lucky for me that I could work co-operatively with those researchers during the most important period for final selection of the breeding lines in the late generations, while I felt big responsibility for these works.

Here I want to summarize my impressions on soybean breeding which I put down on my notebook during my term. I am afraid that they may include some misunderstanding of the situation or lack of the knowledge on the accustomed system. But anyway I will be happy if any of them serves your future progress.

(i) Set up a new variety collection for further research

It has passed several years since we started the introduction of varieties or lines from foreign countries. Now we have a large number of varieties collected in well excess more than 1600 which were roughly observed and measured on their characters during this period. Of course the introduction of varieties or lines will be continued and the total number of varieties will increase in the future. Then it will be harder and harder for one researcher to continue observations and measurements on all the materials in variety collection in the same way as the past where each line was treated with on the same weighting.

Recently we have sometimes felt the need of closer observations and measurements on the varieties or lines selected on their special characters. Therefore setting up a new variety collection which is composed of 50-70 selected varieties or lines of interesting characters is supposed to be much effective for further research. And once a new variety collection is set up, the ordinary collection will serve for preservation of the seeds of varieties or lines with roughly checking on the important characters (mostly qualitative ones). Such new variety collection will be used for more refined observations or measurements on the interested characters including quantitative ones and will serve for propagation of seeds for other experiments.

(ii) Rotation of crops at the soybean fields

In the past our soybean experiments were often disturbed by poor germination. This poor germination was obviously caused by the inadequate moisture condition of soil at the emerging time. On this reason irrigation facility is thought to be indispensable for accurate examinations, even in the rainy season.

Now the main stations for soybean breeding facilitated irrigation serve suitable fields with soil moisture controlled by such facilities. The soybean fields are usually chosen among such fields and seemed to be nearly fixed, causing frequent soybean cropping at the same fields. This condensed cropping, however, tends to pose problems in the future. I think, we should better rotate crops by planting other non-leguminous crops during the season when the soybeans are not grown.

(iii) Breeding method

In this project we mostly sticked to the pedigree method for selection of breeding materials, as the soybean breeders from Japan are experienced in this method. We grow many pedigree lines in early generations and evaluate them through observation and measurement according to this method. As the result we will be able to reduce the lines to a reasonable number before yield tests are started, if proper selection is conducted on them at the suitable timing. But, such routine works need much of researchers and labourers. Therefore, we must consider such demerits of the pedigree method, if we face buggetary restriction on the number of researchers or labourers.

There are many methods devised for selection of the self-polinated crops, including modifications of the pedigree method and the bulk method. These methods, I think, should have a chance to be compared with the pedigree method on their efficiency in the future. On trying new methods, however, we should always keep positive posture on selecting of lowly inherited characters (seed yield) and consider of the balance between the field area for breeding and the yield tests.

(iv) Spacing of the soybeans in the rainy season

In Sawankhalok, one of the largest soybean growing areas, I observed many farmers growing soybeans in a wider spacing than that in the Agr. Exp. Sta. Even the farmers did not inter-crop the cotton, the minimum row width was taken 75-90 cm. This must be decided by considering weeding or cultivating work. Actually I saw the farmers using cultivators pulled by buffalos or hand tractors in soybean fields.

To set up a selecting condition in the breeding work, it is the most important to take into consideration these farmers' situations, as the new varieties to be bred out should be adapted to the actual cultivating system at the farmer's fields. In general, it seems to be more effective to select our breeding lines in the same condition as in the farmers' fields, but it also must be an idea that we check our promising lines by conducting an experiment on the adaptation to a wider spacing.

(v) To fix the name of yield tests on breeding lines

I found that the names of yield tests on breeding lines in the past were changed every year. This sometimes makes a confusion to the researchers when citing yield data or understanding the reliability of these tests. It is, therefore, advisable that the names of yield tests on breeding lines are fixed as "Preliminary Yield Test" for slightly rough yield test in which breeding lines are tested for the first time, and "Performance Test" or "Regional Yield Trial" for more accurate yield test in which the breeding lines selected out of "Preliminary Yield Test" are evaluated. With respect to the total number of the lines to be included in "Performance Test" or "Regional Yield Trial", limitation to 10-15 breeding lines is, I think, desirable to maintain the reliability of the test.

(vi) Yield ratio to standard variety

On evaluation of the breeding lines at the yield tests, we scarcely compare tham with each other but primarily make a simple comparison of them to the standard variety. In this case, the yield ratio to standard variety expressed in terms of percentage to the yield of a standard variety will be an effective indicator of the yielding ability of a line, especially when we want to summarize yield data from many locations.

I understand that the researchers in this country cling to the Duncan's method of multi-comparison and that the method is effective when we compare many varieties or lines. But, in the final selection of breeding lines, a simple comparison of them to the standard variety seems to be more important. It is a point that we do not know the result through statistics but we can make sure our observations by taking statistics at the background.

(vii) Scoring seed quality

As we picked up the seed quality as one of our breeding objectives among many other important characters, we should observe it on the all of our breeding lines even though they are in the early generations. The characters on seed are generally said to be highly heritable and the selection in the early stage is supposed to be highly effective.

On observing the seed quality, it came to my knowledge that the scoring at the laboratory is contrary to that according to the common method. Here, the seed quality is scored from 1 to 4, score 1 representing very poor quality and score 4 excellent one, whereas according to the common method, the seed quality is scored similarly from 1 to 4, but score 4 represents very poor quality and score 1 excellent quality, and the latter scoring method is in accordance with the product grading at the commercial fields.

(viii) Scoring for the rust disease

Recently Dr. Pateung has proposed a new standard of scoring for rust disease which was made of the combination of the appearance of lesion and the number of sori in the rust lesion. This seems to be more accurate than the conventional scoring method pathologically.

From the beginning of the breeding of resistance to rust disease, our breeders have been accustomed to scoring our lines depending on the proportion of the leaves where the rust lesions are seen. This method, however, is not so accurate but is highly related to the seed yield and is convenient for rough judgement of the resistancy when breeders must handle a number of lines. Now we have some promising lines moderately resistant to rust disease as the result of breeding by such scoring method.

On this reason, I think, we'd better use both methods of scoring compensatively during the first step of breeding for rust resistance.

(ix) Put breeder's opinions for selection down on their field notebooks

During my stay of one year, I frequently borrowed field notebooks from the soybean staff for better understanding of our materials, and I found they were precisely observing on the routine set of characters. But regretfully it sometimes missed breeder's opinions as to the growth or pod setting or primary judgment for selection. The more important thing for breeders when they handle the pedigree lines must be the total judgment upon their lines for selection.

Thus, it is recommended to breeders to keep some columns and put their opinions down on these columns during observation. These records will be surely helpful for the final judgment of selection on

their materials.

(x) Breeding name

In the breeding work we usually put on our breeding lines, pedigree numbers or line names to identify them, which are composed of signs and the arabic numerals, and roughly show the selection conducted upon the lines in the past. But when we continue selection till the late generations the long spelling of pedigree numbers or line names often happens, as seen in "The list of materials for Regional Yield Trials on breeding lines". For example they are as follows: "7016. P_3. P_4. 28. 10(S). P_7. P_8. P_9", "7019. P_3. 24. 3. P_6. 1. P_8. P_9", "7019. P_3. 24. 5. P_6. 5. P_8. P_9", ...etc. This long spelling of pedigree numbers or line names is bothersome to write and apt to make a confusion to breeders who are not much accustomed with this naming.

Therefore it seems convenient to put tentative breeding names at least on our breeding lines which are tested at Regional Yield Trial. Of course these tentative breeding names should be only effective among the soybean staff and be surely different from the variety names. Once the lines are released and get the new variety names, the tentative names must be abandoned.

(xi) To avoid the mixing in the course of threshing

In the pedigree method, we harvest plants from selected lines, thresh them individually and finally complete selection upon the data from individual plants. Therefore the mixing in the course of threshing of individual plants cause serious trouble to the selection phase of the pedigree method.

Although at The Mae Jo Agr. Exp. Sta. we have small type of threshing machines with engines for individual plants, these threshers do not look so helpful because the way of checking whether seeds remain inside the thresher or not is complicated and sometimes the mixing happens. I noticed strict researchers were threshing their materials by hand.

In Japan we also use the same type of thresher but with electric motor, in which remaining seeds can be recognized by their running sound and the mixing problem rarely happens. It may therefore, be

useful to change these engines of small threshers with electric motors if possible.

(xii) Miscellaneous

Replanting soybeans at the variety collection: As we are sometimes disturbed by poor germination, replanting is done as soon as finishing of scoring for germination on the varieties or lines which show poor germination. But I think it should be done at the empty space after transplanting. Observation on uniformity in the variety collection is the most important work and this replanting is supposed to reduce the degree of uniformity.

Pubescence color : I presume there should be a confusion in classifying flower color and pubescence color. While the variation in flower color is reportedly not so simple the common occuring variation is that of white versus purple and in the abbreviated form to put down, W to P is used. Pigmentation of pubescence is controlled by a single gene pair with brown dominant to grey and in the abbreviation it should be put down B to G not as B to W.

Comprehensive understanding on promising lines: In the breeding work each experiment is closely related together and should not be independent one. This means that the breeders are imposed to understand comprehensively the results of all the experiments and not to cling to their own experiments. As we are distributing our promising lines to many places (to Agr. Exp. Stations and to farmer's field tests) asking for their evaluation, the work for comprehensive understanding will be a harder one, but it will be completed by taking into consideration the reliability and the condition of the growth of our materials at these experiments.

Hilum color of the breeding lines : At the cross breeding of soybeans we use many varieties as the parents which are different in the hilum color, and their progeny show a wide range of variability in this character. Of course this character is closely related to the score of seed quality. While working with the soybeans in this country I realized that our breeding lines still fell into a rather wide range of hilum color. In the second step of breeding, I hope, we'll aim at a slightly narrower range of hilum color as for our breeding lines, so

that our varieties may not be different from each other at the seed quality.

5. Regulations Concerning Variety Determination in Thailand

In the following are reproduced an English version of the Regulations Concerning Variety Recommendation Committee on Upland Crops in Thailand and that of the Regulation Concerning on Testing the Upland Crop Variety. The translation was the elaboration, for the greater part, of Mr. Ransan Keereetaveep in charge of the soybean breeding at The Mae Jo Agricultural Experiment Station, and the author made only minor modifications. The author would be pleased if they might serve for the understanding of the organization and the task of the committee for determination of varieties and also the outline of the procedures required for various tests.

The author was unable to hear about any varieties determined according to these regulations.

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Regulation concerning on crop variety recommendation committee Division of Upland Crop, Department of Agriculture

1. The committee examines the crop variety of the Division of Upland Crops.

It is comprised of the chief of the Division of Upland Crops, the heads of all projects at the Division of Upland Crops, the representatives from Plant Pathology, Entomology, Technical, Agricultural Chemistry and Agricultural Engineering Divisions, including the specialists and the researchers in the breeding work not more than 5 persons.

2. Members of the committee shall be appointed for a term of two years.

3. The committee is enpowered to consider of the nominated variety whether it shows the better characteristics than the standard variety or not. Variety or varieties accepted by the committee shall be presented to the Department of Agriculture for approval, recommendation and release to the farmers.

4. The nominated variety shall be supported by the following;

4.1 The test must be conducted by the Division of Upland Crops at several locations with the standard variety at least 2 years.

4.2 Evidence of distinctness on the morphological and agronomic characteristics, yielding ability, resistance to the disease or insect damages.

4.3 Other outstanding ability compared to the standard variety.

4.4 The sufficient amount of breeder's seed must be presented to the committee by the owner.

5. The nominated and approved variety should be registered with the Department of Agriculture as the standard variety, and the data should be printed in detail in the advertizing of the Department of Agriculture.

6. In the case of self pollinated crop, or open pollinated variety of cross pollinated crop or often cross pollinated crop, the owner or the breeder of the nominated variety should have sufficient amount of breeder's seed for submitting to the Seed Multiplication Branch, Division of Upland Crops or other seed multiplication branches for seed production, and should keep his breeder's seed mechanically and genetically pure for as long as it is the recommended variety.

Regulation concerning on testing the upland crop variety
Division of Upland Crops, Department of Agriculture

1. The owner of nominated variety can require the Division of Upland Crops to introduce the Recommended Variety to the farmer. The nominated variety must be tested by the Division of Upland Crops, Department of Agriculture, and be approved by the committee of the Division of Upland Crops, Department of Agriculture.

2. The one who wants the nominated variety to be tested should show the intent to the Division of Upland Crops, Department of Agriculture, with the following detail:

2.1 Name or number of variety.

2.2 Name and address of the owner. If the owner does not stay in Thailand, the name and address of the agency in Thailand should be shown.

2.3 Characteristics of variety, and other detail.

2.4 Other special advice or the need for planting.

2.5 Origin of variety.

3. The nominated variety must show the better performance than the standard variety which is now being used.

4. The owner of nominated variety should submit sufficient amount of breeder's seed.

5. The testing should be done in the following season after acception of the breeder's seed by the researchers of the Division of Upland Crops, Department of Agriculture, and the testing should be conducted at several experiment stations at least 2 years but not more than 5 years. It depends on the condition and the result of the experiments in every year.

6. The design and the analysis of the result of the tested variety must be done by the international standard of statistics.

7. The result of the testing should be informed every year, and the detail of the testing from the beginning to the final must be reported again in one booklet.

8. The result of the testing conducted must be shown in the data of the characteristics just as yielding ability, morphological and agronomic characters, disease and insect reactions.

9. The acceptable of this regulation are the upland crops such as corn, sorghum, cotton, jute, kenaf, soybeans, peanut, mungbeans, caster beans, sesame, cassava and sugar cane.

APPENDIX

Statistical Data on Soybeans

Some statistical data are appended. It would please the author if they could serve for understanding of the situation of soybeans in the agriculture of Thailand. For details, reference should be made to "Oil Seeds in Thailand (Mainly with Respect to the Present and Future Problems of Soybeans)" (1973) published by Japan External Trade Organization (JETRO).

Table 35. Statistics of Principal Crops in Thailand by Groups

Crops	1971/72			1972/73		
	Planted area 1000 rai*	Production 1000 tons	Value million baht**	Planted area 1000 rai*	Production 1000 tons	Value million baht**
Upland food crops (Maize, mungbeans, cassava, suger cane)	9,436	11,466	6,428.1	10,697	15,971	8,427.5
Oil seeds (castor beans, grandnuts, sesame, soybeans coconuts)	3,601	1,053.2	3,472.7	3,872	989.3	3,789.0
(Soybeans)	(359)	(54.3)	(137.9)	(500)	(72.0)	(211.7)
Fiber crops (cotton, kenaf, kapok)	3,459	563.0	2,176.0	3,639	580.8	3,039.5
Rubber	5,435	316.3	1,673.2	5,485	336.9	1,815.9
Tabacco	179	9.6	144.9	174	8.8	138.5
All crops except rice	22,138	13,408.1	11,894.9	23,857	17,886.8	15,210.4
Rice	47,043	13,744	11,698.2	44,620	11,669	12,838.3
All crops	69,181	27,152.1	23,593.1	68,477	29,555.8	28,041.7

Note: * ; 1 rai = 0.16 ha
** ; 1 baht = 15-11 yen

Source ; Agricultural Statistics of Thailand (1972/73)

Table 36. The List of Crops Involved in the Oil Crops Project, Deaprtment of Agriculture

Name	Scientific Name	Planted area 1000 rai	Production 1000 tons	Values million baht
Soybeans	Glycine max. (Merill) L.	309	58.9	156.0
Grandnuts	Arachis hypogaea	703	137.1	381.9
Castor beans	Ricinus communis L.	287	41.7	122.5
Sesame	Sesamum indicum L.	189	20.9	114.0
Sunflower	Helianthus annuus L.			
Safflower	Carthamus tinctorius L.			
Mungbeans	Phaseolus aureus(P. mungo)	1,196	155.3	448.5

Average of 1970/71-1972/73

Source ; Agricultural Statistics of Thailand (1972/73)

Table 37. From "Oilseeds of Thailand - the Present Situation and Future of Soybeans (JETRO report) Planted Area of Soybean by Selected Prefectures

Changwat (Pref.)	1968	1969	1970	1971	Remark* (principal planting season)
	ha	ha	ha	ha	
Sukhotai	35,968	35,968	42,099	37,608	rainy season
Chiang Mai	9,893	10,554	14,866	18,726	dry season
Nakhon Sawan	3,968	5,708	5,730	2,021	rainy season
Lop Buri	34	1,471	5,158	5,922	late rainy season
Chachoengsao	1,053	1,092	1,817	3,429	rainy season
Mae Hong Son	1,440	1,440	1,564	1,564	rainy season
Kamphaeng Phet	1,302	1,312	1,435	1,435[e]	rainy season
Tak	971	672	683	2,842	dry season
Saraburi	781	622	781	920	late rainy season
Chiang Rai	556	180	341	576	rainy season
Nakhon Ratchasima	329	340	501	450	dry season
Total above (1)	56,296	59,359	74,975	75,494	
Thailand (2)	60,499	63,827[e]	80,618[e]	81,176[e]	
(1) as per cent of (2)	93	93	93	93	

Note : 1 e = estimate 2 * added by reporter

Source : Reports from Prefectural Agri. Officer (1968 - 71)

Table 38. Production and Export Targets of Main Agricultural Products in the Third National Economic and Social Development Plan (1971-76)

	Products	Production target in 1976	Export target in 1976
1.	Maize	3,500,000 tons	3,000,000 tons
2.	Soybeans	300,000 tons	10,000 tons (soybean mill 140,000 tons)
3.	Groundnuts	400,000 tons	14,000 tons
4.	Mulberry-silk	25 million silk worms stock for farm distribution	1.25 million yards
5.	Coconut	*	
6.	Sea shrimp	150,000 tons	14,000 tons
7.	Livestock	50,000 heads for annual export as against 35,000 heads for present quota export	50,000 heads

Note : * No production target is given due to relatively longer period required to obtain the result from improving the production.

Table 39. Area Planted, Average Yield and Production of Soybeans

	Area planted 1000 rai	Average yield kg/rai	Production 1000 tons	Increases of production for the Period (%)
1960/61	139	190	25.6	
1961/62	149	169	24.2	
1962/63	174	176	30.0	
1963/64	210	165	33.0	
1964/65	213	147	31.3	
1965/66	117	166	19.1	1961/62 - 1966/67
1966/67	285	137	37.9	148
1967/68	399	145	52.8	
1968/69	329	155	44.8	
1969/70	299	164	48.2	
1970/71	368	140	50.4	1967/68 - 1971/72
1971/72	359	161	54.3	143
1972/73	500	144	72.0	
Target in 1976			300	

Source : Agricultural Statistics of Thailand (1972/73)

Table 40. From "The Investor" (July 1975)

Exports of Oilseeds from Thailand, 1970-74

Product	1970		1971		1972		1973		1974	
	tons	million baht	tons	million baht	tons	million baht	tons	million baht	tons	million baht
Castor seeds	35,679	93	47,472	124	28,832	97	26,575	272	29,406	218
Cotton seeds	23,720	34	18,567	30	35,786	48	5,895	9	6,811	23
Kapok seeds	11,269	18	9,943	15	12,134	16	8,202	23	9,890	32
Soya beans	6,290	16	6,099	17	7,240	23	13,715	76	8,610	47
Groundnuts	6,445	29	4,084	19	1,524	9	6,717	45	4,491	41
Sesame	5,422	27	9,023	41	8,494	48	6,435	49	14,083	98
Total	88,825	217	95,188	246	94,010	241	67,539	474	73,291	459

Source : Department of Customs

Table 41. Import of Oilseeds from Thailand and the Percentage Share of Them (1972-1974)

Item	Total import	Import from Thailand	Share %	Total import	Import from Thailand	Share %	Total import	Import from Thailand	Share %
	(tons)	(tons)		(tons)	(tons)		(tons)	(tons)	
Castor beans	46,874	27,638	59.0	45,916	23,880	52.0	38,111	24,446	64.1
Cotton seeds	180,204			159,148			123,303	6,322	5.1
Kapok seeds	29,039	11,745	40.5	22,186	8,037	36.2	19,225	11,997	62.4
Soybeans	3,395,582	-	-	3,634,572	2,435	0.1	3,240,033	-	-
Ground nuts	62,325			76,324			52,652	292	0.6
Sesame	51,404	4,642	9.0	56,040	4,547	8.1	49,655	5,139	10.4

Source : Statistic Sec. of Customs Bureau, Ministry of Finance (Japan)