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FREQUENCIES OF NODULATION RESPONSE ALLELES, RJ2 AND RJ4, IN SOYBEAN PLANT
DEVINE, T.E. ; BREITHAUPT, B.H. 1 OF 1

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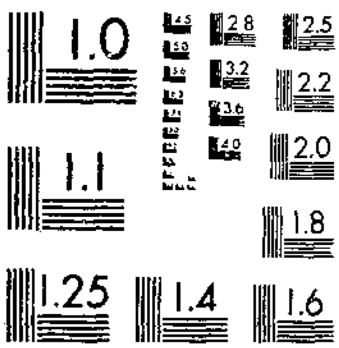

MICROCOPY RESOLUTION TEST CHART
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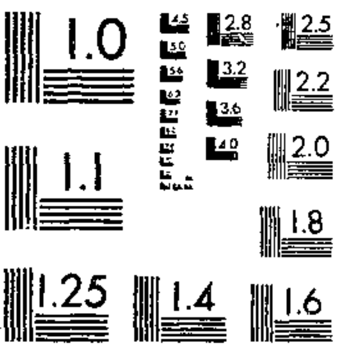

MICROCOPY RESOLUTION TEST CHART
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FREQUENCIES OF NODULATION RESPONSE ALLELES, Rj_2 AND Rj_4, IN SOYBEAN PLANT INTRODUCTION AND BREEDING LINES

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ABSTRACT

Devine, T. E., and B. H. Breithaupt. 1981. Frequencies of nodulation response alleles, Rj_2 and Rj_4, in soybean plant introduction and breeding lines. U.S. Department of Agriculture, Technical Bulletin No. 1628, 42 pp.

The Rj_2 and Rj_4 alleles in soybeans (*Glycine max* (L.) Merr.) condition ineffective nodulation with particular strains of *Rhizobium japonicum* (Kirchner) Buchanan. The frequencies of both these alleles declined progressively with advancing levels of breeding for agronomic performance in the United States. This result suggests either a negative adaptive value for Rj_2 and Rj_4 or genetic linkage of these alleles with other alleles having a negative adaptive value for agronomic performance. To aid soybean breeders in the choice of breeding lines, we have presented the genetic constitution for the Rj_2 and Rj_4 loci for 847 plant introduction lines and the lines in the 1979 preliminary and uniform tests. The geographic pattern of the frequency of these alleles in Asian soybean populations suggests that ecotypes of the host and microsymbiont coevolved under selection pressure for mutual symbiotic compatibility.

KEYWORDS: Coevolution, *Glycine max* (L.) Merr., natural selection, nitrogen fixation, *Rhizobium japonicum* (Kirchner) Buchanan, symbiosis.

CONTENTS

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FREQUENCIES OF NODULATION RESPONSE ALLELES, Rj_2 AND Rj_4, IN SOYBEAN PLANT INTRODUCTION AND BREEDING LINES

By T. E. DEVINE and B. H. BREITHAUPT [1]

Soybeans (*Glycine max* (L.) Merr.) and other economically important leguminous crops normally form a symbiotic relationship with rhizobial bacteria that results in the development of root nodules, in which atmospheric nitrogen is fixed in a form that can be used in plant metabolism. In soybeans, several genes have been identified that control nodulation response with specific strains or serological groups of strains of *Rhizobium japonicum* (Kirchner) Buchanan. The Rj_2 allele conditions an ineffective nodulation response with strains of the 122 and c1 serogroups of *R. japonicum* (*1*).[2] Plants carrying the Rj_2 allele nodulate normally with other strains of *R. japonicum* but form cortical proliferations or rudimentary nodules with strains of the 122 and c1 serogroups (fig. 1, *B*). The Rj_4 allele (*8*) conditions an ineffective nodulation reaction specifically with rhizobial strain 61 of the Beltsville Culture Collection. This allele results in the formation of cortical proliferations rather than nodules when plants are inoculated with strain 61 (fig. 1, *D*).

In this bulletin, we present the genetic constitution for the alleles present at the Rj_2 and Rj_4 loci for a large sample of soybean plant introduction lines from Asia. To provide information on these alleles in the soybean breeding lines currently widely used by soybean breeders and geneticists to develop new cultivars, we tested the lines entered in the 1979 U.S. northern and southern regional preliminary and uniform soybean tests. The frequencies of the Rj_2 and Rj_4 alleles in the plant introduction and the preliminary and uniform test lines were compared to determine whether these frequencies were altered during breeding for improved agronomic adaptation in the United States.

These alleles have been regarded as interesting but undesirable biological oddities. We have proposed that they reflect lack of coevolution of host plant ecotypes with the microsymbiont ecotypes in the areas of origin in Asia (*2*).

MATERIALS AND METHODS

Seeds of the plant introduction lines for maturity groups 00–IV and V–X were supplied, respectively, by R. L. Bernard, Urbana, Ill., and E. E. Hartwig, Stoneville, Miss., from the USDA soybean germplasm collections. Seeds of lines tested in the 1979 U.S. regional preliminary and uniform tests for maturity groups 00–IV and IV–S–VIII were supplied by J. R. Wilcox, Purdue University, West Lafayette, Ind., and E. E. Hartwig, respectively.

Seeds of each line were surface sterilized in 50 percent ethanol, rinsed in water, and planted in hills with five seeds per hill in plastic growth trays (*3*). The trays contained sterilized vermiculite as the support medium and each had 48 hills. All seeds in a tray were

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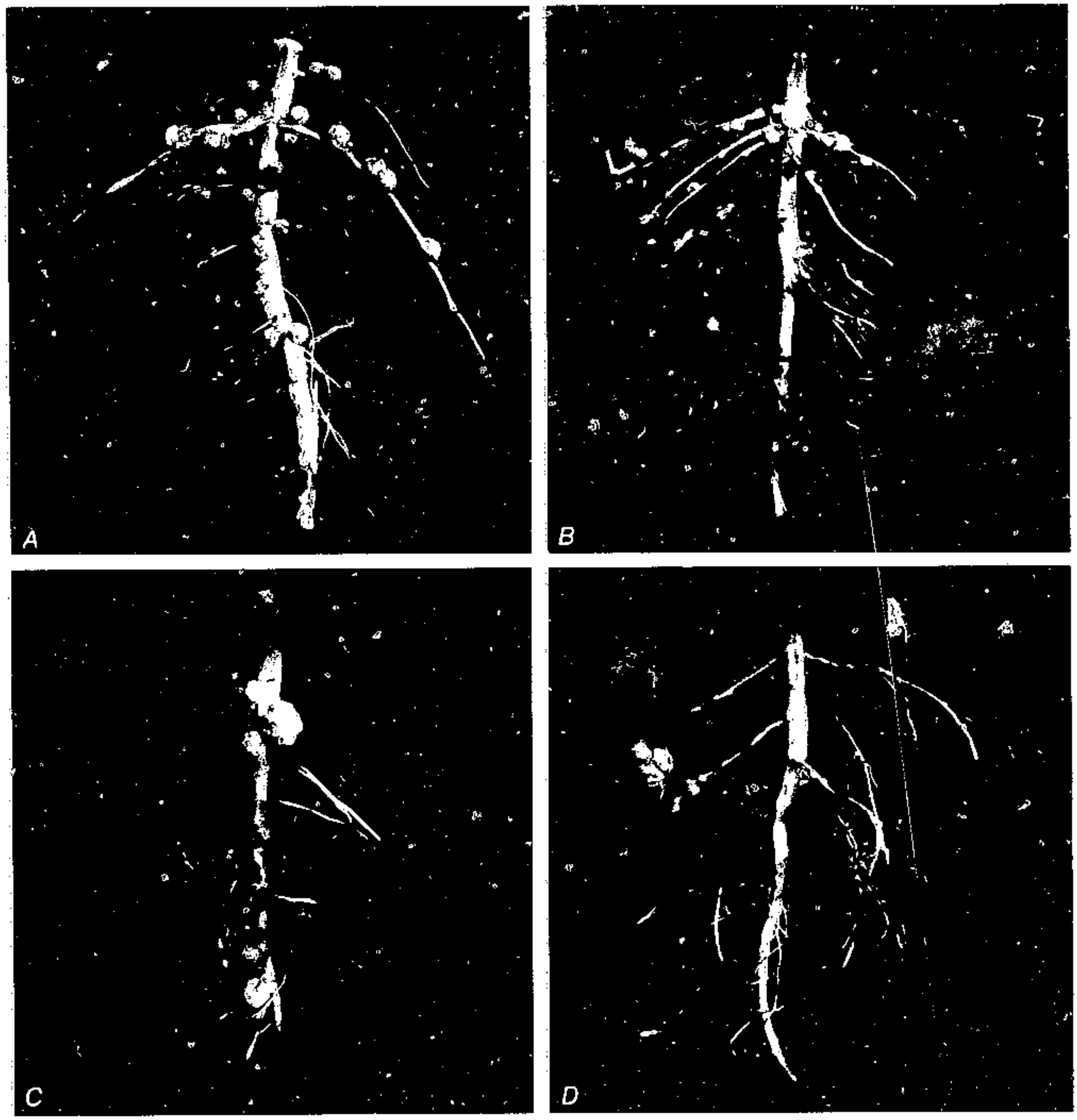
[2] Italic numbers in parentheses refer to Literature Cited, p. 8.



PN-7003, PN-7001, PN-7000, PN-7002

FIGURE 1.—Normal (rj_2 and rj_4) and ineffective (Rj_2 and Rj_4) root responses of soybean cultivars: *A*, Normal nodulation on Clark (rj_2 rj_2) inoculated with strain 7 of serogroup c1 of *Rhizobium japonicum*; *B*, ineffective response on Hardee (Rj_2 Rj_2) inoculated with strain 7, showing cortical proliferations rather than nodules; *C*, normal nodulation on Clark (rj_4 rj_4) inoculated with strain 61 of *R. japonicum*; *D*, ineffective response on Hill (Rj_4 Rj_4) inoculated with strain 61, showing cortical proliferations and few nodules.

inoculated with 7-day-old broth cultures of either rhizobial strain 7 representing the c1 serogroup or strain 61 from the Beltsville Culture Collection. Seedlings were evaluated 3–4 weeks after planting for nodulation response. Those lines showing ineffective responses were tested again to confirm the results. Lines that exhibited a heterogeneous nodulating response were retested in the growth tray system in rows of approximately 50 seeds each to determine the percentage of individuals carrying the particular *Rj* allele.

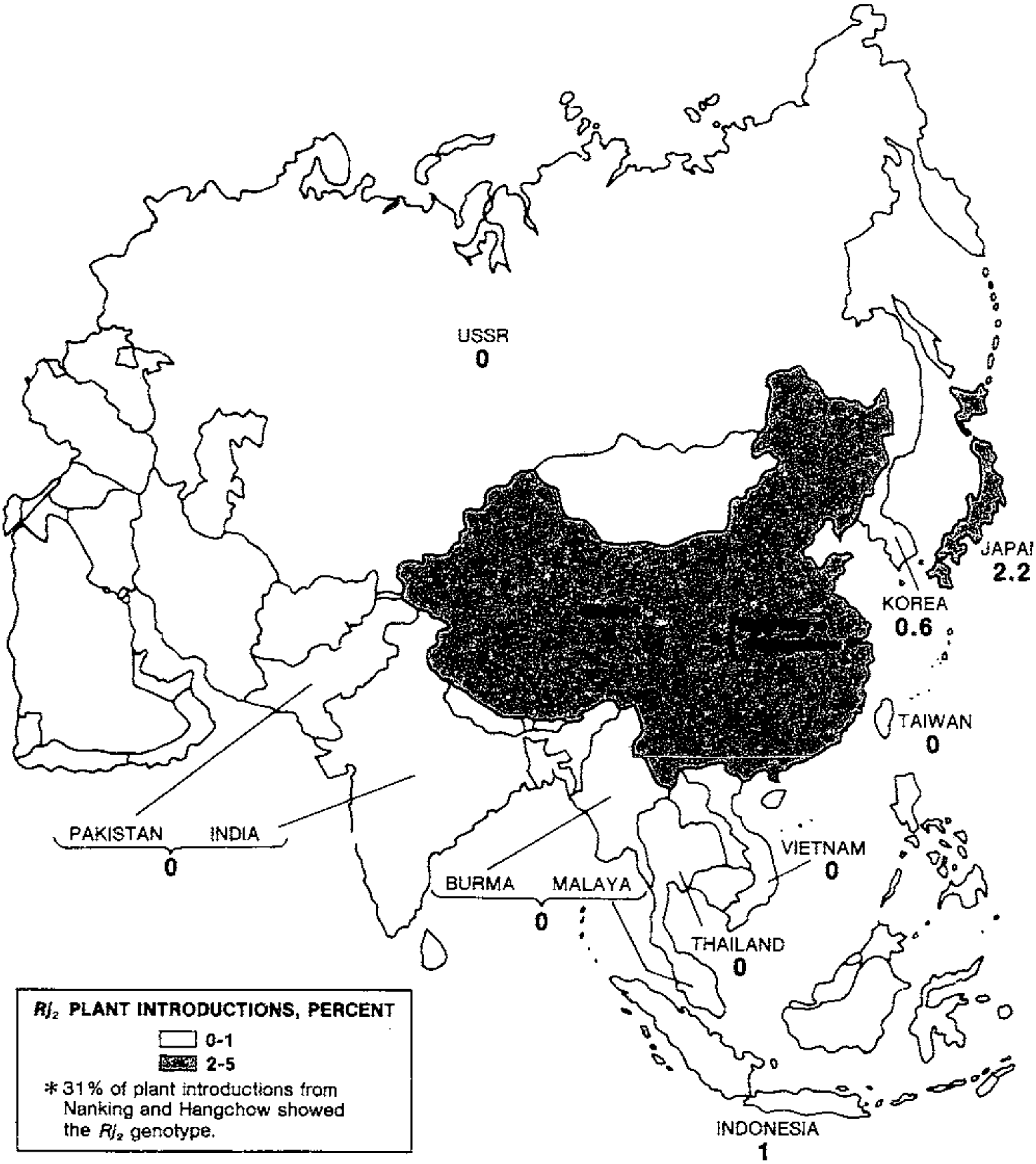
RESULTS AND DISCUSSION

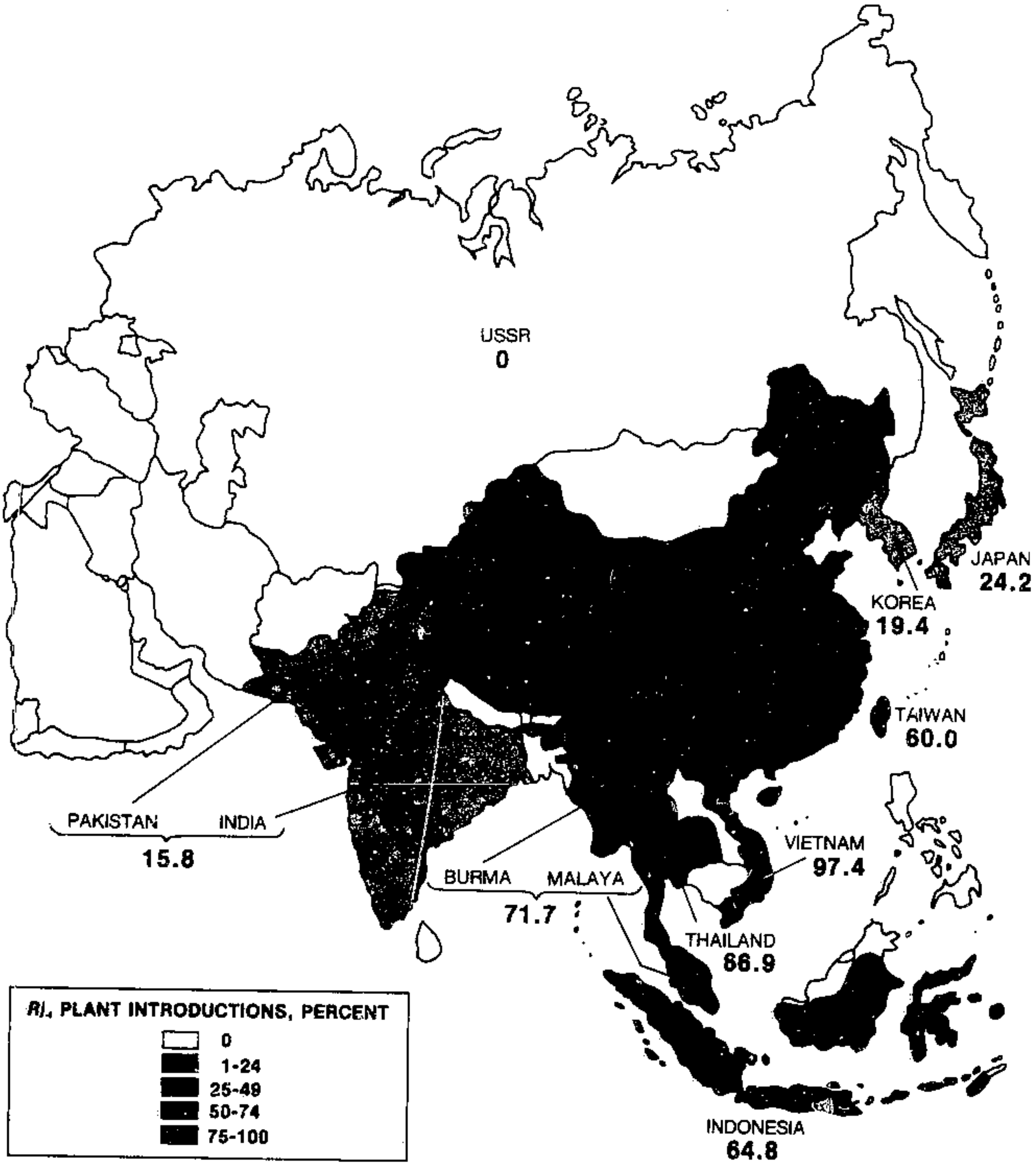
The results of the tests for the frequencies of the nodulation response alleles, Rj_2 and Rj_4, in the plant introduction (PI) lines are given in table 1. The Rj_2 allele occurred with relatively low frequency—2 percent of the lines in the sample of 847 PI's. These lines were in maturity groups III–VIII and most originated in China and Japan (table 2, fig. 2). There appears to be a clustering of the Rj_2 allelic frequency in the vicinity of the neighboring Chinese cities of Nanking and Hangchow, which are 240 km apart. Of the total 18 PI's found to carry the Rj_2 allele in this testing program, 9 were from these 2 cities. Furthermore, of the 29 lines tested from these cities, 9 or 31 percent displayed the Rj_2 allele. Although the sample of 29 lines is small, the frequency of 31 percent is markedly different from the overall frequency of 2 percent in the total of all lines.

The Rj_4 allele occurred in 29.7 percent of the 847 PI's tested for this allele. It was found in all the maturity groups but with a lower frequency in the earlier groups, 00–II, than in the later ones (table 2). The highest frequency (94.3 percent) was in maturity group X. The Rj_4 allele was particularly prevalent in lines from southeast Asia, i.e., Burma, Malaya, Indonesia, Thailand, and Vietnam (table 2). Only a few lines are available in the USDA soybean germplasm collections for some of these countries, i.e., Vietnam 5, Burma 2, and Malaya 12; however, the frequencies are consistent with those of neighboring countries (fig. 3).

In some instances, the origin listed in the PI records may not be indicative of the area of actual development of the cultivar. Some samples were obtained from research station collections of soybean germplasm from a wide geographic area and maintained as a source of diversity. This is probably true of lines from New Delhi, India, which is historically not an area of soybean culture. Trade and migration of human populations have likely moved ecotypes from their place of original development. The classification of the PI's by maturity group provides an additional check on geographic locations by latitude. The timing of flowering and ripening of seed in soybeans is very strongly influenced by the plant's genetically programed response to photoperiod. Since the length of the photoperiod is determined by distance from the equator, the genetic control system of lines adapted to any given latitude must fall within a range that permits seed to ripen in order for the cultivars to survive. Thus, although lines from Siberia, U.S.S.R., vary in maturity from group 00 through II, lines of much later maturity would not survive in Siberia, since flowering would occur so late that the seed would not ripen before frost. Similarly, early maturing lines would not be adapted to Indonesia, since flowering would occur so early in seedling ontogeny that the size of the plant formed would preclude a worthwhile yield of seed. Despite the difficulties in ascertaining the origin of some introductions, the information on germplasm origin apparently is sufficiently accurate and definitive to detect ecotypic differences in the frequencies of the Rj_2 and Rj_4 alleles.

These results indicate that there is a relationship between the geographical sources of the PI's and the frequencies of the *Rj* alleles. This suggests the principle that ecotypes of the host and microsymbiont have coevolved with mutual symbiotic compatibility. A corollary of this principle is that ecotypes of the host and microsymbiont that have not coevolved may, when artificially brought into


USSR
0
JAPA
2.2
KOREA
0.6
TAIWAN
0
PAKISTAN INDIA
0
BURMA MALAYA
0
VIETNAM
0
THAILAND
0
INDONESIA
1
Rj_2 PLANT INTRODUCTIONS, PERCENT
0-1
2-5
* 31% of plant introductions from Nanking and Hangchow showed the Rj_2 genotype.


USSR
0
JAPAN
24.2
KOREA
19.4
TAIWAN
60.0
PAKISTAN
INDIA
15.8
BURMA
MALAYA
71.7
VIETNAM
97.4
THAILAND
86.9
INDONESIA
64.8
Rj, PLANT INTRODUCTIONS, PERCENT
0
1-24
25-49
50-74
75-100

association, exhibit defective symbiosis in either the effectiveness of nodulation or the efficiency of fixation or both. The Rj_2 and Rj_4 responses may then be indicative of the association of ecotypes of the host that have not coevolved with ecotypes of the microsymbiont. For example, during soybean introduction into the United States, the reassortment of ecotypes of the host and microsymbiont may have resulted in the coupling of ecotypes of *R. japonicum* from northern China or Japan with soybean host plant germplasm from southern Asia.

Although the Asian sources of the PI's used in this study are documented as to country of origin and in most instances to the locality within that country, rhizobial strain 7 can be traced only to an isolate from the USDA farm at Arlington, Va., made in 1915, and strain 61 can be traced only to an isolate from experimental plots in North Carolina made in 1946 (*6*).

If host compatibility with the microsymbiont is related to ectoype coevolution, and if successful symbiotic nitrogen fixation is an important component of the complex of adaptive characteristics for host survival, then it would appear that the rhizobial strains with those symbiotic characteristics recognized as incompatible by the Rj_2 and Rj_4 alleles do not dominate the rhizobial population (so as to exert a significant selection pressure) in areas where the host populations have a high frequency of the Rj_2 or Rj_4 allele. If the same principle that governs the effects of the Rj_2 and Rj_4 alleles on effectiveness of nodulation also governs the efficiency of nitrogen fixation, then coupling the proper ecotypes of the soybean host and rhizobial microsymbiont should result in improved efficiency of nitrogen fixation.

Breeders may be particularly interested in the PI's they are using as sources of desirable traits in their breeding programs. Some PI's that carry the Rj_4 allele occur as ancestors of cultivars that are frequently in the parentage of modern cultivars and experimental lines. PI 40658, the source of cultivar Laredo, and PI 71569, the source of the cultivar Clemson, carry the Rj_4 allele. PI 54610-1, one of the parents of the cultivar Ogden, also carries the Rj_4 allele. The cultivar Dunfield, which was previously reported to carry the Rj_4 allele (*8*), is often found in the parentage of experimental lines now being tested for release to soybean producers. The cultivar Peking, which has been used as a source of resistance to the cyst nematode, carries the Rj_4 allele. PI 171442, which is used as a source of resistance to phytophthora rot, carries the Rj_4 allele. The fact that some of the inbred lines in the germplasm collection display both the Rj_2 and Rj_4 phenotypes indicates that they are not two allelic forms at the same locus but that they reside at two distinct loci.

The genotypes of the lines in the 1979 preliminary and uniform tests are given in table 3. Characteristics of individual lines may serve as a guide to soybean breeders in selecting lines for use as parental materials from among those with otherwise similar agronomic characteristics. Inoculum producers and distributors should also be alert to possible incompatibilities of their strains with existing and potential new cultivars.

We compared the frequencies of the Rj_2 and Rj_4 alleles in the PI lines and the 1979 preliminary and uniform test lines to determine whether a shift in the frequencies of these alleles occurred concomitant with selection for improved agronomic performance (table 4). The PI's are the raw material with which plant breeders initiate plant improvement programs. The preliminary test lines represent the products of recombination and selection that have performed sufficiently well agronomically in local or statewide testing programs to merit entry in the national testing program. The uniform test lines represent a yet more advanced level of selection, restricted to those that have previously performed well in the preliminary tests.

To strengthen the basis for comparison, we selected the PI's acquired at the earliest dates for testing. Lines in the current 1979 preliminary and uniform tests are usually derived from crosses made 10 or more years ago. Thus, the PI's acquired at the earlier dates are more apt to represent the germplasm available for utilization as parental materials in those crosses. Although relatively few lines served as the source of our currently used germplasm

(15 PI's are reported to account for approximately 80 percent of the currently used U.S. germplasm), presumably the lines carrying the *Rj* alleles had a proportional opportunity to be selected as parents. Selection was practiced by breeders for agronomic desirability both in selecting parental materials and in culling the progeny of crosses among lines selected for use as parents.

The Rj_4 allele occurred with a relatively high frequency in the plant introductions (29.7 percent) and should therefore have had ample opportunity based on random chance to have been included in the selection of parental materials. The Rj_2 allele on the other hand was relatively infrequent in the plant introductions (2 percent); however, the assignment of cultivar names to several of the PI's carrying the Rj_2 allele (Charlee, Cherokee, CNS, Missoy, Monetta, and Seminole) indicates that these lines were deemed to have some features of agronomic merit and should, therefore, at least have been considered in the selection of parental materials. Until this publication, the genetic constitution at the Rj_2 and Rj_4 loci would not have been known to breeders for most soybean lines. Consequently, direct conscious selection for these alleles would not have been possible.

Since the maturity of group IV–S is close to that of groups IV and V, the data for IV–S are included in the comparison of the frequencies in the uniform tests with those in the PI and the preliminary tests. No preliminary test exists for maturity groups 00 and 0, and the group IV–S is tested only in the uniform test. Since maturity groups 00 and 0 are absent in the preliminary tests, summary data are presented for the PI's and the preliminary and uniform tests that do not include these maturity groups. For the comparison between the PI's and the uniform tests, summary data are given that include all the data for maturity groups 00 through VIII in order to maximize the use of the data available. Data for the preliminary and uniform tests are not a sample but are the entire population of experimental lines in these tests in 1979. In the case of both the Rj_2 and Rj_4 alleles, the frequencies of the incompatible alleles progressively declined from the PI's to the preliminary tests to the uniform tests (table 4).

Although a shift in allelic frequency can occur because of random drift, particularly in small populations, it seems unlikely that this would account for the consistent trend with both alleles and the relatively consistent trend over most maturity groups. The alternative hypothesis would be that lines carrying either Rj_2 or Rj_4 may have been generally substandard performers agronomically and thus have been eliminated in the culling process leading to advancement to the 1979 preliminary and uniform tests. Even so, some cultivars known for good agronomic performance do carry the Rj_2 or Rj_4 allele.

It is not clear whether genotypes are disadvantaged in performance in U.S. testing programs because of close linkage of the Rj_2 or Rj_4 alleles to other detrimental alleles or an inherent adaptive deficiency of the Rj_2 and Rj_4 alleles themselves. The makeup of the rhizobial populations in the evaluation sites used for soybean testing in the United States is not well understood. Possibly at some locations, the Rj_2 and Rj_4 alleles may significantly impair nitrogen fixation and be detrimental to performance. It would be desirable to have more information on the rhizobial populations at the testing sites used in breeding programs.

If breeders and geneticists are to understand the role of ecotype coevolution in the development of symbiotic specificity, it will be important to identify precisely the origin of both host and microsymbiont genotypes. The information now available on soybean PI's permits such identification of many lines. Unfortunately we have very meager information on most strains of *R. japonicum*. Hopefully, new introductions of both *R. japonicum* and soybeans will be definitively described. If research can identify ecotypes of *Rhizobium* that show superior combining ability with specified host germplasm, it should prove possible to successfully predict the locations from which new rhizobial collections are most likely to yield the most compatible strains.

In addition, an understanding of ecotype variation may provide insight into the occurrence of types of *Rhizobium* with differing physiological characteristics, such as rhizobial-induced chlorosis (5), hydrogenase activity (*7*), and tolerance of extremes of pH (*4*) and temperature. Such differences may have survival value in specific ecological niches. An understanding of these adaptive functions would benefit efforts to tailor combinations of host plants with desirable rhizobial strains for agricultural ecosystems.

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TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4*, in soybean plant introduction lines by maturity groups*

Lines	Origin	Date of introduction	Frequency of alleles[1]	
			Rj₂	*Rj₄*
MATURITY GROUP 00				
Agate	Japan	1939	–	–
Flambeau	U.S.S.R.	1934	–	–
Hidatsa	Japan	1929	–	–
Pando	Korea	1947	–	–
Sioux	Japan	1929	–	–
FC 30685	do	——	–	–
30687	do	——	–	–
PI 159764	Seoul, Korea	——	–	–
227327	Hokkaido, Japan	——	–	+
240079	Sapporo, Japan	——	–	–
291326	Koshan, Heilungkiang, China (NE.)	1963	–	–
MATURITY GROUP 0				
FC 30684	China (NE.)	——	–	–
30692	do	——	–	–
PI 70242–4	Wutai, China (NE.)	——	–	64%+
79739	Anta, Heilungkiang, China (NE.)	——	–	–
89001	Dairen, China (NE.)	——	–	–
243547	Omagari, Japan	——	–	–
243550	do	——	–	–
248512	Japan	——	–	–
261469	Kyushu, Japan	——	–	–
261475	China (NE.)	——	–	–
291311A	Koshan, Heilungkiang, China (NE.)	1963	–	–
291312	do	1963	–	+
291313	do	1963	–	–
291316	do	1963	–	–
291319A	do	1963	–	–
291320B	do	1963	–	–
291321	do	1963	–	–
291325	do	1963	–	–
291329	do	1963	–	+
291331	do	1963	–	+
295947	Amur River Region, U.S.S.R.	1964	–	–
295948	do	1964	–	–
295949	do	1964	–	–
MATURITY GROUP I				
Elton	U.S.S.R.	1906	–	–
Habaro	do	1906	–	–
Mendota	Korea	1929	–	–
FC 03609	China (NE.)	1920	–	–
PI 54809	Harbin, Sungkiang, China (NE.)	1922	–	–
54834	do	1922	–	–
54853	do	1922	–	–

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4*, in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1]	
			Rj₂	*Rj₄*
	MATURITY GROUP I—con.			
PI 54854	Harbin, Sungkiang, China (NE.)	1922	–	–
54857	do	1922	–	+
54865	do	1922	–	–
63271	China (NE.)	1925	–	–
68474–2	Schwangcheng, Sungkiang, China (NE.)	1926	–	–
68551–3	Inner Mongolia, China	1926	–	–
68554	do	1926	–	–
68572	Anta, Heilungkiang, China (NE.)	1926	–	–
68576	Inner Mongolia, China	1926	–	–
68586	China (NE.)	1926	–	–
68604–2	Chang-Chia-wan, China (NE.)	1926	–	–
68610	Anta, Heilungkiang, China (NE.)	1926	–	–
68746	Schwangcheng, Sungkiang, China (NE.)	1926	–	–
68770	Anta, Heilungkiang, China (NE.)	1926	–	+
69507	Harbin, Sungkiang, China (NE.)	1926	–	–
69533	Schwangcheng, Sungkiang, China (NE.)	1926	–	+
70016	Yungtsengyuan, Kirin, China (NE.)	1926	–	–
70017	Shanghowan, Kirin, China (NE.)	1926	–	–
70027	Nungkiang, Heilungkiang, China (NE.)	1926	–	–
70087	Tungchiang, Sungkiang, China (NE.)	1926	–	–
70241	Kirin, China (NE.)	1926	–	+
70473–1	Chingho, China (NE.)	1926	–	–
70485	Heilungkiang, China (NE.)	1926	–	+
70520	do	1926	–	+
71161	China (NE.)	1927	–	+
78242	Yekaterinoslav, U.S.S.R.	1928	–	–
78243	do	1928	–	–
79617	China (NE.)	1929	–	–
79694	Harbin, Sungkiang, China (NE.)	1929	–	–
79727	do	1929	–	–
79870–1	China (NE.)	1929	–	–
81033	Hokushu, Japan	1929	–	–
81037–4	do	1929	–	–
81040	do	1929	–	–
81765	Japan	1929	–	–
81772	do	1929	–	–
81775	do	1929	–	–
82183	Seoul, Korea	1929		–
83945–3	Suwon, Korea	1929	–	–
84668	do	1930	–	+
84674	do	1930	–	–
84686	do	1930	–	+
84810	do	——	–	–

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj$_2$ *and* Rj$_4$, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Rj_4
MATURITY GROUP I—con.				
PI 84964	Kobe, Japan	1930	–	–
86021	Obihiro, Hokushu, Japan	1930	–	–
86133	do	1930	–	–
86410	Nakano, Tokyo, Japan	1930	–	–
86411	do	1930	–	–
86416	Urawa, Japan	1930	–	–
86737	Mito, Japan	1930	–	–
87531	China (NE.)	1930	–	–
88288	Kungchuling, Kirin, China (NE.)	1930	–	–
88295	China (NE.)	1930	–	–
88443	Dairen, China (NE.)	1930	–	–
88484	Hsiungyaocheng, China (NE.)	1930	–	–
88497	do	1930	–	–
88797	Dairen, China (NE.)	1930	–	–
88804	do	1930	–	–
89055	do	1930	–	–
89057	do	1930	–	–
89058	do	1930	–	–
92468	U.S.S.R.	1931	–	–
92469	do	1931	–	–
92470	do	1931	–	–
96152	South Hamgyong, Korea	1932	–	–
181532	Japan	1949	–	–
181536	do	1949	–	–
181538	do	1949	–	–
181570	do	1949	–	–
196159	do	1951	–	–
196160	do	1951	–	–
200508	Shikoku, Japan	1952	–	–
227322	Hokkaido, Japan	1955	–	+
227325	do	1955	–	–
227329	do	1955	–	+
227331	do	1955	–	–
229354	Japan	1955	–	–
248509A	do	1958	–	+
261472	Hokkaido, Japan	1959	–	–
423706	Korea	1976	–	–
423942	Japan	1976	–	–
423943	do	1976	–	–
423944	do	1976	–	–
423947	do	1976	–	–
423949	do	1976	–	–
423953	do	1976	–	–
423954	do	1976	–	–

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4*, in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1]	
			Rj_2	Rj_4
	MATURITY GROUP II			
Kanro	Korea	1929	–	–
FC 01547	China (NE.)	1911	–	+
PI 30594	Niguta, Sungkiang, China (NE.)	1911	–	–
30599	do	1911	–	–
30600	Schwangcheng, Sungkiang, China (NE.)	1911	–	–
47131	Harbin, Sungkiang, China (NE.)	1919	–	–
54604	China (NE.)	1921	–	–
54607	do	1921	–	–
54608	do	1921	–	–
54619	Kaiyuan, Liaosi, China (NE.)	1921	–	–
54818	Harbin, Sungkiang, China (NE.)	1922	+	–
54859	do	1922	–	–
54862	do	1922	–	–
54873	do	1922	–	–
60279	Shenyan, China (NE.)	1924	–	+
60296-1	Chenkiang, China	1924	–	–
65338	Harbin, Sungkiang, China (NE.)	1925	–	+
65341	do	1925	–	+
65346	do	1925	–	+
65354	do	1925	–	+
65388	do	1925	–	–
68421	Schwangcheng, Sungkiang, China (NE.)	1926	–	–
68427	do	1926	–	–
68430	do	1926	–	–
68436	do	1926	–	–
68439	do	1926	–	+
70463	China (NE.)	1926	–	+
70476	Erhtaohotzu, China (NE.)	1926	–	–
70478	Mishan, Sungkiang, China (NE.)	1926	–	+
72337	China (NE.)	1927	–	–
72342	do	1927	–	+
73585	do	1927	–	–
80494	Yokohama, Japan	1929	–	–
80671	Tokyo, Japan	1929	–	–
81763	China (NE.)	1929	–	–
81767	do	1929	–	–
81768	do	1929	–	–
81770	do	1929	–	–
81771	do	1929	–	–
82184	Seoul, Korea	1929	–	–
84580	Suwon, Korea	1930	–	–
84609	do	1930	–	+
84637	do	1930	–	–

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles*, Rj_2 *and* Rj_4, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Rj_4
	MATURITY GROUP II—con.			
PI 84665	Suwon, Korea	1930	–	–
84673	do	1930	–	–
84681	do	1930	–	–
84750	do	1930	–	–
84928	Pyongyang, Korea	1930	–	–
84954	Seoul, Korea	1930	–	–
84965	Kobe, Japan	1930	–	–
84992	Urawa, Japan	1930	–	–
85012	do	1930	–	–
85014	do	1930	–	–
85021	Pyongyang, Korea	1930	–	–
85340	Suwon, Korea	1930	–	–
85492	do	1930	–	–
85508	do	1930	–	–
85625	do	1930	–	–
85671	China (NE.)	1930	–	–
86031	Obihiro, Hokushu, Japan	1930	–	–
86038	do	1930	–	–
86045	do	1930	–	–
86089	Japan	1930	–	+
86102	do	1930	–	–
86112	do	1930	–	–
86115	do	1930	–	+
86443	Omagari, Japan	1930	–	–
86454	do	1930	–	+
86463	do	1930	–	–
87065	South Kyongsang, Korea	1930	–	–
87619–1	North Hamgyong, Korea	1930	–	–
88810	Kanggye, North Pyongan, Korea	1930	–	–
88825	do	1930	–	–
89138	Kyongsong, Korea	1930	–	–
89154	do	1930	–	–
89156	do	1930	–	–
92460	U.S.S.R.	1931	–	–
92464	do	1931	–	–
92465	do	1931	–	–
92717	Kungchuling, Kirin, China (NE.)	1931	–	–
92719	do	1931	–	–
92733	do	1931	–	–
96171	North Hamgyong, Korea	1932	–	–
96549	Songchon, Korea	1932	–	–
181533	Japan	1949	–	–

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] *Rj*₂	*Rj*₄
	MATURITY GROUP II—con.			
PI 181534	Japan	1949	–	–
181537	do	1949	–	–
181541	do	1949	–	–
181548	do	1949	–	
196150	do	1951	–	
196154	do	1951	–	–
196158	do	1951	–	–
200479	Shikoku, Japan	1952	–	–
	MATURITY GROUP III			
PI 54583	Kaiyuan, Liaosi, China (NE.)	1921	–	–
54591	Yung River, China (NE.)	1921	–	+
54592	China (NE.)	1921	–	+
54608–2	Chu-t'ai, China (NE.)	1921	–	–
54610–1	Changchun, Kirin, China (NE.)	1921	–	+
54613	Tiehling, Liaosi, China (NE.)	1921	–	–
54615–1	Harbin, Sungkiang, China (NE.)	1921	–	–
54620–2	Changchun, Kirin, China (NE.)	1921	–	–
57334	China (NE.)	1923	–	–
60272	Shaohing, Chengkiang, China	1924	+	–
61940	Peking, China	1924	–	+
62483	Chaitang, China	1925	–	–
65379	Harbin, Sungkiang, China (NE.)	1925	–	–
68423	Schwangcheng, Sungkiang, China (NE.)	1926	–	+
68470	do	1926	–	–
68483	do	1926	–	–
68494	do	1926	–	–
68560	Anta, Heilungkiang, China (NE.)	1926	–	–
68621	do	1926	–	–
68756	Harbin, Sungkiang, China (NE.)	1926	–	+
68759	Anta, Heilungkiang, China (NE.)	1926	–	–
68806	Harbin, Sungkiang, China (NE.)	1926	–	–
69515	Kushan, Liaotung, China (NE.)	1926	–	–
69993	Shulan, Kirin, China (NE.)	1926	–	+
69995	Acheng, Sungkiang, China (NE.)	1926	–	+
70001	Mishan, Sungkiang, China (NE.)	1926	–	+
70014	Hailin, Sungkiang, China (NE.)	1926	–	–
70076	Lungching, Kirin, China (NE.)	1926	–	+
72232	Nanchang, Kiangsi, China	1927	–	–
79583	Anta, Heilungkiang, China (NE.)	1929	–	+
79616	China (NE.)	1929	–	–
79874–1	do	1929	–	+
80461	Nishigahara, Tokyo, Japan	1929	–	+
80470	Takadacho, Tokyo, Japan	1929	–	–
80481	Konon, Tokyo, Japan	1929	–	–

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4*, in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1]	
			*Rj*₂	*Rj*₄
	MATURITY GROUP III—con.			
PI 81027	Sapporo, Hokushu, Japan	1929	–	–
81038	do	1929	–	–
81041	do	1929	–	–
81780	Kotani, Japan	1929	–	–
82232	Korea	1929	–	–
82246–1	do	1929	–	–
82278	Kangnung, Korea	1929	–	–
82302	Seoul, Korea	1929	–	–
82308	do	1929	–	+
83940	Suwon, Korea	1930	–	–
84578	do	1930	–	+
84579	do	1930	–	+
84631	do	1930	–	+
84662	do	1930	–	–
84666	do	1930	–	–
84680	do	1930	–	+
84682	do	1930	–	–
84757	do	1930	–	–
84914	do	1930	–	–
84957	Shimonoseki, Japan	1930	–	–
84970	Kyoto, Japan	1930	–	–
84979	Uragawa, Japan	1930	–	–
84987	do	1930	–	–
85009–1	do	1930	–	–
85019	Pyongyang, Korea	1930	–	–
85356	Suwon, Korea	1930	–	–
85456	do	1930	–	–
85559	do	1930	–	–
85630	do	1930	–	–
85666	Tokyo, Japan	1930	–	+
85878	Morioka, Japan	1930	–	–
86004	Obihiro, Hokushu, Japan	1930	–	–
86006	do	1930	–	–
86024	do	1930	–	–
86026	do	1930	–	+
86025	do	1930	–	–
86032	do	1930	–	–
86053	do	1930	–	–
86098	do	1930	–	–
86510	Japan	1930	–	–
88353	Kaiyuan, Liaosi, China (NE.)	1930	–	+
91725–4	Pyongyang, Korea	1931	–	–
91729	do	1931	–	+

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Frequency of alleles[1] Rj_4
	MATURITY GROUP III—con.			
PI 95740	North Cholla, Korea	1932	–	–
96162	North Hamgyong, Korea	1932	–	–
96321	do	1932	–	+
96787	Korea	1932	–	–
97139	do	1932	–	+
157416	Suwon, Korea	1947	–	–
157491	do	1947	–	–
171449	Kanagawa, Japan	1948	–	–
173994	Korea	1949	–	–
181540	Japan	1949	–	–
181542	do	1949	–	–
181552	do	1949	–	–
187152	do	1950	–	–
196148	do	1951	–	–
196162	do	1951	–	–
	MATURITY GROUP IV			
FC 19976-1	Japan	1932	–	–
19979-4	do	1932	–	–
PI 19986	Yokohama, Japan	1907	–	–
54600	Liaoyung, Liaotung, China (NE.)	1921	–	+
54610-4	Chongchung, Kirin, China (NE.)	1921	–	+
54617	Fangtze, Shantung, China	1921	–	–
58955	Weihsien, Hopeh, China	1924	–	+
59849	Omagari, Japan	1924	–	–
60970	Peking, China	1924	–	–
62199	China	1924	–	+
63468	do	1925	–	+
64698	Suwon, Korea	1925	–	–
64747	Aizu, Wakamatsu, Japan	1925	–	–
68011	Kungchuling, China	1926	–	–
68449	China (NE.)	1926	–	–
68644	Inner Mongolia, China	1926	–	–
68768	Schwangcheng, Sungkiang, China (NE.)	1926	–	+
70013	Chihsinghlo, Kirin, China (NE.)	1926	–	–
71444	Nanking, Kiangsu, China	1927	–	+
71463	do	1927	–	–
79696	Harbin, Sungkiang, China (NE.)	1929	–	+
79743	Anta, Heilungkiang, China (NE.)	1929	–	+
80466-2	Nichigahara, Tokyo, Japan	1929	–	+
80473	Tokyo, Japan	1929	–	–
80479	Iwateken, Japan	1929	–	–
80488	Yokohama, Japan	1929	–	–
80828-1	Fukushimaken, Japan	1929	–	–

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4*, in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Rj_4
	MATURITY GROUP IV—con.			
PI 80837	Rikuu, Japan	1929	–	–
81023	Sapporo, Hokushu, Japan	1929	–	+
81030	do	1929	–	–
81034-2	do	1929	–	+
81042-1	do	1929	–	–
81764	China (NE.)	1929	–	+
82210	Kanghwa Island, Kyonggi, Korea	1929	–	–
82218	Sosa, Kyonggi, Korea	1929	–	–
82246	Seoul, Korea	1929	–	+
82264	do	1929	–	+
82315	do	1929	–	–
83889	Suwon, Korea	1930	–	–
83892	do	1930	–	–
83944	do	1930	–	–
84594	do	1930	–	+
84628	do	1930	–	–
84632	do	1930	–	+
84633	do	1930	–	–
84639	do	1930	–	–
84713	do	1930	–	–
84751	do	1930	–	+
84807	do	1930	–	–
84912	do	1930	–	–
84959	Shimonoseki, Japan	1930	–	–
84960	do	1930	–	–
84985	Urawa, Japan	1930	–	–
85626	Suwon, Korea	1930	–	–
85665	Tokyo, Japan	1930	–	–
86007	Obihiro, Japan	1930	–	–
86060	do	1930	–	–
88491	Fuyu, Kirin, China (NE.)	1930	–	+
91073	Kanggye, North Pyongan, Korea	1931	–	–
91100-4	Kungchuling, Kirin, China (NE.)	1931	–	–
91103	do	1931	–	–
91679	Pyongyang, Korea	1931	–	–
91719	do	1931	–	–
92689	Kungchuling, Kirin, China (NE.)	1931	–	+
92713	do	1931	–	+
94159-3	Kagoshimaken, Japan	1931	–	+
95769	South Kyongsang, Korea	1932	–	–
95853	South Chungchong, Korea	1932	–	–
96093	South Pyongan, Korea	1932	–	–
103080	Honan, China	1933	–	+

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Frequency of alleles[1] Rj_4
	MATURITY GROUP IV—con.			
PI 103091	Honan, China	1933	-	+
124871	Hokkaido, Japan	1937	-	-
157395	Suwon, Korea	1947	-	-
157396	do	1947	-	-
157424	do	1947	-	-
171427	China	1948	-	+
171431	Ma-chu Ch'iao, Hopeh, China	1948	-	+
171434	Peking, China	1948	-	+
171454	Kanagawa, Japan	1948	-	-
173995	Korea	1949	-	-
179826	Peking, China	1949	-	+
181539	Japan	1949	-	-
181557	do	1949	-	-
196167	Korea	1951	-	-
196172	do	1951	-	-
200504	Shikoku, Japan	1952	-	-
200519	do	1952	-	-
200522	do	1952	+	-
209335	Hokkaido, Japan	1953	-	-
219783	Hyogoken, Japan	1954	-	+
224271	do	1955	-	-
253654	China	1958	-	-
253659	do	1958	-	+
	MATURITY GROUP V			
Arlington	Paoting, Hopeh, China	1908	-	+
Peking	China	1907	-	+
Virginia	do	1907	-	+
PI 59845	Omagari, Japan	1924	-	-
60269	Kwangju, South Cholla, Korea	1924	-	+
60273	Shaohing, Chekiang, China	1924	-	-
60296	do	1924	-	+
62203	Tangshan, Hopeh, China	1924	-	+
62204	do	1924	-	-
65342	Harbin, Sungkiang, China (NE.)	1925	-	-
71465	Nanking, Kiangsu, China	1927	-	-
71667	do	1927	-	-
71677	do	1927	-	+
79832	Harbin, Sungkiang, China (NE.)	1929	-	-
80466	Nichigahara, Tokyo, Japan	1929	-	-
80498	Yokohama, Japan	1929	-	-
81042	Sapporo, Japan	1929	-	-
81774	Kawazoe, Japan	1929	-	-
82286	Seoul, Korea	1929	-	-
82588	do	1929	-	-

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles*, Rj_2 *and* Rj_4, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Frequency of alleles[1] Rj_4
	MATURITY GROUP V—con.			
PI 83836	Tanchon, South Hamgyong, Korea	1929		–
83874	Kangdong, South Pyongan, Korea	1929	–	
83942	Suwon, Korea	1929		–
84669	do	1929	–	–
84910	Pyongyang, Korea	1929		+
84949	Pusan, South Kyongsang, Korea	1929	–	
85666-S	Tokyo, Japan	1930	–	
86045-S	Obihiro, Hokushu, Japan	1930	–	+
86078	do	1930	–	–
86084	do	1930		+
86113-S	do	1930		–
86465	Omagari, Japan	1930		
86543	Test, Japan	1930	–	
86892	Kyonggi, Korea	1930	–	
86982	North Cholla, Korea	1930	–	+
87037	Korea	1930		
88490	Hsiungyaocheng, China	1930		
88820	Kanggye, North Pyongan, Korea	1930		
89061	Dairen, China (NE.)	1930	–	–
89154S	Kyongsong, Korea	1930	–	–
90243	Nampo, Korea	1930	–	–
90251	Seoul, Korea	1930		–
90481	Ta Hsien, Szechwan, China	1930		
91100	Kungchuling, Kirin, China (NE.)	1930		–
91159-S	Kaiyuan, Liaosi, China (NE.)	1930	–	–
91725	Pyongyang, Korea	1930	–	–
93055-S	Hangchow, Chenkiang, China	1931	–	–
95780	North Kyongsang, Korea	1932	–	–
103079	Kaifeng, Honan, China	1933	–	+
103419	Harbin, Sungkiang, China (NE.)	1933	–	–
123577	Chingyuan, Hopeh, China	1937	–	–
123587	do	1937	–	–
123590	do	1937	–	–
157394	Suwon, Korea	1947	–	–
157406	do	1947	–	–
157413	do	1947	–	+
171430	Shensi, China	1948	–	+
171442	An Yang, Honan, China	1948	–	+
179823	Honan, China	1949	–	–
179825	Chingyuan, Hopeh, China	1949	–	–
200447	Shikoku, Japan	1952	–	+
200450	do	1952	–	–
200468	do	1952	–	+

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Frequency of alleles[1] Rj_4
	MATURITY GROUP V—con.			
PI 200472	Shikoku, Japan	1952	–	–
200495	do	1952	–	–
200503	do	1952	–	–
200510	do	1952	–	–
200534	do	1952	–	–
200546	do	1952	–	–
209333	Japan	1953	–	+
227557	Hokkaido, Japan	1956	–	+
229315	Tokyo, Japan	1956	–	+
229335	do	1956	–	–
229337	do	1956	–	–
229339	do	1956	–	–
229346	do	1956	–	–
229347	do	1956	–	+
229350	do	1956	–	–
235347	do	1956	–	+
319527	China	1967	–	–
319528	India	1967	–	–
339866	Korea	1969	–	–
339867	do	1969	–	–
339869	do	1969	–	–
339978	Uijongbu, Kyonggi, Korea	1969	–	–
339979	do	1969	–	+
339980	Suwon, Korea	1969	–	–
339982	Inchon, Korea	1969	–	–
346306	India	1970	–	–
346307	do	1970	–	–
346308	do	1970	–	–
398193	Seoul, Korea	1973	–	–
398323	Korea	1973	–	–
398324	do	1973	–	–
398605	do	1973	–	–
398713	do	1973	–	–
398829	do	1973	–	–
398948	do	1973	–	–
	MATURITY GROUP VI			
Delsoy	PI 85355, Korea	1930	–	–
Easy Cook	PI 34702, China	1894	–	–
Haberlandt	Korea	1901	–	–
Hahto	PI 40118, Japan	1915	–	–
Hayseed	PI 71525, Nanking, Kiangsu, China	1927	–	+
Laredo	PI 40658, China	1914	–	+
Old Dominion	PI 44512, China	1917	–	+

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4*, in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Frequency of alleles[1] Rj_4
	MATURITY GROUP VI—con.			
Rokusun	PI 80481, Japan	1929	–	–
FC 03981	Tottori, Japan	1924	–	+
PI 36906	Shuchiatun, China (NE.)	1913	–	–
54610	Changchung, Kirin, China (NE.)	1921	–	+
79825	Harbin, Sungkiang, China (NE.)	1929	–	–
79862	do	1929	–	–
80468	Tokyo, Japan	1929	–	–
80476	Yokohama, Japan	1929	–	+
81029	Sapporo, Hokushu, Japan	1929	–	–
81037	do	1929	–	+
82312	Seoul, Korea	1929	–	+
85010	Urawa, Japan	1929	–	+
85465	Suwon, Korea	1929	–	+
85476	do	1929	–	+
85490	do	1929	–	–
86091	Obihiro, Hokushu, Japan	1930	–	–
86109	do	1930	–	–
86490	Omagari, Japan	1930	–	–
86904	North Chungchong, Korea	1930	–	–
87002	Korea	1930	–	–
88461	Hsiungyaocheng, China (NE.)	1930	–	–
88816–S	Kanggye, North Pyongan, Korea	1930	–	–
89775	China	1930	–	+
90406	Changping, Hopeh, China	1930	–	–
90495	Peking, China	1930	–	–
90499	Kalgan, Chahar, China	1930	–	–
90577	Dairen, China (NE.)	1930	–	–
90768	China	1930	–	+
92567	Kungchuling, Kirin, China (NE.)	1931	–	+
92601	do	1931	–	–
92707–S	do	1931	–	+
94159	Kagoshimaken, Tokyo, Japan	1931	–	–
95860	South Chungchong, Korea	1932	–	–
95969	Kangwon, Korea	1932	–	–
96035	North Hamgyong	1932	–	–
96257	do	1932	–	–
96354	do	1932	–	+
97150	Sariwon, Hwanghae, Korea	1932	–	+
97161	do	1932	–	–
157469	Suwon, Korea	1947	+	–
157475	do	1947	–	–
157476	do	1947	–	–
165672	Nanking, Kiangsu, China	1948	–	–

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles*, Rj_2 *and* Rj_4, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Frequency of alleles[1] Rj_4
	MATURITY GROUP VI—con.			
PI 165673	Nanking, Kiangsu, China	1948	+	−
171436	Szechwan, China	1948	−	+
171437	do	1948	−	−
171439	Nanking, Kiangsu, China	1948	+	−
171440	do	1948	−	−
171441	Shensi, China	1948	−	+
171443	do	1948	−	−
171444	Waukiang, Hopeh, China	1948	−	+
181556	Japan	1949	−	−
181559	do	1949	−	+
181561	do	1949	−	+
187156	do	1949	−	+
200446	Shikoku, Japan	1952	−	+
200449	do	1952	−	+
200461	do	1952	−	+
200483	do	1952	−	+
200497	do	1952	−	−
200502	do	1952	−	−
200505	do	1952	−	−
200553	do	1952	−	−
201421	China	1952	−	+
201422	do	1952	−	−
205384	Karachi, Pakistan	1953	−	−
219698	Mingora, Pakistan	1954	−	−
219732	Kurram Valley, Pakistan	1954	−	−
221972	Kiyosata, Japan	1954	−	+
227214	Nagoya, Japan	1956	−	−
229320	Tokyo, Japan	1956	−	−
230974	do	1956	+	−
230976	do	1956	−	−
230978	do	1956	−	−
230979	do	1956	−	+
304217	Nagano, Japan	1965	−	+
340050	Taegu, Korea	1969	−	+
365426	Pakistan	1971	−	−
398192	Seoul, Korea	1973	−	−
398194	do	1973	−	18%+
398220	do	1973	−	−
398254	Ganghwa, Gyeonggi, Korea	1973	−	−
398292	Yeoju, Gyeonggi, Korea	1973	−	−
398372	Chuncheon, Gang-weon, Korea	1973	−	−
398570	Chungju, Chungcheong-Bug, Korea	1973	−	+
398606	Jecheon, Chungcheong-Bug, Korea	1973	−	−

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4*, in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Rj_4
	MATURITY GROUP VI—con.			
PI 398781	Decheon, Chungcheong-Nam, Korea	1973	–	–
398827	Buyeo, Chungcheong-Nam, Korea	1973	–	+
398853	Nonsan, Chungcheong-Nam, Korea	1973	–	+
398967	Chin-do Gun, Chon-la-nam, Korea	1973	–	–
399102	Cholla, Pukdo, Korea	1973	–	+
	MATURITY GROUP VII			
Charlee	PI 71663, Nanking, China	1927	+	–
Clemson	PI 71569, Nanking, China	1927	–	+
CNS	PI 71597, Nanking, China	1927	+	–
Creole	PI 71614, Nanking, China	1927	–	+
Georgian	PI 71538, Nanking, China	1927	–	–
Missoy	PI 71664, Nanking, China	1927	+	+
Monetta	PI 71608, Nanking, China	1927	+	+
Palmetto	PI 71587, Nanking, China	1927	–	+
Pluto	PI 72219, Anwai, China	1927	–	+
Tarheel Black	PI 14952, Shanghai, China	1905	–	–
PI 71558	Nanking, Kiangsu, China	1927	–	+
71564	do	1927	–	+
71570	do	1927	+	+
79861	Inner Mongolia, China	1929	–	–
84642	Suwon, Korea	1929	–	–
84967	Kobe, Japan	1929	–	–
85416	Suwon, Korea	1929	–	–
87565	Junsenmen, Korea	1929	–	–
95960	Kangwon, Korea	1932	–	–
97094	Korea	1932	–	–
97100	do	1932	–	–
165563	Almora, India	1948	–	–
165578	do	1948	–	–
165583	do	1948	–	–
165671	Nanking, Kiangsu, China	1948	–	–
165675	do	1948	–	–
165676	do	1948	–	–
165896	United Provinces, India	1948	–	–
165914	Chausa, United Provinces, India	1948	–	–
165926	Karmi, United Provinces, India	1948	–	–
165929	do	1948	–	–
171438	Szechwan, China	1949	–	+
171445	Nanking, Kiangsu, China	1949	–	–
171446	do	1949	–	–
171451	Kanagawa, Japan	1948	–	–
174857	Sirka, Kumaon, India	1949	–	–
181560	Japan	1949	–	–

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Rj_4
	MATURITY GROUP VII—con.			
PI 181564	Japan	1949	–	+
181566	do	1949	–	–
181567	do	1949	–	+
181568	do	1949	–	–
181569	do	1949	–	–
187154	do	1950	–	–
192867	Bogor, Java, Indonesia	1950	–	–
192868	do	1950	–	–
192869	do	1950	–	+
192870	do	1950	–	–
192871	do	1950	–	–
192872	do	1950	–	–
192873	do	1950	–	–
192874	do	1950	–	+
198078	India	1951	–	–
200445	Shikoku, Japan	1952	–	–
200448	do	1952	–	–
200451	do	1952	–	+
200452	do	1952	–	–
200462	do	1952	–	–
200474	do	1952	–	–
200490	do	1952	–	–
200500	do	1952	–	–
200516	do	1952	–	+
200523	do	1952	–	–
200524	do	1952	–	+
200527	do	1952	–	+
200528	do	1952	–	–
201423	China	1952	–	–
208431	Thonje, India	1953	–	–
208433	Kathmandu Valley, India	1953	–	–
208437	Pokhara, India	1953	–	–
208438	do	1953	–	–
208782	Sasayama, Japan	1953	–	–
208783	do	1953	48%+	–
208788	do	1953	90%+	82%+
219652	Indonesia	1954	–	–
219655	do	1954	–	+
227219	Kyoto, Japan	1956	–	+
227221	do	1956	–	+
227224	do	1956	–	+
228065	Aomari, Japan	1956	–	–
229358	Tokyo, Japan	1956	–	–

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4*, in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Rj_4
	MATURITY GROUP VII—con.			
PI 255734	Kulu Valley, Punjab, India	1958	–	–
256376	New Delhi, India	1959	–	–
281885	Indonesia	1962	–	–
281889	do	1962	–	–
323275	Burma	1967	–	–
323276	Pakistan	1967	–	–
323550	Niglat, Nainital, India	1967	–	–
346298	India	1970	–	–
376844	Chiang Mai, Thailand	1973	–	–
377578	Khon Kaen, Thailand	1973	–	+
	MATURITY GROUP VIII			
Arisoy	PI 86736, Konosu, Japan	1908	–	+
Barchet	PI 23232, Shanghai, China	1924	–	–
Biloxi	PI 23211, Tangyi, Pingyuan, China	1950	–	+
Cherokee	Hangchow, Chenkiang, China	1931	+	+
Nanda	PI 95727, North Cholla, Korea	1932	–	–
Otootan	Taiwan	1911	–	–
Seminole	PI 93058, Hangchow, Chenkiang, China	1931	+	–
FC 31592	Indonesia	1944	–	–
PI 85897	Shizuoka, Japan	1929	–	–
133226	Buitenzorg, Java, Indonesia	1939	–	–
165674	Nanking, Kiangsu, China	1949	–	–
174854	Tsareo, India	1949	–	–
174859	Tehri, India	1949	–	–
174860	do	1949	–	–
174861	do	1949	–	–
174867	do	1949	–	–
175175	Paton, Kumaon, India	1949	–	–
175176	Chilkot, Kumaon, India	1949	–	–
175177	Tusera Pani, India	1949	–	–
175178	Rafla, India	1949	–	–
175179	Sirtang, Kumaon, India	1949	–	–
175184	Maleri, Tehri, India	1949	–	–
175190	Bariye, Tehri, India	1949	–	–
181696	Indonesia	1950	–	+
181697	do	1950	–	+
181698	do	1950	–	+
183900	Malaya	1950	–	–
197182	do	1951	–	14%+
200486	Shikoku, Japan	1952	–	–
200487	do	1952	–	–
200488	do	1952	–	–
200515	do	1952	–	+

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Frequency of alleles[1] Rj_4
MATURITY GROUP VIII—con.				
PI 200520	Shikoku, Japan	1952	−	+
200521	do	1952	−	−
200526	do	1952	−	−
200550	do	1952	−	+
200551	do	1952	−	−
200832	Bhamo, Kachin, Burma	1952	−	−
205899	Thailand	1953	−	+
205901	do	1953	−	+
205903	do	1953	−	39% +
205906	do	1953	−	−
205907	do	1953	−	+
205908	do	1953	−	+
205909	do	1953	−	−
205910	do	1953	−	+
205911	do	1953	−	+
205912	do	1953	−	+
205913	do	1953	−	−
205914	do	1953	−	+
205915	do	1953	−	+
208203	Indonesia	1953	33% +	37% +
208204	do	1953	−	−
208429	Kathmandu Valley, India	1953	−	−
208430	Marsyandi, Khola, India	1953	−	−
208434	Kathmandu Valley, India	1953	−	−
208435	Nalma, India	1953	−	−
208439	Pokhara, India	1953	−	+
209340	Hokkaido, Japan	1953	−	−
209837	New Delhi, India	1953	−	−
219653	Indonesia	1954	−	+
219654	do	1954	−	+
224268	Hyogo, Japan	1955	−	−
228056	Shikoku, Japan	1955	−	+
262180	Japan	1960	−	−
274506	Taiwan	1961	−	+
274507	do	1961	−	−
281887	Indonesia	1962	−	+
281888	do	1962	−	+
281890	do	1962	−	+
281896	do	1962	−	+
284873	Japan	1962	−	+
307836	Jabalpur, India	1966	−	−
307838	do	1966	−	+
307881	do	1966	−	−

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4*, in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Frequency of alleles[1] Rj_4
	MATURITY GROUP VIII—con.			
PI 310441	Taiwan	1966	–	+
323551	Bumsyum, Nainital, India	1967	–	–
323552	Bajina, Nainital, India	1967	–	–
323553	Uprari, Nainital, India	1967	–	–
323559	Sitlakhet, Nainital, India	1967	–	–
323561	Bari, Almora, India	1967	–	–
323562	Sakar, Almora, India	1967	–	–
323575	Niri, Almora, India	1967	–	–
326578	China	1969	–	–
331793	Vietnam	1969	–	+
331794	do	1969	–	87%+
331795	do	1969	–	+
346304	India	1969	–	–
374154	Mhow, India	1972	–	–
374158	Punarum, Mhow, India	1972	–	–
374159	Kinsan Singh, Mhow, India	1972	–	–
374163	Mahadeo Sahara, Indore, India	1972	–	–
374164	do	1972	–	–
374168	do	1972	–	–
374173	Ujjain, India	1972	–	–
374178	Premnathji, Ujjain, India	1972	–	–
376843	Chiang Mai, Thailand	1972	–	+
376845	Japan	1972	–	+
379623	Taichung, Taiwan	1973	–	+
	MATURITY GROUP IX			
PI 174852	Paton, Kumaon, India	1949	–	–
181699	Indonesia	1950	–	+
205901	Thailand	1953	–	+
209834	Nalma, India	1953	–	–
307597	India	1966	–	–
307853	Jabalpur, India	1966	–	–
307865	do	1966	–	–
307891	do	1966	–	–
309655	Malaya	1966	–	90%+
323563	Parolia, Almora, India	1967	–	–
323566	Kousani, Almora, India	1967	–	–
323576	Pan, Almora, India	1967	–	–
323577	Naughari, Almora, India	1967	–	–
323580	Panuwa Dokhan, Nainital, India	1967	–	–
340898	Thailand	1969	–	–
340899	do	1969	–	–
340900	do	1969	–	–
340901	do	1969	–	–
341256	Vietnam	1968	–	+
341257	do	1968	–	+

See footnote at end of table.

TABLE 1.—*Frequencies of nodulation response alleles,* Rj_2 *and* Rj_4, *in soybean plant introduction lines by maturity groups*—Continued

Lines	Origin	Date of introduction	Frequency of alleles[1] Rj_2	Rj_4
	MATURITY GROUP X			
PI 163308	Shim, Kulu Valley, East Punjab, India	1948	–	+
205910	Thailand	1953	–	+
261271	do	1960	–	+
281883	Indonesia	1962	–	+
281891	do	1962	–	+
281892	do	1962	–	+
281894	do	1962	–	+
281895	do	1962	–	+
281896	do	1962	–	+
281897	do	1962	–	+
281898	Malaya	1962	–	+
281900	do	1962	–	+
281901	do	1962	–	+
281902	do	1962	–	+
281905	do	1962	–	+
281906	do	1962	–	+
281908	do	1962	–	+
281909	do	1962	–	+
281910	do	1962	–	+
281913	Thailand	1962	–	+
307837	Jabalpur, India	1966	–	+
307840	do	1966	–	+
307846	do	1966	–	+
307852	do	1966	–	+
307858	do	1966	–	+
307864	do	1966	–	–
307872	do	1966	–	+
307877	do	1966	–	+
307883	do	1966	–	+
307888	do	1966	–	–
307894	do	1966	–	94%+
307899	do	1966	–	+
307900	do	1966	–	+
340902	Thailand	1969	–	+
340903	do	1969	–	+

[1] + = presence of Rj_2 or Rj_4 allele, – = absence of Rj_2 or Rj_4 allele, %+ = percentage of sample with Rj_2 or Rj_4 allele in heterogeneous lines.

TABLE 2.—*Summary of frequencies of* Rj2 *and* Rj4 *alleles in soybean plant introduction lines by maturity group and country of origin*

Category	Plant introduction lines	Frequency of alleles *Rj2*	Frequency of alleles *Rj4*
MATURITY GROUP	*Number*	*Percent*	*Percent*
00	11	0	9.0
0	23	0	15.8
I	94	0	12.8
II	93	0	16.1
III	93	1.1	25.8
IV	93	1.1	33.3
V	98	1.0	26.5
VI	98	4.1	37.9
VII	90	7.1	27.5
VIII	99	3.4	39.3
IX	20	0	24.7
X	35	0	94.3
Total or proportion of total	847	2.0	29.7
COUNTRY OF ORIGIN			
U.S.S.R.	14	0	0
China	248	4.0	35.7
Korea	171	.6	19.4
Japan	243	2.2	24.2
Taiwan	5	0	60.0
Vietnam	5	0	97.4
Burma and Malaya	14	0	71.7
Thailand	26	0	66.9
Indonesia	33	1.0	64.8
India and Pakistan	88	0	15.8
Total or proportion of total	847	2.0	29.7

TABLE 3.—*Frequencies of nodulation response alleles,* Rj2 *and* Rj4, *in 1979 U.S. regional preliminary and uniform soybean test lines*

Lines[1]	Parentage	Frequency of alleles[2] *Rj2*	Frequency of alleles[2] *Rj4*
UNIFORM TEST 00			
*1. Altona	0-52-903 × Flambeau	–	–
*2. Clay (0)	Capital × Renville	–	–
*3. Maple Arrow	Harosoy × 840-7-3	–	–
*4. McCall	(Acme × Chippewa) × Hark	–	–
*5. Portage (00)	Acme × Comet	–	–
6. OAC-22-815	Harosoy 63 × Fiskeby V	–	–
7. BC 1413	(Amsoy × Portage) × 840-73	–	–
8. BD 2117	(Amsoy × Portage) × 827-4	–	–
9. M70-411	II-64-3 × II-63-217Y	–	–
10. M71-17	Clay × Evans	–	–

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and Rj_4, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2]	
		Rj_2	*Rj_4*
UNIFORM TEST 00—con.			
11. M71-25	Clay × Evans	-	-
12. M71-38	Wilkin × H-62-263	-	-
13. M71-39	Wilkin × H-62-275	-	-
UNIFORM TEST 0			
*1. Altona (00)	0-52-903 × Flambeau	-	-
*2. Clay	Capital × Renville	-	-
*3. Evans (0)	Merit × Harosoy	-	-
*4. Hodgson 78 (I)	Hodgson × Merit	-	-
5. M70-153	Steele × Hodgson	-	-
6. M70-334	M62-93 × M64-3	-	-
7. M70-368	H-64-3 × H-63-217Y	-	-
8. M71-43	Wilkin × H-63-217Y	-	
9. M71-52	Evans × H-62-345	-	-
10. M71-54	Evans × H-62-345	-	-
11. M71-57	Evans × H-63-217Y	-	-
12. M71-65	Steele × H-63-194	-	-
13. M71-99	H-61-224 × H-63-217Y	-	-
14. M71-107	H-61-224 × H-63-217Y	-	-
15. M72-3	Evans × Hodgson	-	-
PRELIMINARY TEST I			
*1. Corsoy (II)	Harosoy × Capital	-	-
*2. Evans (0)	Merit × Harosoy	-	-
*3. Hodgson 78 (I)	Hodgson[7] × Merit	-	-
4. A73D16-2	Hark × Wayne	-	-
5. A73D2876	Amsoy × (Harosoy[6] × T117)	-	+
6. A75-102032 (Weber)	AP6 (40 lines intermated 3 times)	-	-
7. A78-121007	A73-19084 × Pride B-216	-	-
8. A78-121014	Pride B-216 × Hodgson	-	-
9. A78-122008	Pride B-216 × M68-49	-	-
10. A78-122030	Hodgson × L70T-543	-	-
11. A78-122031	SRF 350 × Pride B-216	-	-
12. A78-123002	C1520 × Coles	-	-
13. A78-123005	A73-19084 × A72-512	-	-
14. A78-123009	Agripro 25 × Pride B-216	-	-
15. A78-123018	Pride B-216 × Hodgson	-	-
16. A78-124004	Pride B-216 × L66-1359	-	-
17. A78-124018	Pride B-216 × M65-442	-	-
18. A78-124020	A73-19084 × Pride B-216	-	-
19. A78-124023	PA6 IYT (S_3) C1 2-219-2	-	-
20. A78-125008	Pride B-216 × AX 901-40-2	-	-
21. A78-125029	Pride B-216 × AX900-4-3	-	-
22. C1584	L72-844C-1 × Wells	-	-
23. L76-187	Williams × (Chippewa × Custer)	-	-

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and Rj_4, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2]	
		Rj_2	*Rj_4*
PRELIMINARY TEST I—con.			
24. M70-376	H-64-3 × Clay	–	–
25. M70-388	H-64-3 × Corsoy	–	–
26. M70-390	H-64-3 × Corsoy	–	–
27. M70-422	H-64-3 × H-63-217Y	–	–
28. M70-571	Evans × H-64-3	–	–
29. M70-597	Steele × AP68-1016		–
30. M71-80	Merit × H-62-263	–	–
31. M71-100	H-61-22 × H-63-217Y	–	
32. M75-2	Hodgson[4] × [M67-141 × (Chippewa × Higan)]	–	
UNIFORM TEST I			
*1. Corsoy (II)	Harosoy × Capital	–	–
*2. Evans (0)	Merit × Harosoy	–	–
*3. Hodgson 78 (I)	Hodgson[7] × Merit	–	–
4. A75-102032 (Weber)	AP6 (40 lines intermated 3 times)	–	–
5. A76-102009 (Hardin)	Corsoy[3] × Cutler 71	–	–
6. A76-103002	AP6	–	–
7. A77-112008	Washington × A72-512	–	–
8. A77-112023	AP6M(S1) C1	–	–
9. L74-3897	Williams × Beeson	–	–
10. L75-3632	Corsoy[6] × Lee 68	–	–
11. M70-128	Evans × M63-217Y	–	–
12. M70-260	M62-93 × M63-217Y	–	–
PRELIMINARY TEST II			
*1. Corsoy (II)	Harosoy × Capital	–	–
2. A75-102032 (I) (Weber)	AP6 (40 lines intermated 3 times)	–	–
3. A74-302012 (III) (Pella)	L66L-137 (Wayne × L57-0034) × Calland	–	–
4. C1545 (Century)	Calland × Bonus	–	–
5. A73D16-3	Hark × Wayne	–	–
6. A78-122028	Hodgson × Sloan	–	–
7. A78-223022	AP614T (S_3) C1	–	–
8. A78-225002	C1515 × Coles	–	–
9. A78-227012	Pride B-216 × AX901-40-2	–	–
10. A78-227013	Pride B-216 × AX901-40-2	–	–
11. A78-227015	Pride B-216 × AX901-40-2	–	–
12. A78-227016	Pride B-216 × AX901-40-2	–	–
13. A78-321009	Williams × Sloan	–	–
14. A78-321011	Pride B-216 × Agripro 25	–	–
15. C1580	Beeson × CX407 BC_7-255	–	+
16. C1581	Beeson × CX407 BC_7-255	–	+
17. HC75-6399	M65-115 × L72D-549	–	+

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and Rj_4, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2] Rj_2	Rj_4
	PRELIMINARY TEST II—con.		
18. HC76-644	L66-531 × Williams	–	–
19. HC76-710	Wells × York	–	–
20. HC76-1010	Woodworth × L72U-758	–	–
21. HC76-3790	L72U2567 × L72U-3331	–	–
22. HC76-4373	L72U2567 × Williams	–	–
23. L75-8033	Williams × L70-2283 (Chippewa × Custer)	–	–
24. L75-8460	Beeson × L70-2450 (Wayne × Custer)	–	–
25. L75-10513	Beeson × (L70-6494 × Wells)	–	+
26. L76-129	Beeson × L70-2283 (Chippewa × Custer)	–	–
27. L76-136	Beeson × L70-2283 (Chippewa × Custer)	–	–
28. L76-140	Beeson × L70-2283 (Chippewa × Custer)	–	–
29. L76-141	Beeson × L70-2283 (Chippewa × Custer)	–	–
30. L77-176	Williams × L70-2283 (Chippewa × Custer)	–	–
31. U46762	Merit × Cutler 71	–	+
32. U56355	C1477 × C1421	–	+
33. U56491	Adelphia × Clark 63	–	–
34. U57141	Calland × Cutler	–	–
35. U59207	Williams × Amsoy 71	–	52% +
36. U59236	Williams × Amsoy 71	–	–
	UNIFORM TEST II		
*1. Beeson	C1253 × Kent	–	–
*2. Corsoy (II)	Harosoy × Capital	–	–
*3. Harcor	Corsoy × OX383 (Corsoy × Harosoy 63)	–	–
4. A75-102032 (I) (Weber)	AP6 (40 lines intermated 3 times)	–	–
*5. Nebsoy	C1432 × C1430	–	–
*6. Wells II	Wells[8] × Arksoy	–	–
7. A74-302012 (III) (Pella)	L66L-137 (Wayne × L57-0034) × Calland	–	–
8. A77-211021	Beeson × A72-507	–	–
9. A77-212006	Hodgson × M65-69	–	–
*10. C Beeson PR3 (Beeson 80)	Beeson × Arksoy	–	–
11. C1545 (Century)	Calland × Bonus	–	–
12. HW74-618 (Gnome)	Williams × Ransom	–	–
13. H75-5605	L67L-172 × V68-1034	–	–
14. H7703	Beeson × Wells	–	+
15. L73D-195	C1477 (Amsoy[6] × C1253) × Corsoy	–	–

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and* Rj_4, *in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2] Rj_2	Frequency of alleles[2] Rj_4
	UNIFORM TEST II—con.		
16. L73-4673	Corsoy × L66L-154	–	–
17. L75-3674	Corsoy^6 × Lee 68	–	–
18. U11239	Amsoy × Wayne	–	–
19. U20325	C1371-71 × C1253	–	–
	PRELIMINARY TEST III		
1. C1545 (II) (Century)	Calland × Bonus	–	–
*2. Cumberland (III)	Corsoy × Williams	–	–
*3. Union (IV)	Williams × SL12 (Wayne *Rpm Rps*)	–	–
4. A74-302012 (Pella)	L66L-137 (Wayne × L57-0034) × Calland	–	–
5. A78-322024	Williams × Sloan	–	–
6. A78-323011	Coles × Agripro Ex 7710	–	–
7. A78-323019	A72-512 × NK S-1346	–	–
8. A78-323031	Sloan × C1520	–	–
9. A78-324002	A72-512 × Pride B-216	–	94% +
10. A78-325033	AP6 (1YT) S_3 C1	–	–
11. A78-326026	Pride B-216 × AX896-67-3	–	–
12. A78-326032	AX1390	–	–
13. C1583	M61-224 × Williams	–	–
14. HC76-3710	L72U2567 × Williams	–	–
15. HC76-3715	L72U2567 × Williams	–	–
16. HC76-4030	L72U2567 × Essex	–	–
17. HC76-4054	L72U2567 × L72U-41	–	–
18. HC76-4092	Williams × L72U-41	–	–
19. HW7847	Evans × Williams	–	–
20. HW7867	IVR4311 × C1483	–	–
21. K1047	Tracy × Bonus	–	+
22. L75-8121	Williams × L70-2283 (Chippewa × Custer)	–	–
23. L75-8209	Williams × L70-2450 (Wayne × Custer)	–	–
24. L75-12061	Wells × Williams	–	–
25. L75-12341	Wells × Williams	–	–
26. L75-12050	Wells × Williams	–	–
27. L75-12386	Wells × Williams	–	–
28. L77-178	Williams × L70-2283 (Chippewa × Custer)	–	–
29. U20109	Amsoy × Wayne	–	–
30. U46192	Amsoy × Cutler	–	–
31. U46682	L65-4050 × L62-1547	–	–
32. U57073	Wayne × Cutler	–	–
33. U57139	Beeson × Clark 63	–	–
34. U57162	Wayne × Calland	–	–
35. U57250	Adelphia × Amsoy	–	–
36. U59245	Williams × Amsoy 71	–	–

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and Rj_4, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2]	
		Rj_2	Rj_4
UNIFORM TEST III			
1. C1545 (II) (Century)	Calland × Bonus	–	–
*2. Cumberland (III)	Corsoy × Williams	–	–
*3. Elf	Williams × Ransom	–	–
*4. Union (IV)	Williams[5] × SL12 (Wayne *Rpm Rps*)	–	–
5. A74-302012 (Pella)	L66L-137 (Wayne × L57-0034) × Calland	–	–
6. A75-305022	Wye × IVR Ex 4731	–	+
7. A76-304019	(Beeson × AP68-1016) × (L15 × Calland)	–	–
8. A77-214022	L70T-543 × Harcor	–	–
9. A77-214035	AP6 (40 lines intermated 3 times)	–	–
10. A77-311031	AP6 (40 lines intermated 3 times)	–	–
11. A77-314013	A73-21030 × Williams	–	–
12. A77-314017	Coles × A72-507	–	+
13. A77-315024	A72-512 × Agripro Ex 50734	–	+
14. C1566	Beeson × PI 68788	–	+
15. H74-3382	Williams × Ransom	–	–
16. HW74-3384 (Sprite)	Williams × Ransom	–	–
17. HW74-3385	Williams × Ransom	–	–
18. L22 (Will)	Williams[5] × (Clark[6] × T117) Williams Dt_2	–	–
19. L23 (Williams 79)	Williams[6] × Lee 68	–	–
20. L74L-71	Calland × Williams	–	–
21. L75-8388	Williams × L70-2450	–	61% +
22. U10727	Wayne × C1317-71	–	–
23. U36276	Bonus × Wayne		–
24. U37219	C1430 × Calland		–
PRELIMINARY TEST IV			
*1. Essex (V)	Lee × S5-7075	–	–
*2. Union (IV)	Williams[5] × SL11 (Wayne *Rpm Rps*)	–	–
*3. Williams	Wayne × L57-0034 (Clark × Adams)	–	–
4. A78-325028	A72-512 × Williams	–	–
5. A78-325031	AP6 (1YT) S_1 C1		–
6. A78-326024	Pride B-216 × AX896-67-3	–	–
7. C1582	M61-224 × Williams	–	–
8. HC76-3840	L72U2567 × Hodgson	–	–
9. HC76-3914	L70U-2173 × L72U2567	–	–
10. HC76-4091	Williams × L72U-41	–	–
11. HC76-4455	L72U2567 × Ransom	–	–
12. K1043	Tracy × Williams	–	–
13. K1044	Tracy × Williams	–	+
14. K1045	Tracy × Williams	–	+
15. K1046	Tracy × Williams	–	+

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and Rj_4, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2] Rj_2	Frequency of alleles[2] Rj_4
	PRELIMINARY TEST IV—con.		
16. K1048	Tracy × Bonus	–	+
17. K1049	Tracy × K1003	–	+
18. K1051	Tracy × Williams	–	+
19. Ky75-101-18	Wayne × Cutler 71	–	+
20. Ky75-146-74	L66-1359 × Columbus	–	18%+
21. L73-318	Williams[2] × L69-5343 (L6–*Ir Im*)	–	–
22. L74L-55	Calland × Williams	–	–
23. L74L-358	L68-4096 (Wayne — *r Rpm* Rps_1) × L66L-177	–	–
24. L75-8004	Williams × L70-2283 (Chippewa × Custer)	–	–
25. L75-8013	Williams × L70-2283 (Chippewa × Custer)	–	–
26. L75-11730	L70-6494 (Harosoy — Rps_2) × Williams	–	–
27. L75-11806	L70-6494 (Harosoy — Rps_2) × Williams	+	–
28. L75-12593	Bonus × Williams	–	–
	UNIFORM TEST IV		
*1. Crawford	Williams × Columbus	–	–
*2. Essex (V)	Lee × S5-7075	–	–
*3. Franklin	L12 × Custer	–	–
*4. Union (IV)	Williams[5] × SL11 (Wayne *Rpm Rps*)	–	–
5. L23 (III) (Williams 79)	Williams[6] × Lee 68	–	–
6. A77-314014	Coles × A72-507	–	+
7. C1573	C1421 × Williams	–	–
8. K1024 (Desoto)	L66L-140 × Columbus	–	–
9. K1033	Williams × Calland	–	–
10. K1041	Williams × Calland	–	–
11. K1042	L66L-140 × Cutler 71	–	–
12. L70L-3048	L15 × D64-3146	–	–
13. L74D-609 (Pixie)	Williams × Ransom	–	–
14. L74L-125	Calland × Williams	–	–
15. L74L-497	Wayne *Ir* × Coker Hampton 266A	–	–
16. L75-8381	Williams × L70-2450 (Wayne × Custer)	–	+
17. S76-2109	D67-3297 × Essex	–	–
	UNIFORM TEST IV–S		
*1. Columbus	C1069 × Clark	–	–
*2. Crawford	Williams × Columbus	–	–
3. K1033	Williams × Calland	–	–
4. S76-2392	Essex × Mitchell	–	–
5. C1573	C1421 × Williams	–	–

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and Rj_4, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2] Rj_2	Rj_4
	UNIFORM TEST IV–S—con.		
6. S76–2109	D67–3297 × Essex	–	–
7. S76–2203	D67–3297 × Essex	–	–
8. S76–2229	Forrest × V71–480	–	–
9. V74–315	V66–318 × V68–2331	–	–
10. V76–398	Essex × SRF400	–	–
11. V76–465	Essex × SRF400	–	–
12. V76–482	Essex × SRF400	–	–
	PRELIMINARY TEST V		
*1. Hill	D632–15 × D49–2525	–	+
*2. Forrest	Dyer × Bragg	–	–
3. D76–8070	D68–4641 × D72–347	–	–
4. D77–8	Forrest(2) × Tracy	–	5%+
5. D77–15	Forrest(2) × Tracy	–	34%+
6. D77–17	Tracy × Forrest	–	+
7. D77–18	Tracy × Forrest	–	+
8. D77–4870	D74–7631 × J74–57	–	–
9. D77–4874	D74–7631 × J74–57	–	–
10. D77–5064	[Forrest (2) × PI 229358] × J74–8	–	+
11. D77–5090	[Pickett 71(2) × (Dare(2) × PI 96983)] × J74–47	–	+
12. D77–5771	D71–6664 × D71–6234	–	–
13. Ga76–1534	Dare × D64–4731	–	–
14. Ga76–1615	Dare × D64–4731	–	+
15. N77–179	N70–1549 × N72–3213	–	–
16. N77–334	N70–1549 × Centennial	–	–
17. N77–432	N70–1549 × Centennial	–	–
18. N77–434	N70–1549 × Centennial	–	–
19. N77–506	N70–1549 × Centennial	–	–
20. N77–850	N70–1549 × Centennial	–	–
21. R77–15	Mack × D69–8201	–	–
22. R77–236	[T43 × Davis (2)] × Mack (3)	–	–
23. R77–238	[T43 × Davis (2)] × Mack (3)	–	–
24. R77–512	Mack × York	–	–
25. R77–549	(R68–873 × Mack) × (Mack × York)	–	–
26. S76–2103	D67–3297 × Essex	–	–
27. S76–8065	D70–3115 × Essex	–	–
28. S76–8112	D67–3297 × Essex	–	–
29. S77–7415	Essex × Mack	–	–
30. S77–7419	Essex × Mack	–	–
31. V76–200	V68–2331 × V69–495	–	+
32. V76–408	Essex × SRF400	–	–
33. V76–473	Essex × SRF400	–	–

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and Rj_4, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2]	
		Rj_2	*Rj_4*
	PRELIMINARY TEST V—con.		
34. V76-595	V68-920 × V69-862	–	–
35. V76-626	Essex × V68-920	–	–
36. V76-640	Essex × V68-920	–	–
	UNIFORM TEST V		
*1. Essex	Lee × S5-7075	–	–
*2. Forrest	Dyer × Bragg	–	–
*3. Bedford	Forrest(2) × (D68-18 × PI 88788)	–	+
4. R74-511	R66-873 × Mack	–	–
5. D75-12035	Forrest(2) × PI 229358	–	–
6. D76-9375	Forrest × Centennial	–	–
7. J74-51	Forrest(2) × (D68-18 × PI 88788)	–	–
8. N76-098	N70-1741 × Essex	–	–
9. N76-683	N70-1501 × N70-2173	–	–
10. R76-45	Forrest × Mack	–	–
11. S76-2120	D67-3297 × Essex	–	–
12. V75-345	Essex × Shore	–	–
	PRELIMINARY TEST VI		
*1. Centennial	D64-4636 × tawny pub. Lee 68 type	–	–
*2. Bedford	Forrest(2) × (D68-18 × PI 88788)	–	+
3. D75-9505	Forrest × Centennial	–	–
4. D75-10148	Semmes × Hood	–	–
5. D77-12	Forrest(2) × Tracy	–	+
6. D77-14	Forrest(2) × Tracy	–	25% +
7. D77-21	Forrest(2) × Tracy	–	+
8. D77-4806	D74-7631 × J74-57	–	–
9. D77-5398	D71-5289 × D72-8605	–	–
10. D77-5769	D71-6664 × D71-6234	–	–
11. D77-6057	Centennial × J74-47	–	+
12. D77-7148	Hood(2) × Semmes	–	–
13. Ga77-421	R67-141 × Bragg	–	–
14. Ga77-423	R67-141 × Bragg	–	–
15. J77-255	D74-7631 × J74-57	–	–
16. J77-272	D74-7631 × J74-57	–	–
17. J77-342	D74-7631 × J74-57	–	–
18. N77-16	Essex × N70-2173	–	–
19. N77-72	Essex × N70-2173	–	–
20. N77-114	Essex × N70-2173	–	–
21. N77-166	N70-1549 × N72-3213	–	–
22. N77-347	N70-1549 × Centennial	–	–
23. N77-907	N70-1549 × Centennial	–	–
24. N77-931	N70-1549 × Centennial	–	–
25. R75-8B	R72-2647(3) × D72-C57	–	–

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and Rj_4, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2] Rj_2	Frequency of alleles[2] Rj_4
	PRELIMINARY TEST VI—con.		
26. R77-11	Mack × D69-8201	–	–
27. R77-38	[(D68-B4 × R66-1516) × Ray] × (York × Davis)	–	–
28. R77-133	R69-1151 × Mack	–	–
29. R77-166S	Forrest × R69-1400	–	–
30. R77-196	Davis × Williams	–	
31. R77-238S	Forrest × R69-1400	–	–
32. S77-314	D70-3115 × J74-39	–	–
33. S77-318	D70-3115 × J74-39	–	
34. S77-7788	D69-8201 × R70-332	–	–
35. S77-7865	D69-8201 × R70-332		
36. Sc75-614	Davis × Hale 7	–	
	UNIFORM TEST VI		
*1. Tracy	D68-618 × D60-9647	–	+
*2. Centennial	D64-4636 × tawny pubescent Lee 68 type	–	–
3. D74-7741	Forrest × D70-3001	–	–
4. N73-693	D68-216 × Ransom	–	–
5. N73-1102	Tracy × Ransom		56% +
6. D75-7527	Forrest × Mack	–	–
7. N75-2213	Davis × Essex	–	–
8. R74-1625	York × Davis	–	–
9. D74-7711	Forrest × D70-3001	–	
10. D76-9665	Forrest × Centennial	–	–
11. N76-325	N69-5020 × Essex		
12. R75-868	(R76-873 × Mack) × (Mack × York)	–	–
	PRELIMINARY TEST VII		
*1. Bragg	Jackson × D49-2491	–	–
*2. Centennial	D64-4636 × tawny pub. Lee 68 type	–	–
3. D77-6103	Centennial × J74-47		+
4. D77-7285	Hood × Lee 68	–	–
5. D77-7302	D69-8765 × D71-9966	–	65% +
6. D77-7312	D69-8765 × D71-9966	–	–
7. D77-7336	D69-8765 × D71-9966	–	–
8. D77-7416	D69-8765 × D71-9966	–	–
9. D77-7923	Centennial × D73-10204	–	–
10. D77-7926	Centennial × D73-10204	–	–
11. D77-7968	Centennial × D73-10204	–	–
12. D77-7969	Centennial × D73-10204	–	–
13. D77-12244	Tracy × (Hill × PI 159925)	–	–
14. F77-1587	Centennial × [Forrest × (Cobb × D68-216)]	–	–
15. F77-1965	Centennial × [Forrest × (Cobb × D68-216)]	–	–

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and Rj_4, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2] Rj_2	Rj_4
	PRELIMINARY TEST VII—con.		
16. F77-1981	Centennial × [Forrest × (Cobb × D68-216)]	–	–
17. F77-2000	Centennial × [Forrest × (Cobb × D68-216)]	–	–
18. F77-2020	Centennial × [Forrest × (Cobb × D68-216)]	–	–
19. F77-2740	Forrest × (Cobb × D68-216)	–	–
20. Ga77-207	Lee 74 × D64-4636	–	–
21. Ga77-223	Lee 74 × D64-4636	–	–
22. Ga77-402	R67-141 × Bragg	–	18%+
23. Ga77-501	Coker 68-41 × Lee 74	–	–
24. Ga77-506	Coker 68-41 × Lee 74	–	–
25. GaT75-731	Dare × Hampton 266A	–	+
26. GaT76-1122	Dare × D68-180	–	+
27. N74-1618	Govan × Davis	–	–
28. N77-822	N70-1549 × Centennial	–	–
29. N77-889	N70-1549 × Centennial	–	–
30. N77-940	N70-1549 × Centennial	–	–
31. N77-1120	N72-3213 × N70-2173	–	–
32. N78-10001	Forrest × 4-74-6-[illegible]	–	–
33. N78-10002	Forrest × 4-74-6	–	–
34. N78-10003	Forrest × 6-39-4-3	–	–
35. Sc76-493	Hale 7 × Hutton	–	–
36. Sc75-8277	Davis × McNair 800	–	–
	UNIFORM TEST VII		
*1. Bragg	Jackson × D49-2491	–	–
*2. GaSoy 17	Bragg × Hood	–	–
3. F71-1180	F59-1505 × [Bragg(3) × D68-7965]	–	–
4. Ga72-663	Bragg × Lee	–	–
5. F73-7082	Bragg(3) × D60-7965	–	–
6. N74-1572	Govan × Davis	–	–
7. F76-8846	Centennial × [Forrest × (Cobb × D68-216)]	–	–
8. GaT73-24	Davis × D68-180	–	61%+
9. N74-1341	Govan × Ransom	–	–
10. N76-1415	N70-2173 × Hutton	–	–
11. N76-1505	N70-2173 × Hutton	–	–
12. Ts77-5	D66-8556 × Ransom	–	–
	PRELIMINARY TEST VIII		
*1. Dowling	Semmes × PI 200492	+	–
2. F71-1180	F59-1505 × [Bragg(3) × D68-7965]	–	–
3. D77-12480	Tracy × (Hill × PI 159925)	–	–
4. Co76-853	(N64-2451 × Dyer) × Pickett 71	–	+
5. Co76-888	Co68-33 × Hutton	–	–

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and Rj_4, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2] Rj_2	Frequency of alleles[2] Rj_4
	PRELIMINARY TEST VIII—con.		
6. Co77-9	Co68-41 × Co338	–	–
7. Co77-13	Co68-41 × Co338	–	–
8. Co77-42	Co67-21 × Co68-41	–	–
9. Co77-188	Dare × Bragg	–	–
10. F77-1500	Centennial × [Forrest × (Cobb × D68-216)]	–	–
11. F77-1539	Centennial × [Forrest × (Cobb × D68-216)]	–	–
12. F77-1576	Centennial × [Forrest × (Cobb × D68-216)]	–	–
13. F77-1654	Centennial × [Forrest × (Cobb × D68-216)]	–	–
14. F77-1661	Forrest × (Cobb × D68-216)	–	–
15. F77-1729	Forrest × (Cobb × D68-216)	–	–
16. F77-1790	Centennial × [Forrest × (Cobb × D68-216)]	–	–
17. F77-1797	Centennial × [Forrest × (Cobb × D68-216)]	–	–
18. F77-1840	Centennial × [Forrest × (Cobb × D68-216)]	–	–
19. F77-1995	Centennial × [Forrest × (Cobb × D68-216)]	–	–
20. F77-2034	Centennial × [Forrest × (Cobb × D68-216)]	–	–
21. F77-2094	Centennial × [Forrest × (Cobb × D68-216)]	–	–
22. F77-2124	Centennial × [Forrest × (Cobb × D68-216)]	–	–
23. F77-2658	D68-201 × [D67-10507(2) × Hampton]	–	+
24. F77-2809	Forrest × (Cobb × D68-216)	–	–
25. Ga76-432	Lee 68 × Bienville	–	–
26. Ga76-2819	Bragg × Co68-41	–	–
27. Ga77-135	Bragg × D64-4636	–	–
28. Ga77-304	R67-141 × Hutton	–	–
29. Ga77-417	R67-141 × Bragg	–	+
30. GaT76-1106	Hampton 266A × Forrest	–	–
31. GaT76-1124	Dare × D68-180	–	89%+
32. GaT76-1169	Dare × D68-180	–	+
33. GaT76-1177	Dare × D68-180	–	63%+
34. N77-1486	Hutton × N70-2205	–	–
35. N77-1528	Hutton × N70-2205	–	–
36. N77-1602	Hutton × N70-2205	–	–

See footnotes at end of table.

TABLE 3.—*Frequencies of nodulation response alleles, Rj_2 and* Rj_4*, in 1979 U.S. regional preliminary and uniform soybean test lines*—Continued

Lines[1]	Parentage	Frequency of alleles[2] Rj_2	Frequency of alleles[2] Rj_4
UNIFORM TEST VIII			
*1. Hutton	F55–822 × (Roanoke × CNS–4)	-	-
*2. Cobb	F57–735 × D58–3358	-	-
*3. Coker 338	Hampton 266 × Bragg	-	-
*4. Coker 488	Hampton 266 × Bragg	-	
5. F72–6460	Bragg(2) × F59–2496	-	
6. F74–1493	F59–1505 × [Bragg(3) × PI 96035]	-	-
7. Co75–689	(Co208 × N63–858) × Ransom	-	
8. F76–8757	Centennial × [Forrest × (Cobb × D68–216)]	-	-
9. F76–8827	Centennial × [Forrest × (Cobb × D68–216)]		-
10. Ga76–316	Bragg × Ransom	-	
11. GaT74–10	Hale 3 × Delmar	-	+
12. N76–1507	N70–2173 × Hutton	-	-

[1] * = named cultivars released prior to the 1979 test.

[2] + = presence of Rj_2 or Rj_4 allele, - = absence of Rj_2 or Rj_4 allele, % - = percentage of sample with Rj_4 allele in heterogeneous lines.

TABLE 4.—*Comparison of frequencies of* Rj2 *and* Rj4 *alleles in soybean plant introduction lines and 1979 U.S. regional preliminary and uniform soybean test lines*

Maturity group	Plant introduction lines		Preliminary test lines [1]		Uniform test lines [1]	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
		Rj2				
00	11	0	—	—	8	0
0	23	0	—	—	11	0
I	94	0	29	0	9	0
II	93	0	35	0	13	0
III	93	1.1	34	0	21	0
IV	93	1.1	25	4	13	0
IV-S	—	—	—	—	10	0
V	98	1.0	34	0	9	0
VI	98	4.1	34	0	10	0
VII	90	7.1	34	0	10	0
VIII	99	3.4	35	0	8	0
Total or proportion of total for—						
00–VIII	792	2.1	—	—	122	0
I–VIII	758	2.2	260	0.4	103	0
		Rj4				
00	11	9.1	—	—	8	0
0	23	15.8	—	—	11	0
I	94	12.8	29	3.4	9	0
II	93	16.1	35	18.6	13	7.7
III	93	25.8	34	5.7	21	22.0
IV	93	33.3	25	28.7	13	15.[illegible]
IV-S	—	—	—	—	10	0
V	98	26.5	34	18.8	9	0
VI	98	37.9	34	9.6	10	5.6
VII	90	27.5	34	11.3	10	6.1
VIII	99	39.3	35	15.8	8	12.5
Total or proportion of total for—						
00–VIII	792	27.0	—	—	122	7.2
I–VIII	758	27.6	260	13.7	103	8.5

[1] Excludes cultivars released prior to the 1979 test.

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