7. BREEDING OF RICE FOR RESISTANCE TO MAJOR DISEASES, PARTICULARLY LEAF BLAST IN THE PHILIPPINES

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Introduction

Rice blast (*Piricularia oryzae* Cav.) is considered one of the most important diseases in the Philippines because of its serious yearly destruction on rice crops in some areas. Other diseases that affect our rice crop in the order of their importance are stem rot (*Leptosphaeria salvinii* Catt.), sheash rot (*Sclerotium sphaeroides* Nak.), bacterial leaf blight (*Xanthomonas translucens* (J. J. R.) Dawnson), and tungro, a virus disease.

Reyes (1952) stated that considerable damage has been caused by diseases, which was conservatively estimated to decrease the aggregate output by 5 per cent. Under extremely favorable soil and climatic conditions, the major diseases could inflict as much as 25 per cent or more damage, especially if the variety planted is susceptible.

The importance of diseases particularly blast and bacterial leaf blight in rice production cannot be over stressed. This is because, these diseases may become a limiting factor in the attainment of higher level of rice production per hectare through the use of greater amont of nitrogen. For rice plants fertilized at high rate of nitrogen may become susceptible to the disease due to very luxuriant growth.

Previous Work on Disease Resistance

Realizing that the conventional methods of controlling the ravages of diseases which may fall into (1) improved cultural practices and (2) use of effective fungicides are only pallative, plant breeders and plant pathologists have cooperated in studying the reaction of varieties to diseases.

Reyes (1952) reported that the results of his years of meticulous study and observation covering 18 diseases occurring in the Philippines on 52 rice varieties, showed that only Wag-wag was resistant to blast. Certain varieties were liable to the attack of rice blast, stem rot, helminthosporiose, sheath rot, Fusarium blight, etc., while others swow varying degrees of resistance. Some of the varieties that possess notable reaction to certain diseases of more or less destructive nature are indicated below:

1. Stem rot (*Lepthosphaeria salvinii* Catt.)
   a. Raminad Str. 3
   b. Apostol
   c. Guinangang
   d. Mancasar
2. Sheath rot (*Sclerotiem sphaeroides* Nak.)
   a. Elon-elon
   b. Raminad Str. 3

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c. Guinangang

3. Brown linear spot (*Cercospora oryzae*, Miy.)
   a. Mancasar
   b. Ramay
   c. Raminad Str. 3

In a test for the reaction of 27 rice varieties that were considered resistant to blast in their respective countries, (Reyes, 1959) planted singly 21-day old seedlings of test varieties in alternate rows with susceptible varieties at a distance of 20 by 20 cms. The plants were fertilized with ammonium sulfate at the rate of 150 kilograms per hectare.

Inoculation was done at two stages of growth. The first was done at their tillering stage, and the second, during the early heading period. At tillering stage, small amount of inoculum consisting of mycella and spores of the fungus together with small portions of the culture medium were placed between the common lower axils of the unfolded leaf and the youngest expanded leaf. The plants were sprayed with sterile water before they were covered with a humidity tent consisting of moistened heavy cheesecloth. At early heading stage, the incoulum was placed at the hairy portion of the lowest node of the rachis of a newly emerged panicle. After each inoculum, the plants were sprayed with sterile water after which they were covered with humidity tents which were kept moist to keep favorable humidity and temperature for rapid development of the fungus.

From this study, Reyes concluded that under the conditions provided in the test, many of the varieties considered resistant to blast disease in their country of origin showed susceptibility. All the American varieties showed strong tendency for susceptibility to neckrot form of the disease. Of the eight varieties from Malaya only two were found resistant, and about one-half of those that came from Indonesia showed susceptibility to the disease.

He reported further that high percentage of infections were observed in varieties with abundant hairy growth around the neck or colla region of the panicle. Generally the long maturing varieties have greater chance of escaping the disease or prospect of recovery. There was also a positive correlation between relative humidity and infection; and a notable negative correlation between percentage of infection and air temperature was observed.

Ou, in his paper presented during the symposium on the Rice Blast Disease held on July 7–12, 1963 at the International Rice Research Institute at Los Baños, Laguna, Philippines showed that *Japonica* (Taiwan) varieties with reactions of moderately susceptible to very susceptible in Taiwan were found highly resistant in the Philippines. On the other hand, *Indica* (Taiwan) varieties that were resistant to moderately resistant in Taiwan were very susceptible in the Philippines.

Recent Studies on Blast Resistance

The results of studies on blast resistance were obtained at the Maligaya Rice Research and Training Center and other experiment stations from 1962–1965.

1. Method of Testing for Blast Resistance.

The present breeding program for blast resistance utilizes the techniques recommended by the International Rice Commission and revised by the Technical Committee for international blast program at the International Rice Research Institute in 1961. The technique works on the principle of providing the proper micro-climate and fertility in the seedbed for growth of fungus.

The seedbeds of 1.2 m. wide and about 20 meters long were provided with the necessary level of soil fertility by applying well decayed compost and chemical fertilizer with a formulation of 120 kgm. or more of N and 50 kgm. P_2O_5 per hectare. One half of the nitrogen and the whold amount of P_2O_5 were applied before the seeds were sown. The second half of the

nitrogen was applied two weeks after germination.

(1) Planting the varieties.

Five grams of each test variety, the susceptible and resistant checks were sown in 50 cm-rows distanced 10 cms. apart across the bed. Bombardment rows of a susceptible variety, Tjere Mas, were planted and after every two rows of test varieties. A resistant variety, Peta was planted after every ten test varieties between two rows of the susceptible check. Bombarment rows of the susceptible check, 3 on the windward side of the bed, two on the other side and 3 to 5 at both ends of the bed, were also planted at the same distance as the test varieties planted across the bed (see Fig. 1)

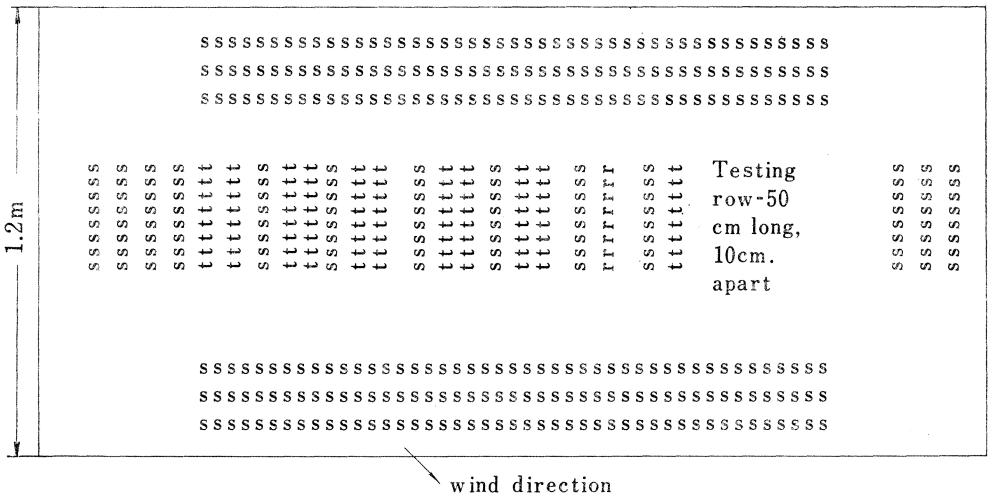

Fig. 1. Diagram of a testing plot or seedbed

The seedbeds were kept moist all the time to provide the proper micro-climate in the seedbed for the development of the fungus. To enhance better infection a seedbed was planted to the susceptible check two weeks before the test varieties were sown. Chopped infected leaves were also spread over the seedbed after the seeds have germinated.

(2) Classification of disease reaction.

The method of scoring disease reaction adopted by a committee that met at the International Rice Researsh Institute was followed in the test for blast resistance. The symptoms and infection reaction are shown below:

Scale Unit	Symptoms	Infection reaction
1	Only small brown specks of pin-head are produced on leaves, few or many, sometimes unrecognizable, no necrotic (collapsed cells) spot.	Resistant (R)
2	Slightly larger brown specks, about 1/2 mm. in diameter, no necrotic spots.	
3	Small, roundish, necrotic, grey spots about 1–2 mm. in diameter, surrounded by brown margin which is roundish or tends so be elliptical; the legions may be many, but leaves are seldom killed from the infection.	Moderately resistant (MR)

4	Typical blast lasion, elliptical, 1–2 cms, long usually confined to the space of two main veins, with large, necrotic grey center and brown or reddish brown margin, usually relatively few on a leaf less than 5% of leave area is damaged.	Moderately susceptible (MS)
5	Many large blast lesions as in group 4 or often larger and broader, the upper portion of one or two of the leaves of seedling of 4 or 5 leaves may be killed by coalescence of lesions the total area killed, however, does not exceed 25%.	
6	Lesions as in Group 5, but are more in numbers; a few leaf-blades may be completely withered; the total area killed may reach 50%; the margin of the lesions often shows less brown color; more of yellowish or greyish brown.	Rusceptible (S)
7	Large, quickly expanding lesions, the margin of which is mostly of grey color with brown tinge; most of the expanded leaves are killed but young ones remain leaf killing ranges from over 50% to complete death.	

2. International Uniform Blast Nursery Test

The International cooperative uniform blast nursery test sponsored by the International Rice Commission, FAO had the objectives of determining varieties that are resistant to different regions of South East Asia.

The method of testing varietal reaction to blast previously discussed in this paper was used in this study. The varieties used in the test were considered resistant in their respective countries.

The final individual reaction of 109 varieties tested in one or two years, is presented in table 1. The lesions due to blast infection appeared about 17 days after the seeds were sown, and the final rating for varietal reaction was obtained 34–40 days after sowing.

The data presented in table 1 shows that while the varieties in the test were considered resistant in their respective countries, a large number of them had shown susceptibility or moderate susceptibility to fungal development.

Is is significant to mention that two of the Philippine varieties considered resistant to blast in previous test with the use of artificial inoculation were moderately susceptible to the disease when subjected under the new method recommended by the FAO.

A summary of blast reaction of varieties by countries is shown in table 2. The table shows that the entries from each cooperating country showed differences in reaction to the disease. Only 3 of the 9 varieties from Burma exhibited high resistance to the disease. Three of the ten varieties from Malaya were susceptible, and not all the varieties from Japan and the United States, where varietal reaction to blast was studied more intensively than in other participating countries, proved resistant to the disease under Philippine conditions.

The fact that a total of only 67.83 percent of the resistant varieties from cooperating countries showed resistance to the disease under Philippine conditions may indicate that more virolent physiologic strains of blast organism than those present in the countries of origin may be present in the Philippines. Ou (1966) stated that some varieties seem able to differentiate general race groups by geographical regions.

3. Test for Resistance to Blast of Established Varieties and Hybrid Strains in Different Stations

The cooperative test for blast resistance was undertaken by the Plant Protection Working Group of the Recommnding Committee of the Philippines Seed Board lead by Dr. Ofelio R. Exconde of the U. P. College of Agriculture. The objective was to evaluate the reaction of Seed Board recommended varieties and promising hybrid strains to blast disease and determine those that are consistently resistant over a wide area.

The results presented in table 3 obtained in four stations indicate that in the first group, consisting of varieties in the advanced test in which 13 Seed Board recommended varieties

were included, only eight out of 29 entries were found resistant to the disease. Of the eight resistant varieties 6 were recommended by the Seed Board for general planting.

In the general test, consisting of 29 promising varieties and hybrid strains, only 9 hybrid strains showed resistance to the disease; the rest were moderately resistant except two which were susceptible.

It is significant to point out that among the 20 glutinuous varieties, only Panpet 120. a strain from a cross between Pangsinan and Peta, was resistant; six were susceptible and the rest were moderately susceptible.

The reactions of the different varieties differed in some cases in the four stations. This differential reactions of varieties in the different locations may be attributed to differences in the prevailing local climatic conditions and the existence of different races of *Piricularia oryzae* Gav. in the four stations. In fact Ou, (1966) noted that the physiologic races differ in the different regions of the country, the distribution of which may be seen below.

Regional Distribution	No. of races identified*
1. Northern Luzon	4
2. Central Luzon	10
3. Southern Luzon	12
4. Bicol	5
5. Western Visayas	17
6. Eastern Visayas	6
7. Mindanao	9

* See appendix 1.

4. Reactions of Hybrid Lines from Pedigree and Modified Bulk Selections to Blast

In this study two groups of hybrid lines were tested for leaf blast resistance. The first group consisted of lines selected by the pedigree and modified bulk methods from the same cross, while the second consisted of pedigree and modified bulk selections.

(1) Reaction of lines from the same cross selected by pedigree and modified bulk methods.

The reaction of 404 lines from three crosses in the F_6 and F_8 generations selected by the pedigree and bulk methods are presented in table 4. It may be seen from the table that of the 69 lines selected by pedigree, 51.49 per cent were resistant to the disease, 40.12 per cent, moderately resistant while only 2.77 and 5.60 per cent were moderately susceptible and susceptible, respectively. On the other hand, of the 335 lines selected by the modified bulk method only 19.3 per cent were found resistant. Greater percentages of susceptible and moderately susceptible lines were observed from the bulk method of selection than from the pedigree method.

This observations seems to indicate that pedigree method of selection is more effective for disease resistance than the modified bulk method.

(2) Reaction of hybrid lines from crosses with one common parent.

In this experiment, 9 F_4 crosses under pedigree selection with a total of 568 lines were tested for leaf blast resistance.

Another group consisted of 2,180 lines selected from bulk planting in the F_6 and F_7 generation. In both groups, either the female or male parent was common in some of the 24 crosses.

The data presented in table 5 show that F_4 lines from the same female parent under pedigree selection differed in reaction to blast as expressed by the great difference in percentage of resistance and susceptibility. This is exemplified by the crosses Yab-yabi×Taichung 71,

and Yab-yabi × B-E-3 in which 43.36% of the lines in the former were resistant while only 12.5% were resistant in the latter. This trend was also true in 6 other combinations in which one variety was used as a common parent in two crosses.

Among 24 crosses in the F_6 and F_7 generations under the modified bulk method of selection, it is interesting to point out that in three crosses in which one common variety was used the reaction of the selected lines to blast differed markedly. In the cross Inilang-ilang × Malagkit Sungsong, all the lines were susceptible; in the cross Inlang-ilang × Nagpunit, 40 per cent were resistant, while in Iniland-ilang × Sampay Bakud, only 7.5 per cent of the lines were resistant. And in three crosses in which Rexoro was used as a common parent, the cross, Rexoro × Apostol produced lines in which 84 per cent were resistant. On the other hand, in Rexoro × Milfor 6 (2) only 2 per cent were resistant while 40.85 per cent and 47.78 per cent were moderately susceptible and susceptible, respectively.

The differences in reaction of lines selected by the pedigree and modified bulk methods in which one variety was used as a common parent may indicate the differences in the desirability of varieties as parents in varietal crosses.

Reaction of Varieties to Other Diseases

Like in the study on the reaction to blast disease, the data presented in the reaction of Seed Board recommended varieties and promising hybrids to other diseases were the results of the cooperative efforts of Plant Pathologist and Plant Breeders in the Bureau of Plant Industry and the U. P. College of Agriculture.

1. Reaction of varieties and promising hybrids to leaf blight

This experiment was conducted in the U. P. College of Agriculture and two experiment stations of the Bureau of Plant Industry to evaluate the resistance or susceptibility of rocommended varieties and promising hybrid strains now under for yield.

The method developed by Goto (1965) for evaluating resistance of rice varieties and species of wild rice was used by the cooperating researchers in each station.

The results presented in table 6 show that of the 78 varieties in the test only three varieties were resistant in the three stations; namely, Norelon Str. 340, a Seed Board recommended variety, Tainan 3, a promising introduction, and Sungforbes 101, a glutinous variety.

The other varieties exhibited variable reactions in the three stations in which they were tested. In some cases varieties were found resistant in two stations, but susceptible in another station. In other instances, varieties were susceptible in two stations but resistant in one station. Based on the average reaction in three stations, four varieties from each group were resistant to the disease, or a total of 12 out of 78 varieties that were studied.

As bacterial leaf blight is becoming an important disease in the country due to increasing amount of fertilizer applied in the rice fields, breeding for resistance to this disease has been expanded. Using resistant varieties as parents, some 49 crosses now in the F_2 generation are being studied at the Maligaya Rice Research and Training Center aside from the tests being conducted on promising hybrid strains.

2. Reaction of Varieties and Promising Hybrid Strains to Tungro Virus Disease under Field Conditions, 1965-1966

Briefly, it may be stated that according to Ou and Rivera* Tungro is probably the most wide-spread and most important virus disease of rice in the tropics. It is transmitted by *Nephottetix apicalis* Match. The most important diagnostic symptoms of the disease are: (1) yellowing of leaves, depending upon the resistance of the variety, (2) stunted growth espe-

* Ou, S. H. and C. T. Rivera. Virus disease of rice in the Philippines nearby Countries. Paper presented during the 10th meeting of the Working Party on Rice Production and Protection, International Rice Commission, held in Manila, Philippines on March 3-10. 1964.

cially in susceptible varieties, (3) affected plants produce few and small panicles and (4) tillering of affected plants is somewhat reduced.

The field test of varieties for reaction to Tungro disease was conducted by Bergonia *et al.** in three locations (Manila, Lanuna and Pangasinan) where infection was ovserved to be serious.

The varieties and hybrids used in the test were previously tested under green house conditions and were rated as resistant and medium resistant. The observations on the reactions of the 25 varieties to tungro under field conditions shown in table 7 indicate that the average infection in Manila was 65.70% and in Pangasinan, 36.54 per cent. This high percentages in average infection in the two places may indicate a high number of leaf-hoppers that were carriers of the virus disease. In fact as high as 98.85% infection on BPI-76 was observed in Manila and 100 per cent on Wagwag in Pangasinan.

It may be pointed out further that the varieties that showed high infection in one place had also high infection in other places as in the case of BPI-76, Norelon Str. 340, and Wagwag.

Based on the average percentage in three places it may be seen that not a single variety in the test under field condition was resistant to the disease. Out of the 25 test varieties, only four were medium resistant while the rest were either medium susceptible or susceptible to tungro virus disease.

Summary

This report covers some results of cooperations studies on the reaction to rice blast of established varieties, promising hybrid strains and hybrid lines selected by the pedigree and modified bulk methods. Reactions of varieties and promising strains to bacterial leaf blight and tungro virus disease under field conditions are also reported herein.

In the cooperative international uniform blast nursery test sponsored by the International Rice Commission and now coordinated by the IRRI, only 67.83 per cent of the test varieties known to be resistant in their respective countries of origin were resistant to blast under Philippine conditions, indicating the possibility of the presence of more virulent strain or race of the organism in the Philippines. Only three of the 9 varieties from Burma exhibited high registance to the disease; three of the ten varieties from Malaya were susceptible, and not all the varieties from Japan and United States where varietal reaction to blast was studied more intensively than in other countries proved resistant to the disease.

Established varieties and promising hybrid strains of rice tested in different experiment stations showed variable reactions to blast disease. This shows the existence of different physiologic races of blast organism in the four testing stations.

The reactions of lines, selected by the pedigree and modified bulk methods, showed that greater percentages of susceptible and moderately susceptible lines selected by the bulk method were observed. These observations seem to indicate that pedigree method is more effective for disease resistance than the modified bulk method.

Lines selected by the pedigree and bulk methods from crosses in which one variety was used as a common parent showed marked differences in reaction to blast disease. These differences may indicate possible differences in the desirability of varieties as parents in varietal crosses.

The study of 78 varieties for bacterial leaf blight resistance show that only three varieties

* Bergonia, H. T., Carlos A. Calica, C. Baniqued and E. P. Novero. Test on the reaction of certain Seed Board rice varieties and promising hybrids to tungro under field conditions. (Mimeographed). Presented during the 14th Annual Rice and Corn Production Conference, held in the BPI on April 11-15, 1967.

were resistant in three stations. These variety were Norelon Str. 340, a Seed Board recommended variety, Tainan 3, a promising introduction and Sungforbes 101, a glutinous variety developed from a cross between Malagkit Sungsung and BBI-76.

The program on Breeding for resistance to bacterial leaf blight was expanded in which 45 F_2 crosses are now underr study.

The test on the reatsion of 25 varieties to Tungro virus under field conditions in three locations showed variability in percentage of infection in the different places. However, there were indications that a variety that showed high percentage in one place had also high infection in another place. Based on the average percentage of infection in three places, not a single variety out of 25 in the test showed resistance to the disease. However, four varieties were moderately resistant.

Table 1. Reaction of individual varieties from different countries to fungal development.

Country of Origin	No. of Var.	Varieties	Rating 1962	Rating 1963	Final Grade	Rating Reaction
Burma	9	1. A 36-3	5	5	5	S
		2. A 56-11	5	4	5	S
		3. B-35-2	5	5	5	S
		4. B 401	5	5	5	S
		5. B 404	4	5	5	S
		6. C 33-18	1	1	1	HR
		7. C 46-15	1	1	1	HR
		8. C 30-32	NS	5	5	S
		9. D 254	1	1	1	HR
Ceylon	5	10. H-4	1	1	1	HR
		11. H-5	2	2	2	R
		12. H-105	1	1	1	HR
		13. H-501	2	1	2	R
		14. Murungakayan 302	1	1	1	HR
France	4	15. Cesariot	4	1	3	MR
		16. Fanny	4	2	4	MS
		17. Arlesienne	2	1	2	R
		18. Cigalon	3	NS	3	MR
Hongkong	4	19. Fa Yiu Tsai	1	1	1	HR
		20. Kam Bau Ngan	*			
		21. Lo Shu Ngar	2	1	2	R
		22. Pak Huk Chai Mei	2	1	2	R
India	10	23. Ninnidhan	2	1	2	R
		24. PTB-10	1	1	1	HR
		25. AC 2250	*			
		26. Hybrid I	*	1	1	HR
		27. Hybrid II	*	1	1	HR
		28. S-67	1	1	1	HR
		29. CO-4	1	1	1	HR
		30. CO-25	1	1	1	HR
		31. CO-Y	NS	1	1	HR
		32. CO-13	NS	3	3	MR
Japan	10	33. Norin 1	1	1	1	HR
		34. Norio 17	1	1	1	HR
		35. Kon-go	1	1	1	HR
		36. Homare-nishiki	NS	1	1	HR
		37. Norin 22	NS	2	2	R
		38. Kanto 51	NS	1	1	HR
		39. Pi No. 51	NS	3	3	MR
		40. Usen	NS	4	4	MS
		41. Choko-to	NS	1	1	HR
		42. Tadukan	NS	1	1	HR

Table 1. (cont'd)

Country of Origin	No. of Var.	Varieties	Rating 1962	Rating 1963	Final Grade	Rating Reaction
Malaya	11	43. Padang Trenggaun 22	1	1	1	HR
		44. Morak Sepilai Kechil	1	NS	1	HR
		45. Acheh Puteh	1	4	3	MR
		46. Subang Intan 117	4	4	4	MS
		47. Mayang Sagumpal	2	1	2	R
		48. Serendah Puteh	*			
		49. Anak Naga	2	4	3	MR
		50. Seri Raja	3	4	4	MS
		51. Mayang Ebos 80	3	4	4	MS
		52. Radin Kuming	3	4	4	MS
		53. Radin Siak 34	3	1	2	R
Pakistan	11	54. Dular	1	1	1	HR
		55. Dharial	4	2	3	MR
		56. Hashi Kalmi	1	1	1	HR
		57. Kataktara	1	1	1	HR
		58. K. P. F. G	1	1	1	HR
		59. Marich Bati	1	1	1	HR
		60. Panbira	2	1	2	R
		61. Latisail	5	4	5	S
		62. Patnai	*			
		63. Tilokkachari	5	4	5	S
		64. Daaca-31	5	NS	5	S
Portugal	2	65. Stirrpe 136	5		5	S
		66. Rinaldo Bersain	6		6	VS
Philippines	14	67. Binicol	4	4	4	MS
		68. Macapilay Pusa	2	1	2	R
		69. Pinursigue	3	3	3	MR
		70. Dinafor 6-50-45-A3	4	3	4	MS
		71. FK-135	2	3	2	R
		72. BPI-76	1	2	2	R
		73. FB-120	2	2	2	R
		74. FK-170	1	1	1	MR
		75. B-E-3	1	2	2	R
		76. FB-124	1	1	1	R
		77. Raminad Str. 3	3	2	2	R
		78. Wagwag	2	1	2	HR
		79. Peta	1	1	1	HR
		80. BPI-121	1	1	1	HR
Senegal	6	81. R-67	1	1	1	HR
		82. R-75	2	1	2	R
		83. Iguape Gatelo	4	2	3	MR
		84. Jappeni Tunkungo	4	1	3	MR
		85. E-425	4	1	3	MR
		86. RT. 1095 S-26	4	2	3	MR
Taiwan	15	87. Chia-uung Yu 280	1	2	2	R
		88. Chia-nung 242	3	2	2	R
		89. C-115	2	1	2	R
		90. Taichung 181	1	1	1	HR
		91. Taichung 182	1	1	1	HR
		92. Taichung 183	1	1	1	HR
		93. Taichung line 48212	1	1	1	HR
		94. Taichung line 47720	1	1	1	HR
		95. Kaohsiung line 135	1	1	1	HR
		96. Kaohsiung line 137	1	1	1	HR
		97. Kaohisung line 164	2	1	2	R
		98. Taisung Yu 83	2	1	2	R
		99. Taichunh (Native) 1	5	1	3	MR
		100. Ber-me-fen	4	3	4	MS
		101. Pai-Kan-tau	2	1	2	R
Tailand	3	102. Nahng Mon S-4	1	1	1	HR
		103. Leuang Yai 34	1	1	1	HR

Table 1. (cont'd)

Country of Origin	No. of Var.	Varieties	Rating 1962	Rating 1963	Final Grade	Rating Reaction
		104. Pak Leuad III	1	1	1	HR
U. S. A.	9	105. C. I. 7787, Zenith	1	1	1	HR
		106. C. I. 9155, Mo. R-500	1	1	1	HR
		107. C. I. 1561, 1-Caloro	4	2	3	MR
		108. C. I. 8985, Lacrosse	4	2	3	MR
		109. C. I. 8998, Nata	4	1	3	MR
		110. C. I. 9454, Lacx Z-N	1	1	1	HR
		111. C. I. 5309,	2	1	2	R
		112. P. I. 180061	3	1	2	R
		113. P. I. 201902	1	1	1	HR

Note: * – Did not germinate
NS – No. seed
HR – Highly resistant
P – Resistant
MR – Moderately resistant
MS – Moderately susceptible
S – Susceptible
VS – Highly susceptible

Table 2. Summary of the reaction of varieties by countries

Countries	No. of Var.	Grade of Resistance to Fungal Development HR	R	MR	MS	S	VS
1. Burma	9	3	–	–	–	6	–
2. Ceylon	5	3	2	–	–	–	–
3. France	4	–	1	2	1	–	–
4. Hongkong	3	1	2	–	–	–	–
5. India	9	7	1	1	–	–	–
6. Japan	10	7	1	1	1	–	–
7. Malaya	10	3	2	2	3	–	–
8. Pakistan	10	5	1	1	–	3	–
9. Philippines	14	4	7	1	2	–	–
10. Portugal	2	–	–	–	–	1	1
11. Senegal	6	1	1	4	–	–	–
12. Taiwan	15	7	6	1	1	–	–
13. Thailand	3	3	–	–	–	–	–
14. U. S. A.	9	4	2	3	–	–	–
Total	109	48	26	16	8	10	1
Per cent		44.03	23.85	14.68	7.34	9.17	0.92

Table 3. Reactions of rice varieties to blast at different stations during 1965 wet season.

Entries	Ssations College [a]	San Mates [b]	Iloilo [c]	Maligaya [d]	Final Reaction
A. Varieties in the Advanced test:					
1. AC 440 DR 260*	R	MR	R	R	R
2. AC 2246 Mas	S	S	S	S	S
3. Peta*	MR	MR	R	R	MR
4. Tjera Mas*	S	S	S	S	S

Table 3. (Cont'd)

Entries	Stations				Final Reaction
	College [a]	San Mateo [b]	Iloilo [c]	Maligaya [d]	
5. HR-38	MR	MR	R	R	MR
6. Rading Kling	R	MR	S	MR	MR
7. D/52/37	MR	S	R	R	MR
8. BPI-76*	R	MR	R	R	R
9. Milbuen I	R	R	R	R	R
10. C-18-74*	S	S	S	S	S
11. Milketan 6	R	MR	R	R	R
12. Pamil I	MR	S	MR	R	MR
13. Taimil 3	MR	R	MR	R	MR
14. C-13	R	S	R	R	MR
15. Bengawan*	R	MR	R	R	R
16. FK-178A*	R	MR	R	R	R
17. Nang Thay*	S	S	R	S	S
18. Norelon Str. 340*	MR	S	S	MR	MS
19. RP-44	MR	MR	R	R	MR
20. RP-43	R	S	R	MR	MR
21. FK-178A*	R	MR	R	R	R
22. FB-76A	R	MR	MR	R	MR
23. FB-76C	R	MR	R	R	R
24. FB-76-6-3	MR	MR	S	R	MR
25. TPBKF-16-1	R	MR	S	R	MR
26. S. K. 36 Str. 482*	MR	S	S	MR	MS
27. Raminad Str. 3*	MR	S	S	MR	MS
28. BPI-121*	R	MR	MR	R	MR
29. B-E-3*	MR	S	S	MR	MS
B. Varieties in the General Test					
1. Milbuen 19	R	MR	S	R	R
2. Tpmil 29	S	MR	R	R	MR
3. A/29/20	S	S	S	S	S
4. Chianung 242	S	S	R	R	MR
5. Tainan-iku No. 486	MR	S	R	Mr	MR
6. Shinchiky-iku No. 74	MR	S	R	No germination	MR
7. C-16	R	S	MR	R	MR
8. BPI-76 (Bicol Sel.)	R	MR	MR	R	R
9. PI-215, 936	R	S	R	R	MR
10. Taichung (native 1)	MR	S	S	S	MS
11. A3-47-2	R	MR	MR	R	MR
12. IR3-66	R	MR	S	R	MR
13. IR8-246	R	S	R	R	MR
14. M527-9	MR	S	R	R	MR
15. RPA-4	R	R	R	R	R
16. RP-9	R	MR	S	MR	MR
17. RPI-46-1	R	MR	MR	R	MR

Table 3. (Cont'd)

Entrres	Stations				Final
	College [a]	San Mateo [b]	Iloilo [c]	Maligaya [d]	Reaction
18. MIFB-318-1	R	MR	R	R	R
19. MIFB-318-2	R	MR	MR	R	MR
20. MIFB-54-1	R	R	R	R	R
21. MIFB-150-4	MR	S	R	R	MR
22. MIFB-44-1	R	MR	R	R	R
23. RPP-31-3	MR	S	S	R	MR
24. FB-76-8-1-2-1	R	MR	R	R	R
25. MIFB-256-4	R	R	R	R	R
26. Tainan 3	R	R	S	R	MR
27. A3-47-3	MR	S	S	S	S
28. IR8-36	R	S	R	R	MR
29. IR9-60	R	R	R	R	R
C. Glutinous Varieties:					
1. Inagubatan	R	S	R	R	MR
2. Pinutyukan	S	S	MR	S	S
3. Serena	S	S	S	S	S
4. Binundok	S	S	S	S	S
5. Malagkit Sungsong	S	S	S	S	S
6. Panpet 63	R	MR	S	R	MR
7. Morforbes 120	R	MR	R	R	R
8. Pantje 116	MR	MR	S	R	MR
9. Morforbes 25	S	MR	S	R	MS
10. Sentje 117	R	MR	S	MR	MR
11. Panpet	MR	MR	S	R	MR
12. Morforbes 23	MR	MR	MR	R	MR
13. Morforbes 122	MR	MR	MR	R	MR
14. Sungforbes 101	S	S	S	S	S
15. Morforbes 22	MR	MR	S	MR	MR
16. Sungforbes 59	MR	S	S	MR	MS
17. Morforbes 119	R	R	S	R	MR
18. Morforbes 55	R	R	S	R	MR
19. Penpet 68	R	MR	S	R	MR
20. Sungforbes 49	S	S	S	S	S

* Seed Board recommended varieties

a) Conducted by O. R. Exconde, *et. al.*

b) Conducted by O. Lawas, *et. al.*

c) Conducted by F. M. Olivares, Jr., *et. al.*

d) Conducted by P. B. Romano. *et. al.*

Table 4. Reaction of selected lines from pedigree and modified bulk selections from the same crosses.

Method of Selection	Crosses.	Total	R	MR	MS	S
Pedigree F6	MA-3-26 × FB-76-2-2	13	(46. 15) 6	(46. 15) 6	(0) 0	(7. 7) 1
Bulk	- do -	35	(0) 0	(20. 00) 7	(34. 3) 12	(45. 7) 16
Pedigree F6	Binirhen 366 × RPP-17	44	(50. 0) 22	(40. 9) 18	(0) 0	(9. 1) 4
Bulk	- do -	100	(7. 0) 7	(31. 0) 31	(16. 0) 16	(46. 0) 46
Pedigree F8	(Rexoro × Purple Leaf × Intan)	12	(58. 33) 7	(33. 3) 4	(8. 33) 1	(0) 0
Bulk	- do -	200	(50. 1) 102	(32. 5) 65	(13. 0) 26	(3. 5) 7
	Pedigree (Average %)	69	51. 49	40. 12	2. 77	5. 60
	Bulk selection (Average %)	335	19. 3	27. 8	21. 1	31. 7

Note: Figures in parenthesis are percentages.

Table 5. Reaction of hybrid lines with one common parent.

(1) Pedigree

Crosses	Total	R	MR	MS	S
1. F_4 Fortuna × BPI-76	94	(11. 70) 11	(30. 83) 29	(22. 34) 21	(35. 10) 23
2. F_4 Fortuna × FB-110	66	(7. 57) 5	(39. 39) 26	(34. 84) 23	(18. 18) 12
3. F_4 Yab-yabi × Taichung	226	(43. 36) 98	(33. 63) 86	(1. 77) 4	(5. 31) 12
4. F_4 Yab-yabi × B-E-3	24	(12. 50) 3	(25. 00) 6	(29. 16) 7	(33. 33) 8
5. F_4 Minangan × B-E-3	44	(18. 18) 8	(63. 63) 28	(9. 09) 4	(27. 27) 12
6. F_4 Pata × (RPA-49 × FK-133-2)	72	(2. 77) 2	(54. 16) 39	(34. 72) 25	(8. 33) 6
7. F_4 Peta × (Ma-3-26 × FB-76-2-2)	44	(29. 54) 13	(54. 54) 24	(11. 16) 5	(4. 54) 2
8. F_4 BPI-76 × (RPA-49 × FK-133-2)	61	(49. 18) 30	(44. 25) 27	(4. 92) 3	(1. 64) 1
9. F_4 BPI-76 × (MA-3-26 × FB-76-2-2)	137	(58. 00) 80	(37. 01) 50	(5. 07) 7	(0) 0
	568				

Note: Figures in parenshesis are percentages.

Table 5. Reaction of hybrid lines with one common parent.

(2) Modified bulk

Crosses	Total	R	MR	MS	S
1. F_6 Binirhen 366 × RPP-17	100	(7.0) 7	(31.0) 31	(16.0) 16	(46.0) 46
2. F_6 Binirhen 366 × RPP-10	100	(16.0) 16	(20.0) 20	(13.0) 13	(51.0) 51
3. F_6 MI-50 × MI-71 × Mangarez	60	(38.3) 23	(33.33) 20	(20.1) 12	(8.33) 5
4. F_6 MI-42 × MI-72 × Mangarez	60	(16.16) 10	(41.66) 25	(26.66) 16	(15.0) 9
5. F_6 MI-42 × MI-72 × Rexoro	70	(11.42) 8	(20.0) 14	(51.43) 36	(17.14) 12
6. F_6 MI-42 × MI-72 × Dinalaga	90	(11.11) 10	(24.44) 22	(44.44) 40	(20.0) 18
7. F_6 Inilang-ilang × Malagkit Sungsong	30	– 0	– 0	– 0	(100.0) 30
8. F_6 Inilang-ilang × Sampay Bakod	40	(7.5) 3	(35.0) 14	(30.0) 12	(27.5) 11
9. F_6 Inilang-ilang × Nagpunit	20	(40.0) 8	(25.0) 5	(20.0) 4	(15.0) 3
10. F_7 RPI-34 × MA-13-12	110	(10.91) 22	(61.73) 28	(12.72) 14	(5.41) 6
11. F_7 RPP-42 × MA-13-12	60	(78.33) 47	(18.33) 11	(3.33) 2	(0) 0
12. F_7 RPP-49 × MA-13-12	140	(9.28) 13	(14.28) 20	(31.41) 44	(45.0) 63
13. F_7 RPP-49 × RPI-72	140	(7.14) 10	(22.14) 31	(65.71) 92	(5.0) 7
14. F_6 MA-3-26 × FB-76-2-1	50	(20.0) 10	(34.0) 17	(22.0) 11	(24.0) 12
15. F_6 (MI-50 × MI-71) × FB-76-2-1	50	(36.0) 18	(44.0) 22	(10.0) 5	(10.0) 5
16. F_7 Rexoro × Milfor 6(2)	350	(2.85) 1	(11.14) 39	(40.85) 143	(47.71) 167
17. F_7 Rexoro × Apostol	100	(84.0) 84	(11.0) 11	(3.0) 3	(2.0) 2
18. F_7 Rexoro × (Purple leaf × Intan)	200	(51.0) 102	(32.5) 65	(13.0) 26	(3.0) 7
19. F_6 MA-3-26 × FB-76-2-2	35	(0) 0	(20.0) 7	(34.28) 12	(45.7) 16
20. F_6 MA-3-26 × MA-1-10	60	(10.0) 6	(45.0) 27	(20.0) 12	(25.0) 15
21. F_6 MA-15 × Azucena	140	(4.28) 6	(12.14) 17	(32.14) 45	(51.42) 72
22. F_6 MI-56 × Azucena	90	(18.89) 17	(60.0) 54	(14.44) 13	(6.67) 6
23. F_6 IBP-15 × IBP-24	55	(3.63) 2	(12.73) 7	(12.73) 7	(70.91) 39
24. F_6 IBP-15 × IBP-111	30	(20.0) 6	(23.7) 7	(6.6) 2	(50.0) 15
	2,180				

Note: Figures in parenthesis are percentages.

Table 6. Reactions of rice varieties to bacterial leaf blight at three stations during 1965 wet season.

Entries	Stations			Final
	College [a]	Iloilo [b]	San Mateo [c]	Reaction
A. Varieties in the Advanced Test:				
1. AC/440 Dr. 260	R	R	MR	R
2. AC/224 Mas	R	S	MR	MR
3. Peta	S	R	MR	MR
4. Tjere Mas	R	R	MR	R
5. HR-38	R	R	MR	R
6. Radin Kling	R	R	MR	R
7. D/52/37	R	R	MR	R
8. BPI-76	S	R	MR	MR
9. Milbuen I	R	R	S	MR
10. C-18-74	R	R	MR	R
11. Milketan 6	R	S	MR	MR
12. Pamil I	R	R	S	MR
13. Taimil 3	R	R	MR	R
14. C-18	R	R	MR	R
15. Bengawan	R	R	S	MR
16. FK-178A*	R	S	MR	MR
17. Nang thay	R	S	MR	MR
18. Norelon Str. 340	R	R	R	R
19. RP-44	R	R	S	MR
20. RP-43	R	R	MR	R
21. FK-178B	R	S	S	MS
22. FB-76A	R	S	MR	MR
23. FB-76C	R	S	S	MS
24. FB-76-6-3	R	S	MR	MR
25. TPBKF-16-1	R	S	R	MR
26. SK-36 Str. 482*	R	S	—	MS
27. Raminad Str. 3*	S	S	MR	MS
28. BPI-121*	R	S	S	MS
29. B-E-3*	R	S	MR	MR
B. Varieties in the General Test:				
1. Milbuen 19	R	S	MR	MR
2. Tpmil 29	S	S	MR	MS
3. A/29/20	R	S	MR	MR
4. Chainung 242	R	R	MR	R
5. Tainan-iku No. 486	R	R	MR	R
6. Shinchiky-iku No. 74	R	S	MR	MR
7. C-16	R	S	MR	MR
8. BPI-76 (Bicol Sel.)	R	R	MR	R
9. PI-215, 936	R	S	MR	MR
10. Taichung (Native)	R	S	S	MS
11. A3-47-2	R	S	MR	MR

Table 6. (Cont'd)

Entries	Stations			Final
	College [a]	Iloilo [b]	San Mateo [c]	Reaction
12. IR3-66	S	S	MR	MS
13. IR8-246	S	S	MR	MS
14. M527-9	R	S	MR	MR
15. RPA-4	R	S	S	MS
16. RP-9	R	S	S	MS
17. RPI-46-1	R	S	MR	MR
18. MIFB-318-1	R	S	MR	MR
19. MIFB-318-2	R	S	R	MR
20. MIFB-54	R	S	R	MR
21. MIFB-150-4	R	S	MR	MR
22. MIFB-44-1	R	S	MR	MR
23. RPP-31-3	R	S	MR	MR
24. FB-76-8-1-2-1	R	S	MR	MR
25. MIFB-266-4	R	S	MR	MR
26. Tainan 3	R	R	R	R
27. A3-47-3	R	S	MR	MR
28. IR8-36	S	S	MR	MS
29. IR9-60	S	S	R	MS
C. Glutinous Varieties				
1. Inagubatan	R	S	S	MS
2. Pinutyukan	R	S	S	MS
3. Serona	R	S	MR	MR
4. Binundok	R	R	MR	R
5. Malagkit Sungsong	R	R	MR	R
6. Panpet 63	R	S	S	MS
7. Morforbes 120	R	S	MR	MR
8. Pantje 116	R	S	MR	MR
9. Morforbes 25	R	S	MR	MR
10. Sentje 117	R	S	MR	MR
11. Panpet 64	R	S	MR	MR
12. Morforbes 23	R	S	MR	MR
13. Morforbes 122	S	S	R	MS
14. Sungforbes 101	R	R	R	R
15. Morforbes 22	R	S	MR	MR
16. Sungforbes 59	R	S	R	MR
17. Morforbes 119	R	S	MR	MR
18. Morforbes 66	R	S	R	MR
19. Pinpet 68	R	S	MR	MR
20. Sungforbes 49	R	R	MR	R

a) Conducted by O. R. Exconde, *et. al*
b) Conducted by F. M. Olivares, Jr. *et. al*
c) Conducted by O. Lawas, *et. al*

Table 7. Reaction of rice varieties and promising hybrids to "Tungro" under field conditions, crop year 1965–66 a)

(Infection in percentage)

Variety	Test Locations			Average Infection	Reaction Classification
	Manila (BPI)	Laguna	Pangasinan		
1. B–E–3	50.00	10.0	44.29	47.14	MS
2. Bengawan	64.45	(*)	3.19	34.82	MS
3. BPI–76	98.85	11.50	92.36	67.57	S
4. BPI–121	85.35	19.50	46.40	50.41	S
5. C–18	69.00	11.00	49.84	43.28	MS
6. Nang Thay	74.20	14.00	68.89	52.36	S
7. Norelon 340	98.80	28.50	68.18	63.16	S
8. Peta	56.20	6.00	7.08	23.09	MR
9. Tjere Mas	40.80	0.50	14.49	18.59	MR
10. AC440 Dr. 260	80.10	21.50	79.76	60.25	S
11. A/29/20	50.75	7.50	35.39	31.21	MS
12. AC2246 Mas	55.50	4.00	19.14	26.21	MS
13. C–13	30.60	13.00	(*)	22.05	MR
14. C–16	67.55	5.50	(*)	36.52	MS
15. Earlblumil	88.25	13.00	29.72	43.65	MS
16. FK–178A	61.55	7.50	29.41	32.82	MS
17. Milbuen 19	59.20	11.00	44.07	38.09	MS
18. Milketan 6	54.65	5.50	31.26	30.47	MS
19. Pemil 1	64.15	8.00	37.66	36.60	MS
20. PA–2	53.20	12.50	18.56	28.08	MS
21. RP–9	55.55	13.00	10.57	26.37	MS
22. RP–44	53.30	6.00	7.14	22.14	MR
23. RPA–4	48.80	18.50	16.50	27.27	MS
24. Tpmil 19	82.00	8.00	37.60	42.55	MS
25. Wagwag (check)	94.80	(*)	100.00	97.40	S
Average	65.80	11.02	36.04		

(*) Destroyed by rats.

a) Reported by H. T. Bergonia, C. A. Calica, C. Baniqued, and E. P. Novero during the 14th Annual Rice and Corn Production Conference at the Bureau of Plant Industry, Manila on April 11–15, 1967.

Appendix 1. Pathogenic races of *piricularia oryzae* of the philippines based upon tentative differential varieties selected in the philippines

Race / Differential Variety	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13	P-14	P-15	P-16	P-17	P-18	P-19	P-20	P-21	P-22	P-23	P-24	P-25	P-26	No. of isolates	No. of races identified from respective regions
Kataktara AD 2		R	R	R	R	R	R	R	R	R	R	R		R		R	R	R	R	R	R	R		R	R			
CI 5302	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	M	R		
Chokoto	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S	S	R		
Co 25	S	R	R	R	R	R	S	S	M	R	R	R	R	R	S	R	R	R	R	R	R	R	R	S	R	M		
Wag-wag	R	R	R	R	R	R	R	R	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R		
Pai-kan-tao	R	R	R	R	R	R	S	S	S	R	R	S	S	S	S	S	R	R	R	R	R	R	R	S	M	R		
Peta	S	S	S	S	S	S	S	S	S	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R		
Raminad Str. 3	R	S	R	R	R	S	R	S	S	S	S	S	R	R	S	S	S	R	S	S	R	R	R	R	R	R		
Taichung T-C-W-C	S	K	R	R	S	S	S	S	S	S	S	S	S	S	S	S	S	S	R	R	R	R	R	S	S	R		
Lacrosse	S	R	R	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	R	R	R	R	S	S	S		
CI 8970 (Straw)	R	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	R	S	S	S	R		
Khao Tah Haeng 17	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S		
No. of isolates	2	3	5	7	1	2	2	1	1	4	9	8	1	7	2	6	11	3	5	5	8	3	1	1	1	1	Total 100	
Regional Distribution:																												
Northern Luzon	–	–	–	–	–	–	–	–	–	–	6	1	–	1	–	1	–	–	–	–	–	–	–	–	–	–	9	4
Central Luzon	–	1	–	2	–	–	–	1	–	1	1	–	–	–	–	–	3	2	2	1	2	–	–	–	–	–	16	10
Southern Luzon	–	–	1	1	–	–	–	–	–	–	2	5	–	3	1	4	4	–	1	2	–	2	–	–	1	–	27	12
Bicol	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	2	–	–	1	1	–	–	–	–	–	6	5
Western Visayas	1	1	1	–	–	–	1	–	1	–	–	1	1	1	1	1	1	1	2	–	4	1	1	–	–	1	21	17
Eestern Visayas	–	1	2	3	–	2	1	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12	6
Mindanao	1	–	1	1	1	–	–	–	–	–	–	–	–	1	–	–	1	–	–	1	1	–	–	1	–	–	9	9

Discussion

S. Okabe, Japan: Regarding the comparison between pedigree and bulk methods shown in table 4, could you suggest any reasons why the difference has resulted in the later generation? In the pedigree method, did the selection procedure include any artificial pressure in respect to blast resistance?

Answer: It may be pointed out that both pedigree and bulk methods of selection are being used in the improvement of rice at the Marigaya Rice Research and Training Center. For the pedigree method, individual plants were selected every year for such characters as maturity period, type of panicles and type of grains, shatterability of grains, and lodging character, as well as resistance to pests and diseases. In the bulk method, selection of individual plant was done in the F_5 generation.

The high percentage of resistant pedigree lines compared with that of the bulk selections may be due to the yearly selection of superior plant type within the selected lines which were free from disease infection. In the bulk method individual plant selection was made only in the F_5 generation when the lines selected were tested for blast resistance in the F_6 and later generations.

There was no selection made based on artificial inoculation before the pedigreed lines were compared with the bulk selected lines in the test in the F_6 generation.

In the F_8 generation, the high percentage of resistant bulk lines may be due to individual plants selection made in the F_6 generations before they were tested for blast resistance.

T. K. Van, Malaysia: You stated that in the test on the reaction of 25 varieties to Tungro virus, these were indications that a variety that showed high percentage in one place had also high infection in another place. Was any observation made regarding the leaf hopper populations between these two places.

Answer: According to the authors of the report, the places were selected for study of the disease because of the recurrence of the tungro disease in these places. While they did not mention specifically the extent of population of the leafhoppers in these places they pointed out that crop failures were observed in these places. Since no control measure against the leafhoppers were done during the experiment, and because of the recurrence of infection in these places it appears that the population of insect vector was sufficient to cause crop failures.

D. N. Srivastava, India: Could you kindly elaborate the method of testing rice varieties to bacterial blight at the 3 centers.

Answer: A uniform method of testing rice varieties for bacterial leaf blight resistance was adopted by workers in the three experiment stations. The method involved the use of short pins mounted in two rows on a rubber stopper which is attached to the thumb by a rubber band. A piece of cork covered with cotton and cheese cloth soaked in bacterial suspension of *X. oryzae* is attached to the middle finger. The middle of the flag leaf of plants to be inoculated is placed between the pine and cork which are slightly pressed against each other so that the inoculum from the cork wrapped with cotton and cheese cloth enters the vascular bundles of the leaves after the rubber stopper with the pins is withdrawn.

Twenty-days after inoculation, the flag leaves that were inoculated are examined. In very susceptible varieties, the lesions may extend toward the base and tip of the leaves. On resistant varieties, the downward movement of lesions may be limited to 1.5 cms. from the point of inocolation and for highly susceptible varieties lesions may be from 15 to 20 cms.

H. M. Beachel, U. S. A.: To improve efficiency of bulk method for blast resistance why not subject seedlings to natural blast infection by growing in a blast nursery?

Answer: The suggestion to subject the seedlings to natural infection by growing them in

a blast nursery plot to improve the bulk method of selection, is well taken. The method, if continued from the F_2 seedlings up to the F_5 generation when individual plant are selected for plant type, and other important characteristics for progeny test, will enhance greatly the number of blast resistant lines that may be selected in the progeny test. However, this may require plenty of time and labor in sorting the individual resistant seedlings for planting which we are trying to avoid in the use of the bulk method. Since a large number of individual plants are selected for other important agronomic characters F_5 for the progeny test, we thought that we will also have a good chance of selecting lines with high resistance to blast.

With adequate technical assistance and funds for labor, the suggestion will certainly be useful in improving the bulk method of selection for resistance to blast disease.

References for Paper 7

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