Screening Peanut Plant Introductions in Controlled Environment Chambers for Resistance to *Rhizoctonia solani*

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ABSTRACT

WOODARD, K. E., and B. L. JONES. 1980. Screening peanut plant introductions in controlled environment chambers for resistance to *Rhizoctonia solani*. Plant Disease 64:949-950.

One-hundred forty-one peanut plant introductions were screened in controlled environment chambers for preemergence and seedling resistance to *Rhizoctonia solani*. Plant introductions 295724 and 296551 were most resistant, and field plot tests confirmed that they were resistant to infection by *R. solani*.

The peanut (*Arachis hypogaea* L.) is one of many plant species susceptible to *Rhizoctonia solani* Kühn. This ubiquitous fungus is capable of infecting all organs of the peanut plant (3). Since 1958, *R. solani* has been particularly common in Texas (1) in areas where peanuts have been grown for many years. Statewide losses (5) directly attributed to *R. solani* on peanuts were estimated at 2% for both the 1978 and 1979 crops. This is an estimated loss of $2.2 million for the 1979 crop.

Development of agronomically acceptable cultivars of any crop species resistant to *R. solani* has been unsuccessful (2). The objective of the present study was to determine if some peanut plant introductions could escape or tolerate *R. solani* during the critical period of germination, emergence, and hardening-off.

MATERIALS AND METHODS

Cultures of *R. solani* were obtained from peanut fields in central Texas. Each culture was hyphal tipped from water agar (WA) plates and grown on potato-dextrose agar (PDA). The isolates were tested in a greenhouse to verify that each was a pathogen of peanut seedlings. The most virulent *R. solani* isolate from greenhouse tests was selected for use in this study. The optimum temperature (linear growth) on PDA for the isolate was 28–30 C.

The isolate was cultured on water-soaked grain sorghum (*Sorghum bicolor* (L.) Moench) seed autoclaved in 500-ml Erlenmeyer flasks. After 7–10 days of growth, the *R. solani*-sorghum seed culture was removed from the flasks, air-dried for 24 hr, and macerated in a Wiley Mill equipped with a No. 20 screen.

An estimate of the effective amount of inoculum was made by plating individual particles of the macerated culture on 2% WA. Growth of *R. solani* hyphae from the larger particles (about 0.5 mm^3) approached 100%; therefore, each larger particle was counted as one propagule of *R. solani*. The number of propagules in a weighed sample of macerated culture gave a crude estimate of effective inoculum level.

Sandy loam soil (pH 6.7) from the Texas Agricultural Experiment Station at Stephenville was used as the planting medium. By the assay method of Weinhold (4), the indigenous *R. solani* population of this soil was determined to be 4.0 propagules per 100 g of soil. Inoculum of *R. solani* from the macerated sorghum seed culture was added at 200 propagules per 100 g of soil (2.5 g of inoculum per 5.8 kg of soil). Preliminary tests with the commercial peanut variety Tamnut 74 indicated that this amount of inoculum would not inhibit seed germination but would prevent seedling emergence.

Twenty-four untreated seeds of each test genotype were planted in a metal flat (20 × 30 × 7.5 cm) containing 5.8 kg of unsterilized soil plus 2.5 g of *R. solani* inoculum thoroughly mixed with the soil. The soil was moistened to approximately field capacity. The flats were kept in a controlled environment chamber in total darkness at 28–30 C for 7 days. Each flat was then examined for seedling emergence. Flats containing emerged seedlings were transferred to greenhouse benches to test seedling survival for 21 days. The

Table 1. Peanut cultivars selected as the most resistant to *Rhizoctonia solani* from 141 plant introductions

PI	No. of tests	PI (% emerged[a])	Tamnut 74 (% emerged)
295176	2	12	02
295181	2	06	06
295724	2	16	02
296551	3	13	01
298881	2	15	06
314897	2	15	06
338500	2	04	06
341265	2	06	10
355266	3	01	10
386350	2	06	00

[a] Average of all tests.

0191-2917/80/10094902/$03.00/0
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Table 2. Percent loss of peanut plants from *Rhizoctonia solani* 7, 14, 21, and 130 days after planting in field test plots

Cultivar	Tested germination (%)	Plant loss[a] (%)			
		7 days	14 days	21 days	130 days
PI 296551	88.0	7.3 a	3.0 a	3.5 a	9.0 a
PI 295724	86.0	13.8 a	9.3 ab	9.0 ab	13.3 ab
PI 300596	96.0	25.3 b	17.3 bc	16.5 bc	26.0 c
PI 319793	58.0	30.3 b	20.3 c	18.5 c	21.3 bc
Tamnut 74	100.0	31.5 b	21.5 c	22.0 c	29.3 c

[a] Average of four replicates, 100 seeds per replicate. Calculated as: % loss = % tested germination − % surviving plants. Numbers in columns followed by the same letter are not significantly different ($P = 0.05$) according to Duncan's multiple range test.

peanut genotypes tested were plant introductions obtained from the USDA Southern Regional Plant Introduction Station, Experiment, GA. Tamnut 74 was used as a check.

Each genotype selected for field testing was replicated four times in a randomized complete block design with 6.1-m rows and 0.9 m between centers. One-hundred hand-shelled, untreated seed were planted per row. Seeds were from the previous year's harvest, and seeds from each lot were tested for germination before planting. Plots were planted on 29 May 1979, and seedlings were counted at 7-day intervals for 3 wk. A final count of surviving, productive plants was made at harvest (130 days). During the weekly counts, necrotic plants were examined with a hand-lens. The causal organism was determined by associating disease symptoms of the plant with the presence of a pathogen known to be capable of causing the symptoms. The *R. solani* population of the field plots was assayed at three propagules per 100 g of soil (4).

RESULTS AND DISCUSSION

From the 141 plant introductions screened by the methods described, 10 were selected for additional testing (Table 1). Selections were based on seedling emergence and survival for a 21-day testing period. Because of the extreme inoculum density used in the controlled environment chambers tests, all seed or seedlings were affected by the pathogen. The effects ranged from minor lesions on seedling hypocotyls to complete rotting of the seed in the soil. Typical damage was manifested as necrotic lesions on seedling hypocotyls. Although no seedling emerged undamaged in the controlled environment chambers, the two plant introductions (295724 and 296551) selected for field trials showed greater ability to recover from the fungal infection.

PI 295724 and PI 296551 were field tested during 1979. Tamnut 74, PI 300596, and PI 319793 were included in the field test. Results of the field test (Table 2) showed a significant increase ($P = 0.05$) for PI 296551 and PI 295724 in seedling emergence and mature plant survival over the other three genotypes.

In the field test plots, *Aspergillus niger* accounted for approximately 10% of seedling mortality. As far as could be determined, *R. solani* was responsible for the remaining preemergence and seedling loss. *Sclerotium rolfsii* was the major pathogen of the mature plants.

Our results indicate that the controlled environment chamber method could be an efficient way to screen peanut lines for resistance to *R. solani*.

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