Evaluation of Peanut Cultivars for Resistance to Field Infection by *Sclerotium rolfsii*

W. D. BRANCH, Department of Agronomy, and A. S. CSINOS, Department of Plant Pathology, University of Georgia, Coastal Plain Experiment Station, Tifton 31793-0748

ABSTRACT

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During 1983–1985, field plot studies were conducted to evaluate the relative severity of *Sclerotium rolfsii* among 16 peanut (*Arachis hypogaea*) cultivars. The valencia market types were significantly more susceptible than spanish, runner, or virginia types. Toalson, Tifrun, Pronto, and Sunbelt Runner had the fewest disease loci, and Early Bunch, Tifrun, Sunbelt Runner, Florigiant, NC 7, and GK 3 had the highest yields. The identification of cultivars with both low disease incidence and high yield performance should be a beneficial approach for control of stem rot.

Stem rot, white mold, or southern blight are all common names for the same disease of the cultivated peanut (*Arachis hypogaea* L.) caused by the soilborne fungus *Sclerotium rolfsii* Sacc. (2). This disease occurs throughout the world in peanut and other host crops, and severe yield losses may be expected as a consequence of high infection levels (1).

Chemicals and cultural practices have been the predominant control measures used in the past (14), but these methods are only about 50% effective (6–8). Recently, the inclusion of moderately resistant genotypes used in conjunction with specific fungicides have further suppressed disease development more than when either was used separately (18).

Investigations as early as 1917 have reported differential susceptibility among various peanut cultivars and advanced germ plasm lines (3–5, 9–13,15,17). However, very little screening of currently available cultivars for *S. rolfsii* resistance has been done. Therefore, the objective of this study was to assess the disease reaction and yield performance among present commercial peanut cultivars.

MATERIALS AND METHODS

Sixteen peanut cultivars were selected to represent the four U.S. market types: valencia, spanish, runner, and virginia. Market types equate fairly well to botanical varieties as follows: subspecies *hypogaea* var. *hypogaea* = virginia and runner types, and subspecies *fastigiata* var. *fastigiata* and var. *vulgaris* = valencia and spanish types, respectively. However, peanut cultivars developed over the past few years through hybridization between subspecies make classification somewhat more difficult according to botanical groups.

The field site chosen at the Coastal Plain Experiment Station research farm

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had a known history of stem rot occurrence. Soil was a Tifton loamy sand that is typically used for peanut production in this area of the state. A randomized complete block design with four replicates was used during each of the 3 yr of this study. Plots consisted of two rows 6.1 m long by 1.8 m wide. Row spacing was 0.8 m within plots and 1.0 m between adjacent plots. Seeds were spaced about 0.1 m apart.

Planting dates were 12 May 1983, 22 May 1984, and 2 May 1985. Recommended production practices were followed every year, except no disease control measures were employed for soilborne pathogens. Cultivars were individually dug and harvested according to visual maturity estimates.

Immediately after plants were inverted, disease loci per plot was counted. A disease locus consisted of one or more plants infected in a 30-cm section of row (16). Yields were obtained from total pod weights after forced-air-drying and hand-cleaning.

Data from each year were analyzed by analysis of variance, then combined across years. Waller-Duncan's multiple range test (k-ratio = 100) was used for mean separations.

RESULTS AND DISCUSSION

In mid-July, main stems of symptomatic plants wilted during the hottests part of the day. Often white, spreading mycelium, characteristic of *S. rolfsii*, was present on the soil surface and adjacent lateral branches as well as main stems, accompanied by spherical tan sclerotia. The best time to observe and assess damage from the disease was immediately after digging and inverting plants. Crown and root decay was then readily apparent along with a general reduction of peanut pods if infection occurred early. Some damage from *Rhizoctonia solani* Kühn also occurred on lateral branches, but it was not considered serious enough to warrant evaluation.

The valencia market types were found more susceptible to *S. rolfsii* than spanish, runner, or virginia types in all 3 yr of this study (Table 1). These findings agree with earlier reports (9–11,15), and as expected, virginia and runner types yielded better than the other two types.

Table 1. Three-year summary of four peanut market types evaluated for *Sclerotium rolfsii* incidence and yield performance (1983–1985)

Market type	Disease loci (no./12.2 m)	Pod yield (kg/ha)
Valencia	13.0 a[z]	2,280 c
Runner	7.6 b	4,798 a
Virginia	7.5 b	4,950 a
Spanish	5.9 c	3,444 b

[z]Means within each column followed by the same letter do not differ significantly at $P = 0.05$.

As a group, spanish types were found to be the least susceptible to *S. rolfsii* compared with the other market types (Table 1), but there were exceptions among cultivars within types (Table 2). The lack of susceptibility of these spanish cultivars does not agree with other results (9). Likewise, immunity as initially reported (10,11) was not detected among any of the 16 cultivars evaluated under our relatively high infection levels. But, genotypes and locations differed in these previous studies (9–11).

Toalson, a spanish cultivar with resistance to pod rot caused by *Pythium myriotylum* Dreschler and *R. solani* (19), had fewer disease loci caused by *S. rolfsii* than Florunner (Table 2) but yielded comparably (Table 3). The possible relationships between stem rot and pod rot resistance are being investigated (20). Conversely, New Mexico Valencia C, New Mexico Valencia A, and Tennessee Red had significantly higher numbers of disease loci than other cultivars, except for Valencia McRan and Florunner (Table 2).

Early Bunch, Tifrun, Sunbelt Runner, Florigiant, NC 7, and GK 3 yielded significantly better than other cultivars, except for Sunrunner (Table 3). Florunner is currently the most popular runner cultivar grown in the United States, and thus, it serves as a standard check in most yield trials. In this study, only two other runner cultivars, Tifrun and Sunbelt Runner, had significantly greater yields than Florunner. However, neither cultivar was specifically selected for stem rot resistance.

Because low disease incidence and high yield performance are both important in peanut cultivar evaluation to *S. rolfsii*, the following classification is proposed as

Table 2. Disease evaluation of 16 peanut cultivars for incidence of field infection by *Sclerotium rolfsii*

Cultivar	Market type	Disease loci (no./12.2 m)			
		1983	1984	1985	Mean
New Mexico Valencia C	Valencia	23.5 a[z]	9.2 a	11.5 a	14.8 a
New Mexico Valencia A	Valencia	25.0 a	7.5 abcd	9.5 abc	14.0 ab
Tennessee Red	Valencia	17.5 ab	8.8 ab	10.5 ab	12.2 abc
Valencia McRan	Valencia	13.5 bc	9.0 ab	10.5 ab	11.0 bcd
Florunner	Runner	12.5 bcd	7.5 abcd	7.8 abcd	9.2 cde
Sunrunner	Runner	10.5 bcd	7.8 abc	9.0 abc	9.1 de
NC 7	Virginia	10.0 bcd	4.8 cdef	9.5 abc	8.1 def
Florigiant	Virginia	11.5 bcd	4.5 cdef	7.8 abcd	7.9 def
GK 3	Virginia	8.5 cd	6.5 abcde	6.5 abcd	7.2 ef
Starr	Spanish	14.5 bc	4.5 cdef	2.5 d	7.2 ef
Tamnut 74	Spanish	11.5 bcd	4.5 cdef	5.0 bcd	7.0 ef
Early Bunch	Virginia	11.0 bcd	3.0 ef	6.8 abcd	6.9 ef
Sunbelt Runner	Runner	7.0 cd	5.5 bcdef	6.8 abcd	6.4 efg
Pronto	Spanish	8.5 cd	4.0 def	5.0 bcd	5.8 fg
Tifrun	Runner	9.0 cd	4.5 cdef	3.5 cd	5.7 fg
Toalson	Spanish	5.0 d	2.0 f	3.5 cd	3.5 g
Average		12.4 A	5.8 B	7.2 B	8.5

[z]Cultivar means within each column or yearly averages within the last row followed by the same letter do not differ significantly at $P = 0.05$.

Table 3. Yield evaluation of 16 peanut cultivars grown in a *Sclerotium rolfsii* infected field

Cultivar	Market type	Pod yield (kg/ha)			
		1983	1984	1985	Mean
Early Bunch	Virginia	4,503 b[z]	5,897 a	5,249 ab	5,216 a
Tifrun	Runner	5,624 a	4,028 de	5,914 a	5,189 a
Sunbelt Runner	Runner	4,554 b	5,532 ab	4,831 b	4,972 ab
Florigiant	Virginia	4,547 b	5,019 c	5,206 ab	4,924 ab
NC 7	Virginia	4,562 b	5,121 bc	4,858 b	4,847 ab
GK 3	Virginia	4,928 ab	3,657 de	5,858 a	4,814 ab
Sunrunner	Runner	4,574 b	4,116 d	5,198 ab	4,629 bc
Florunner	Runner	4,334 b	3,599 e	5,278 ab	4,404 cd
Toalson	Spanish	4,144 b	4,024 de	3,844 c	4,004 d
Tamnut 74	Spanish	2,964 c	3,651 de	3,270 cde	3,295 e
Pronto	Spanish	2,694 cd	3,973 de	3,100 cde	3,255 e
Starr	Spanish	2,431 cde	3,739 de	3,496 cd	3,222 e
Valencia McRan	Valencia	1,892 de	2,493 f	2,620 e	2,335 f
New Mexico Valencia A	Valencia	1,660 e	2,553 f	2,762 de	2,325 f
New Mexico Valencia C	Valencia	1,713 e	2,509 f	2,572 e	2,264 f
Tennessee Red	Valencia	1,961 de	2,160 f	2,460 e	2,194 f
Average		3,568 B	3,880 AB	4,157 A	3,868

[z]Cultivar means within each column or yearly averages within the last row followed by the same letter do not differ significantly at $P = 0.05$.

a comparative combination rating scale, where 1 = high yield performance and low disease incidence, 2 = high yield performance and medium disease incidence, 3 = high yield performance and high disease incidence, 4 = medium yield performance and low disease incidence, 5 = medium yield performance and medium disease incidence, 6 = medium yield performance and high disease incidence, 7 = low yield performance and low disease incidence, 8 = low yield performance and medium disease incidence, and 9 = low yield performance and high disease incidence.

According to this rating index, 1 is least susceptible and 9 is most susceptible. High, medium, and low categories were determined by mean separations from the combined analyses. As such, Tifrun and Sunbelt Runner were rated 1; Early Bunch, Florigiant, NC 7, and GK 3 were rated 2; Toalson and Pronto were rated 4; Sunrunner, Florunner, Tamnut 74, and Starr were rated 5; Valencia McRan was rated 8; and New Mexico Valencia A, New Mexico Valencia C, and Tennessee Red were rated 9.

An association between erect or bunch growth habit and stem rot susceptibility has been suggested previously (13,15). All valencia and spanish cultivars used in this study have bunch growth habits. Although the valencia cultivars were found most susceptible, the spanish types and the Toalson cultivar in particular were not considered highly susceptible to *S. rolfsii*. Likewise, Early Bunch, a large-seeded virginia market type, has a bunch growth habit, but it also was found to be quite productive and tolerant to *S. rolfsii*. Peanut growth habit therefore would not appear to be very closely related to stem rot susceptibility.

These results indicate the beneficial approach of determining yield performance and disease incidence for assessing *S. rolfsii* susceptibility among peanut cultivars. Because of seasonal variation (Tables 2 and 3), multiple-year evaluations should continue to be conducted on other genotypes in the future.

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