Control of Peanut Leaf Rust Alone or in Combination with Cercospora Leaf Spot

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ABSTRACT

Two types of experiments demonstrated that peanut rust caused by *Puccinia arachidis* can be a potentially serious foliage disease of peanuts in the near absence of the Cercospora leaf spot diseases caused by *Cercospora personata* or *C. arachidicola*. Losses from peanut leaf rust were reduced by weekly applications of Bravo 75WP, Bravo 6F (chlorothalonil), Dithane M45 (coordination product of zinc ion and Maneb 80% WP), and Fungi Sperse Magi-Cal® (30.5% sulfur, 5.7% zinc, 23% organic calcium compound) to plants treated with Benlate (benomyl) to control the Cercospora leaf spots. These same fungicides and in addition Manzate 200 (coordination product of zinc ion and Maneb 80% WP) and combinations of Benlate + Manzate 200, Benlate + Manzate 200 + Oil (Humble Orchex Oil N795), Dithane M45 + Du-Ter (triphenyltin hydroxide), and Benlate M (commercial mix of Benlate and Manzate 200) also reduced losses on plants affected with both leaf rust and the Cercospora leaf spots. Benlate alone controlled the two *Cercospora* pathogens but did not control *Puccinia arachidis*.

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Additional key word: epiphytotic.

Peanut leaf rust, caused by *Puccinia arachidis* Speg., has become of increasing concern to the producers of fall-harvested peanuts, *Arachidis hypogaea* L., in South Texas since 1965 (4, 8). Specific recommendations for reducing rust losses have not been made because information on control measures has been very limited.

Most of the literature on rust of peanuts has been concerned with its occurrence and not with the potentially destructive nature of the disease. Bromfield (2) in a comprehensive review emphasized the lack of information on epiphytology and fungicidal control measures. Harrison in 1967 (4) indicated that the severity of rust might be reduced by the application of foliage fungicides. Arneson in 1971 (1) also reported that losses from rust may be reduced by applications of certain fungicides on peanuts in Honduras and Nicaragua.

Preliminary results from tests in 1970 (6, 7) indicated that peanut rust could be controlled either when the rust occurred alone or in combination with Cercospora leaf spot caused by *Cercospora personata* (Berk. & Curt.) Ell. & Ev. and *C. arachidicola* Hori. The early appearance of rust in South Texas in June 1971 afforded an opportunity to study further both the economic effects of, and control measures for, leaf rust on peanuts. Rust and the two Cercospora leaf spots were epiphytotic in many peanut fields in that area by mid-season of the 1971 fall-harvested crop (8).

P. arachidis was identified 3 July 1971 in a field near Pearsall, Texas,in Frio County. It apparently had started in small infection centers during mid-June. The uredospores had apparently come from some outside source (10). These infection centers rapidly developed into the "hot spots" mentioned by Harrison (8). These "hot spots" developed so rapidly that by late July they were present in most fields in the western half of Frio County. By the time the early crop was harvested in late July and early August entire fields were severely rusted even though they still appeared to be green when viewed from a distance. The early development of rust is illustrated in Fig. 2 and 3. The major loss to the early crop was confined to the "hot spot" infection centers as illustrated in Fig. 3.

MATERIALS AND METHODS.–The effect of peanut leaf rust on Spanish-type peanuts (cultivar 'Starr') was determined by conducting two series of tests: (i) tests for the control of rust (rust control series) in the near absence of Cercospora leaf spot, and (ii) tests in which leaf rust occurred in combination with the Cercospora leaf spot. For the rust control series, different fungicide sprays were applied to peanuts that had been sprayed with Benlate at 0.56 kg/hectare (0.5 lb/acre)/application at approximately 14-day intervals to control the Cercospora leaf spot fungi. This treatment controlled the development of Cercospora leaf spots but permitted *P. arachidis* to develop (5, 6, 7; and Fig. 4, 5, 6). Occasionally, lesions caused by both *Cercospora* pathogens have been observed on Benlate-treated buffer rows and Benlate checks prior to the death of rust-infected peanut plants. Fungicides used in the rust control series included: Bravo 75WP (chlorothalonil), Bravo 6F

TABLE 1. Effect of some fungicides upon the pathogenicity of the leaf rust pathogen *Puccinia arachidis* with leaf spot pathogens *Cercospora personata* and *C. arachidicola* suppressed by applications of a Benlate (benomyl) fungicide. Tests conducted during the leaf rust epiphytotic of 1971 in South Texas

Fungicide[a]	Rate/Application		Peanut yields at Locations[b]				Rust Ratings[c]	
			Palmer		Toalson			
	Metric (per hectare)	English (per acre)	Metric (kg/hectare)	English (lb/acre)	Metric (kg/hectare)	English (lb/acre)	Palmer	Toalson
Check	0.0	(0.0)	921	(822)	1,484	(1,324)	1.0	1.0
Dithane M45	1.7 kg	(1.5 lb)	2,895	(2,583)	2,377	(2,121)	7.4	7.3
Fungi Sperse	9.4 liters	(1.0 gal)	2,838	(2,532)	2,442	(2,179)	5.1	6.8
Bravo 75WP	1.7 kg	(1.5 lb)	3,145	(2,806)	2,585	(2,306)	7.6	7.5
Bravo 6F	1.8 liters	(1.5 pints)	3,089	(2,756)	2,975	(2,654)	8.2	8.1
Cosanil	1.7 kg	(1.5 lb)	2,734	(2,439)	2,130	(1,900)	3.1	3.1
Eli Lilly 279	111.0 gm[d]		3,027	(2,701)	2,302	(2,054)	6.5	5.7
LSD (0.05) =			549	(490)	426	(380)	1.0	0.7

[a] All plots, including check and buffer rows, were sprayed with Benlate [factory mixture, one part benomyl methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate and four parts Manzate 200 (80%)] at 560 gm/hectare (0.5 lb/acre) at 14-day intervals for the control of the Cercospora leaf spot pathogens.

[b] Kilograms of nuts per hectare (pounds of nuts per acre).

[c] Rust ratings at harvest: 1 = no disease control, all foliage dead or nearly so; 9 = only occasional rust pustules, no death of foliage.

[d] Active material applied.

TABLE 2. Effect of some fungicides and fungicide mixtures upon the pathogenicity of a combination of *Puccinia arachidis, Cercospora personata* and *C. arachidicola* during the leaf rust and leaf spot epiphytotic in South Texas in 1971

Fungicides	Rate/Application		Peanut yields at Locations[a]				Rust Ratings[c]	
			Palmer		Toalson			
	Metric (per hectare)	English (per acre)	Metric (kg/hectare)	English (lb/acre)	Metric (kg/hectare)	English (lb/acre)	Palmer	Toalson
Check	0.0	(0.0)	411	(367)	696	(621)	1.0	1.0
Dithane M45	1.7 kg	(1.5 lb)	2,656	(2,370)	2,458	(2,193)	7.0	6.1
Fungi Sperse	9.4 liter	(1.0 gal)	2,234	(1,993)	2,381	(2,124)	6.4	5.8
Bravo 75WP	1.7 kg	(1.5 lb)	2,772	(2,473)	3,026	(2,700)	7.6	7.0
Bravo 6F	1.8 liter	(1.5 pints)	2,961	(2,642)	3,152	(2,812)	8.1	7.9
Cosanil	1.7 kg	(1.5 lb)	2,311	(2,062)	1,358	(1,212)	3.1	1.4
Eli Lilly 279	111.0 g[c]	(1.57 oz[c])	2,789	(2,488)	1,899	(1,694)	5.9	4.0
Manzate 200	1.7 kg	(1.5 lb)	2,915	(2,601)	2,480	(2,213)	8.1	5.3
Benlate M[d]	2.8 kg	(2.5 lb)	2,300	(2,052)	2,672	(2,384)	7.6	7.5
Benlate Manzate 200	0.28 kg 1.40 kg	(0.25 lb) (1.25 lb)	2,743	(2,447)	2,674	(2,386)	7.2	5.9
Benlate Manzate 200 Orchex Oil N795[e]	0.28 kg 1.40 kg 9.4 liters	(0.25 lb) (1.25 lb) (1.0 gal)			2,688	(2,398)		7.9
Benlate Bravo 75WP	0.28 kg 1.40 kg	(0.25 lb) (1.25 lb)	2,562	(2,286)	2,954	(2,636)	7.6	6.2
Dithane M45 Du-Ter	1.40 kg 0.28 kg	(1.25 lb) (0.25 lb)	2,729	(2,435)	2,635	(2,351)	8.0	6.6
LSD (0.05) =			522	(466)	326	(291)	0.8	0.8

[a] Kilograms of nuts per hectare (pounds of nuts per acre).

[b] Disease ratings at harvest: 1 = all foliage dead or nearly so (disease not controlled); 9 = occasional rust pustules of Cercospora leaf spots, no death of foliage.

[c] Active material.

[d] Benlate = factory mixture, one part benomyl [methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate] and four parts Manzate 200 (80%).

[e] Orchex Oil N795® (Humble Oil & Refining Co., Baytown, Texas).

(chlorothalonil), Dithane M45 (coordination product of zinc ion and Maneb 80% WP), Eli Lilly 279 [α-(2-chlorophenyl)-α-cyclohexyl-5-pyrimidine methanol], Fungi Sperse Magi-Cal (30.5% sulfur, 5.7% zineb, 23% organic calcium compound), and Cosanil (25% zineb, 20% sulfur, 5% copper).

In tests concerned with the control of both rust and Cercospora leaf spot, plots not treated with Benlate were used. In addition to the fungicides used in the rust control series, combinations of Benlate + Manzate 200 (benomyl + coordination product of zinc ion and Maneb 80% WP), Benlate + Manzate 200 + Oil (Humble Orchex Oil N795), Benlate + Bravo 75WP, Dithane M45 + Du-Ter (triphenyltin hydroxide), and Benlate M (commercial mix of benomyl and Manzate 200) and Manzate 200 alone were also used.

All test chemicals were applied eight times at approximately weekly intervals with a sprayer powered with a PTO Warner 10F four-piston pump. The sprays were applied at 468 liters/hectare (50 gal/acre) and 200 psi (14.1 kg/cm^2). The two-row spray boom was fitted with four nozzles (T6W TeeJet, wide angle, hollow cone) per row arranged to provide complete coverage of the foliage. The entire unit was tractor-mounted with a three-point hitch.

Both series of tests were located in Frio County on the G. A. Toalson & Sons' Farm near Pearsall, Texas, and in Atascosa County on the Palmer Bros.' Farm near Pleasanton, Texas. The individual spray plots were randomized and replicated (five and four times in the Toalson and Palmer tests, respectively). Each plot consisted of two rows 12.8 meters (42 feet) and 15.2 meters (50 feet) long at the Toalson and Palmer locations, respectively. There were two buffer rows between each test plot. The rust control tests and the rust plus leaf spot control experiments were separated at each location either by extra buffer rows (Toalson test) or a wide alley (Palmer test). An aerial view of the Toalson test site is shown (Fig. 4).

Disease ratings made at harvest time were based on a modification of the Horsfall-Barratt system of determining disease severity using a scale of 1-9 (9). Disease ratings and yields in pounds of nuts per acre were used to evaluate the efficacy of the fungicides to control peanut rust either alone or in combination with Cercospora leaf spot. The harvest date that appeared best for the majority of the treatments was used. In the case of the Toalson test, this was 110 days from planting, whereas in the Palmer test it was 131 days. Previous tests for Cercospora leaf spot control (3) have revealed that peanut yields may be increased by delaying harvest, however, it was not practical to delay harvest beyond the indicated time in these tests.

RESULTS AND DISCUSSION.–The data (Table 1, Fig. 4, 5, and 6) indicate that leaf rust can be a potentially serious disease of peanuts, and that it can be controlled economically by the use of fungicides even under epiphytotic conditions. The data (Table 1, Toalson test) also provide evidence that Bravo 75WP [at 1.7 kg/hectare (1.5 lbs/acre) application] or Bravo 6F [at 1.8 liters/hectare (1.5 pints/acre)/application] applied at approximately weekly intervals will hold rust in check even when rust had become established before the spray schedule was initiated. The fungicides, Dithane M45, Fungi Sperse Magi-Cal, Eli Lilly-279, and Cosanil also reduced losses from rust in the absence of leaf spot but were less consistent in their performance.

Both leaf rust and Cercospora leaf spots were present on the 34-day-old peanuts in the Toalson tests when the first sprays were applied on 11 August. Southerly winds apparently had carried spores of the pathogens across the test area from an adjoining field where both rust and leaf spot were present and which had been harvested the last week of July. Plants in buffer rows and check plots were severely diseased and by the time the plants were 90 days old many were dead both in the rust control test (which had been uniformily sprayed with Benlate) and in the test on control of leaf rust in combination with Cercospora leaf spot.

The disease incidence at the Palmer location for both rust and Cercospora leaf spots were not severe until mid-season. Development of these diseases, however, progressed rapidly so that by harvest time unprotected or poorly protected plants were dead or severely affected.

The disease ratings and yields presented in Tables 1 and 2 indicate that leaf rust can be nearly as destructive alone as when it occurs in combination with Cercospora leaf spot. The plants in the Benlate-sprayed checks in the rust control series had disease ratings of 1.0, whereas the plants in plots sprayed with Bravo and Dithane M45 had disease rating ranging from 7.4 to 8.2, indicating good control. Figure 6 illustrates the degree of control with Dithane M45 and Bravo 75WP in one of the preliminary rust control tests in 1970.

The data in Table 2 indicate that spraying with Bravo 75WP, Bravo 6F, Dithane M45, Manzate 200 or combinations of Benlate + Manzate, Benlate + Manzate 200 + Orchex Oil N795, Benlate + Bravo 75WP, Benlate M and Dithane M45 + Du-Ter show promise for controlling the leaf rust and Cercospora leaf spot fungi under epiphytotic conditions when those sprays are applied to approximately weekly intervals.

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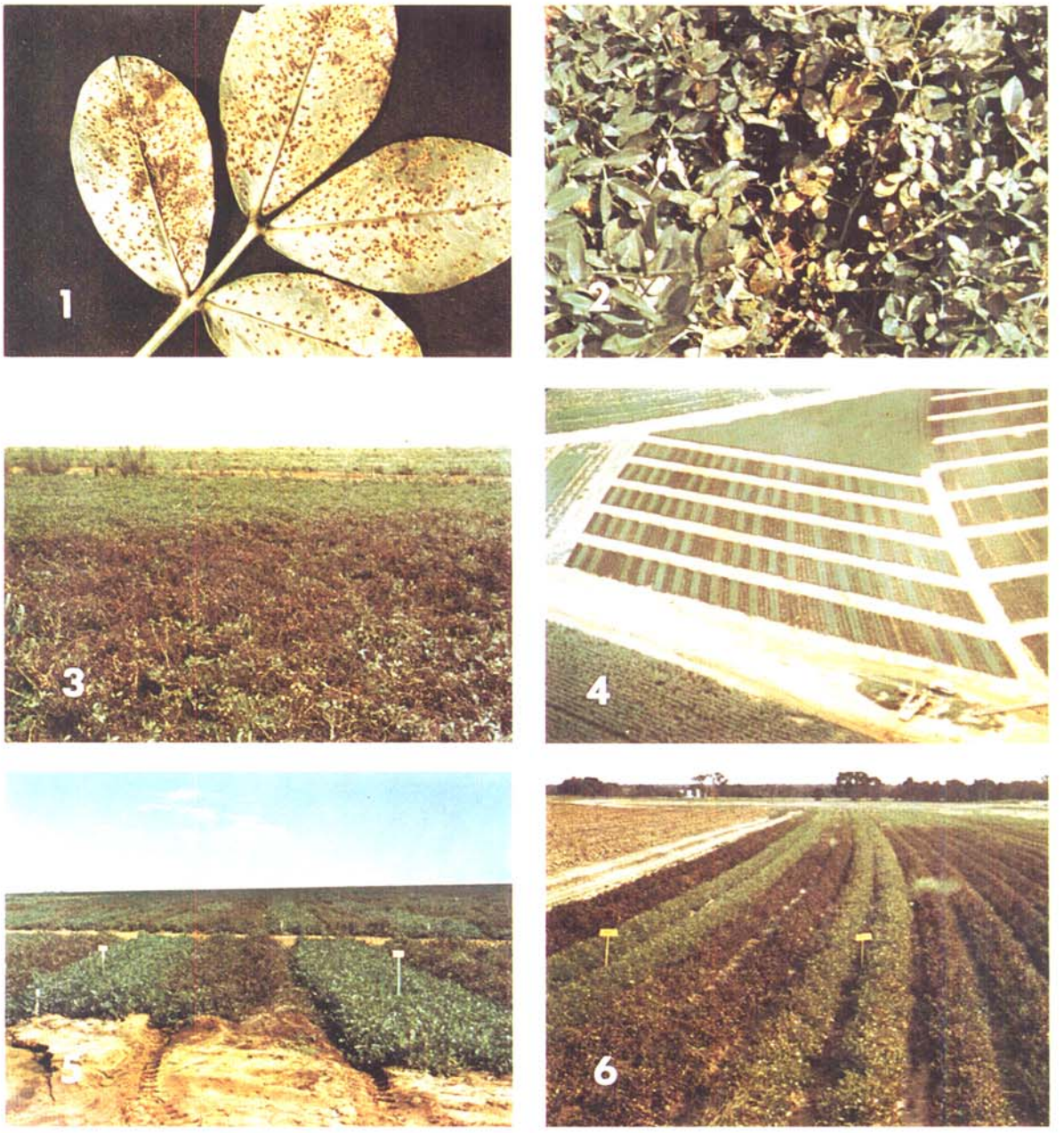

Fig. 1-6. 1) Peanut leaf with rust uredia. 2) Early symptoms of a rust infection center; note general yellowing of leaves in center. 3) Portion of a large "hot spot" rust infection center in early August 1971 in field ready for harvest. Only an occasional leaf was affected with Cercospora leaf spot in green area of the field. Uredia were numerous on the foliage in the green portion of the field. 4) Aerial view of 1971 Toalson spray test; brown strips represent buffer rows or check plots where plants were killed by rust alone (on the right, one-third of test site) or by a combination of rust and Cercospora leaf spots (on the left, two-thirds of test site). 5) Two of the green strips in Fig. 4 at harvest time. These plots had been sprayed with Bravo 75WP (left green strip) and Benlate + Manzate 200 + Orchex Oil N795 (right green strip). 6) View of 1970 rust control test in which Dithane M45 (left) and Bravo 75WP (right) sprays had been superimposed on Benlate-treated peanuts; the buffer rows with plants dead from rust had been sprayed with four applications of Benlate; rust development apparently was uninhibited.

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