The Influence of Calcium on the Susceptibility of Peanut Pods to Pythium Myriotylum and Rhizoctonia Solani[1]

Laurence D. Moore and W. H. Wills[2]

ABSTRACT

No correlation was found between calcium applied at an equivalent rate of either 897 or 1,793 kg/ha in an artificial medium and the amount of pod breakdown incited by either **Pythium myriotylum or Rhizoctonia solani. R.** solani appeared to be the dominant organism although the isolates tested exhibited a wide range of pathogenicity to peanut pods.

Garren (1) reported that increasing the calcium available in the underground fruiting zone of peanuts (*Arachis hypogaea* L.) plants from 800 to 8,000 pounds per acre (896.3 to 8,963.5 kg/ha) land plaster ($CaSO_4$ $2H_2O$) resulted in a reduction in the percentage of "soil rot" of peanut. Effective reduction in pod rot was also attained by application of 1,000 or 2,000 pounds per acre (1,120.8 or 2,241.6 kg/ha) land plaster. Subsequently, Hallock and Garren (2) reported that, in field studies, pod breakdown (pod rot) caused by *Pythium myriotylum* Drechs. was significantly lower in peanut pods containing $>$ 0.20% calcium as compared to $>$ pods having less than 0.15% calcium. There was, however, an inconsistency in results obtained over the three-year test period. Above-normal rates of land plaster up to 3,090 kg/ha reduced pod breakdown in 1964 and 1965 but did not significantly reduce pod breakdown or increase fruit yields in 1966. The present investigation was designed to evaluate the effect of calcium supplied in a defined medium on the susceptibility of peanut fruits to pod breakdown incited by *Pythium myriotylum* and *Rhizoctonia solani* Kuhn.

---

[1]Contribution No. 270. Department of Plant Pathology and Physiology, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.

[2]Associate Professor and Professor of Plant Pathology, Department of Plant Pathology and Physiology, Virginia Polytechnic Institute and State University.

Materials and Methods

The bunch peanut, Ga. 119-20, was used throughout this study. Seeds were germinated in sterile Weblite (R) (expanded shale, Webster Brick Corporation, Roanoke, Virginia) and transplanted when one to two-weeks old into 12 liter black plastic pots containing Weblite and Osmocote (R) 14-14-14 controlled release fertilizer (Sierra Chemical Co., Newark, Calif.). The chemical composition of Weblite is as follows: total silica as SiO_2, 58.3%; total aluminum as Al_2O_3, 25.2%; total iron as F_2O_3, 9.4%; total calcium as CaO, 0.0%; total magnesium as MgO, 2.7%; total sulfur as SO_3, 0.0%; total sodium as Na_2O, 0.1%; and total potassium as K_2O, 2.3%.

Two different container systems were employed in which the peanut fruits were provided with specific amounts of calcium and inoculated independently of the parent plant. One system consisted of twenty-one 140 cc styrofoam cups 60 cm deep placed around each of 24 parent plants, providing seven cups of each of three calcium treatments per plant. All 21 cups surrounding each of six of the 24 parent plants were inoculated with the same organism or organisms. In this system there were 42 replications of each treatment. A treatment consisted of one of three organism combinations or a control and one of three calcium treatments. The second system consisted of wooden boxes 10 cm deep and 7.5 cm wide. Four boxes were placed around each parent plant and the calcium treatments and inoculation treatmets were completely randomized among the boxes to provide eight replications of each treatment as in the first system. In both systems Weblite was used as the support medium. The influence of calcium on pod breakdown was evaluated in four separate studies. The first container system was used in the first three studies, while the second system was used in the fourth study.

The amount of $CaSO_4 \cdot 2H_2O$ added to the Weblite was based on the amount of land plaster reported by Hallock and Garren (2) to provide for control of pod breakdown. Three different treatments were used i.e. normal level of calcium sulfate (1.45 g Ca/3.5 liters Weblite) which is equivalent to 897 kg/ha land plaster; a high level of calcium sulfate which is equivalent to 1,793 kg/ha land plaster and a calcium-potassium sulfate mixture which is equivalent to 897 kg/ha land plaster and 933 kg/ha K_2SO_4.

Pegs were trained into the support medium during a seven to ten week period during which the Weblite was infested with **Pythium myriotylum or Rhizoctonia solani** or a combination of both organisms or was left uninfested as a control. Wills and Moore (4) isolate No. 1 of **P. myriotylum** was used in all four studies. Three **Rhizoctonia** isolates were tested because of their wide range of pathogenicity to peanut seedlings (4). **R.** solani isolate No. 10 was used in the first and second study, isolate No. 8 was used in the third study, and isolate No. 6 was used in the fourth study. The inoculum was prepared by growing the organisms in a sand, corn meal, water mixture (100 g sand, 5 g corn meal, and 40 ml of water) for three weeks. Approximately 5 g of inoculum was incorporated into 140 cc of Weblite. Throughout the studies, tap water was added to the Weblite to maintain a moisture level adequate to support the development of fruit.

Four to six weeks following inoculation, the pods were harvested and evaluated for disease development. Isolations were made at random from infected pods to confirm colonization by the pathogens used. The data were recorded as percentage of pods with pod breakdown.

Results and Discussion

Typical (3) Pythium and Rhizoctonia-incited pod breakdown was observed in the three calcium treatments. Pegs as well as immature and mature pods were infected. Pythium pod breakdown first appeared as a light browning and watersoaking of the peanut shell. Eventually entire pods appeared watersoaked and exhibited brown necrotic areas. Rhizoctonia-incited pod breakdown in the initial stages of disease development was observed as small discrete lesions a few millimeters in diameter. In the more advanced stages, dark brown lesions 4 mm or larger were present on the fruit. Some fruits were entirely brown. When both pathogens were present in the infested Weblite, infected pods most often exhibited symptoms of Rhizoctonia-incited pod breakdown.

It appeared that both Pythium and Rhizoctonia nearly destroyed some peanut pods leaving only fragments in the Weblite. Both organisms commonly attacked pegs destroying the growing tip or causing the formation of distinct lesions on the peg. Fusarium and other supposed secondary microorganisms were often present in pods infected by either organism.

There appeared to be no correlation between the level of calcium present in the Weblite and susceptibility to either Pythium or Rhizoctonia-incited pod breakdown (Table 1). Comparing the Pythium pod breakdown data from the four studies, there was from 11 to 16% pod breakdown in peanut fruit grown at the normal calcium level, while a range of 5 to 21% was found for those fruit grown at the high calcium level. There was even greater variation among the Rhizoctonia calcium treatment, especially among the four studies of the experiment. In the first study, *R. solani* isolate No. 10 caused 80 to 94% pod breakdown while 9 to 24% pod breakdown was caused by this

Table 1. The influence of calcium on pod breakdown incited by Pythium myriotylum and Rhizoctonia solani.

	PERCENTAGE POD BREAKDOWN											
Treatments	Pythium				Rhizoctonia				Pythium and Rhizoctonia			
Study No.	1	2	3	4	1	2	3	4	1	2	3	4
Normal calcium	11	16	15	16	94	9	83	14	--	20	83	--
High calcium	21	13	5	6	93	17	78	14	--	23	78	--
Calcium and potassium	12	0	10	30	80	24	82	11	--	28	89	--

isolate in the second study. In the third study, *R. solani* isolate No. 8 caused from 78 to 83% pod breakdown while isolate No. 6 caused from 11 to 15% breakdown in the last study. As shown in Table 1, no correlations could be drawn between calcium treatments and pod breakdown incited by the *Rhizoctonia* isolates. There appeared to be little or no additive effect when fruits were inoculated with both Pythium and Rhizoctonia. Rhizoctonia appeared to be the dominant organism.

The addition of land plaster to the under ground fruiting zone of peanuts may under certain field conditions aid in resistance to pod rot, but it appears that calcium, itself, in the artificial system employed in this investigation, is not a primary factor governing the susceptibility of peanut pods to Pythium or Rhizoctonia. Recent field studies have also failed to show any such correlation between pod rot and addition of excess land plaster*. No attempt was made to correlate calcium uptake or calcium content of the pods with susceptibility to pod rot.

Literature Cited

1. Garren, K. H. 1964. Land plaster and soil rot of peanut pods in Virginia. Plant Dis. Reptr. 48:349-352.
2. Hallock, D. L. and K. H. Garren. 1968. Pod breakdown, yield and grade of Virginia type peanuts as affected by Ca, Mg, and K sulfates, Agron. J. 60:253-257.
3. Jackson, C. R. and D. K. Bell. 1969. Diseases of peanut (groundnut) caused by fungi. Univ. of Georgia, College of Agr. Exp. Sta. Res. Bull. 56.
4. Wills, W. H. and L. D. Moore. 1973. Pathogenicity of Rhizoctonia solani and Pythium myriotylum from rotted pods to peanut seedlings. Plant Dis. Reptr. 57:578-582.

*Garren, K. H. 1973. Personal Communication.