Research on Peanut Disease: Resistance to Sclerotinia and Southern Blights in Oklahoma

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2002 progress made possible through OPC support

- Lowering the relative humidity from 100% to about 70% in the incubation chamber 24 hours after inoculation with Sclerotinia produced more realistic Sclerotinia reaction on Okrun and Southwest Runner, which mimics field evaluations.
- Calcium content in peanut shells increased by at least 30% in response to calcium application in the form of calcium sulfate (gypsum) or calcium chloride.
- A procedure for reproducing peanut pod breakdown by the southern blight fungus under greenhouse and laboratory conditions was developed.

Background

Peanuts are an important economic crop for Oklahoma. Pressure from soilborne diseases are limiting and increasing peanut production costs. Sclerotinia and southern blights are soilborne diseases that are economically important to peanut production in Oklahoma. Much progress has been made in management of sclerotinia blight through the release of several resistant peanut cultivars since 1990. Research is continuing to identify new resistant peanut breeding lines for both diseases, therefore, development of improved screening methodology under greenhouse and field conditions is needed to accelerate the development and release of additional resistant cultivars. Enhancement of calcium content in the cell walls of plants may play a role in increasing plant resistance to pectolytic and macerating enzymes produced by fungi such as the Sclerotinia and southern blight pathogens. Therefore, the effect of calcium nutrition, applied as calcium chloride, on altering Sclerotinia and southern blights disease reactions needs to be investigated in advanced peanut breeding lines under greenhouse and field conditions.

Research Objectives

1 To initiate research to determine post-inoculation physical environmental parameters under greenhouse conditions that produce Sclerotinia response in peanut lines mimicking field reaction. This research will be conducted in the greenhouse and in small field plots.
2 To initiate research to investigate the effect of applying calcium chloride, under greenhouse and field conditions, to enhance the content of calcium in the shell and kernels of several advanced peanut breeding lines.
3 To initiate studies to determine the effect of increased calcium content in the peanut shell and kernels and on the ability of Sclerotinia and southern blight pathogens to degrade peanut pods under greenhouse and field conditions.
4 To initiate studies to determine the rate of degradation of cell walls isolated from peanut shells that have normal and increased calcium content, by pectolytic and macerating enzymes produced by the Sclerotinia and southern blight fungi.

Research progress in 2002

In objective 1, research was initiated to vary post inoculation relative humidity in the incubation chambers under the greenhouse. Lowering the relative humidity from 100% to about 70% in the incubation chamber 24 hours after inoculation with Sclerotinia produced more realistic Sclerotinia reaction on Okrun and Southwest Runner, which mimics field evaluations (Tables 1 and 2).

In objective 2, greenhouse experiments were conducted to determine the effect of applying calcium on the calcium content of peanut shells and kernels. Calcium content in peanut shells increased by at least 30% in response to calcium application in the form of calcium sulfate (gypsum) or calcium chloride. Calcium content of peanut kernels did not increase in response to applying calcium. This step is necessary to research objectives 2 and 3.

In objective 3, a procedure for reproducing peanut pod breakdown by the southern blight fungus under greenhouse and laboratory conditions was developed. A manuscript describing this technique was submitted to *Peanut Science* for publication. This technique will have a wide application to study factors influencing the interaction between peanut pods and the southern blight fungus and other pod-infecting pathogens under controlled conditions. Also, this technique will facilitate progress on research objectives 3 and 4.

Table 1: Reaction parameter of *S. minor*, over post inoculation relative humidity regimes, in Okrun and Southwest runner peanut cultivars.

	Reaction parameter		
Cultivar	DI(%)[1]	LL(mm)[2]	AUDPC[3]
Okrun[4]	86 a	42.9 a	84.6 a
Southwest Runner[5]	81 a	28.9 b	56.7 b

[1] DI(%) = Disease incidence at 6 day PI
[2] LL(mm) = Length of lesion (mm) at 6 day PI
[3] AUDPC = area under disease progress curve
[4] OK = A Sclerotinia susceptible cultivar
[5] SW = A Sclerotinia resistant cultivar
Values in each reaction parameter followed by the same letter are not significantly different at P > 0.05

Table 2: Response of Okrun (OK) and Southwest runner (SW) peanut cultivars to inoculation with *S. minor* under post inoculation (PI) high and low relative humidity (RH).

		Cultivar Response Parameters		
PI Treatment		DI(%)[1]	LL(mm)[2]	AUDPC[3]
Continuous High RH	OK[4]	96 a	64.0 a	129.4 a
	SW[5]	100 a	47.5 b	93.6 b
Lower RH 24 hours PI	OK	66 a	21.9 a	39.8 a
	SW	73 a	10.4 b	19.8 b

[1] DI(%) = Disease incidence at 6 day PI
[2] LL(mm) = Length of lesion (mm) at 6 day PI
[3] AUDPC = area under disease progress curve
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Values in each reaction parameter followed by the same letter are not significantly different at P > 0.05.