Use of Pinolene or Other Spray Adjuvants with Iprodione for Improved Control of Sclerotinia Blight on Peanut[1]

F. D. Smith*, P. M. Phipps and R. J. Stipes[2]

ABSTRACT

Various spray adjuvants were evaluated in 1985 and 1986 with iprodione (Rovral®) for improved control of Sclerotinia blight of peanut, caused by *Sclerotinia minor* (Jagger) Kohn. Treatments were applied three times on demand, using high-volume nozzles to deliver 335 L/ha or low-volume nozzles to deliver 140 L/ha. Acetic acid, Buffer P.S.®, Chem Wett Plus®, hydrochloric acid, pinolene (Nu-Film-17®), SoyOil 937® and Spray-Aide® were tested with iprodione in 1985, and ChemWett Plus®, pinolene and Spray-Aide® were chosen for additional trials in 1986. Treatments of iprodione at 1.12 kg/ha with pinolene at 0.42% in low-volume sprays and 0.18% (v/v) in high-volume sprays produced the greatest yield of peanut during both years. Additional testing of iprodione with pinolene used only high-volume sprays, and these treatments were applied on demand: three times in 1987 and twice in 1988, 1989 and 1990. Yield and value of peanut over the 6-yr period of high-volume treatments were increased significantly (P=0.05) by iprodione with pinolene, compared to iprodione alone. The addition of pinolene increased the mean yield by 348 kg/ha and value of peanut by $291/ha. The cost of using pinolene as an adjuvant averaged $6.95/ha each year. Disease incidence was 12% lower in plots treated with iprodione and pinolene, compared to iprodione alone, but this difference was not significant over the period.

Key Words: *Arachis hypogaea*, groundnut, Sclerotinia blight.

Sclerotinia blight, caused by *Sclerotinia minor* (Jagger) Kohn (6), currently claims 4 to 8% of the peanut crop (*Arachis hypogaea* L.) in Virginia each year (P.M. Phipps, *unpublished estimate*). This disease was first detected in the Virginia-North Carolina area in 1971 (14). Since that time, the disease has been reported in other peanut-producing areas of the country, such as Oklahoma (19), New Mexico and Texas (17). The disease is first detectable at the soil surface and under the dense peanut canopy. The well-concealed infections are often not detected in time for effective use of fungicides. The rapid spread of the disease has the potential to substantially reduce peanut yields in affected areas unless current control measure are improved.

In Virginia, iprodione [3-(3,5-dichlorophenyl)-N-(methylethyl)-2,4-dioxo-1-imidazolidinecarboxamide] is widely used for control of Sclerotinia blight of peanut. Iprodione is a dicarboximide fungicide and has been labeled for control of Sclerotinia blight since 1985. The dicarboximides function as protectant fungicides with activity against representatives of the following genera: *Botrytis, Sclerotinia, Monilinia, Alternaria, Sclerotium and Phoma* (13). Applications of iprodione for control of Sclerotinia blight should commence when the disease becomes active and thereafter at 4-wk intervals for a total of not more than three times (10). Between applications, the disease stays active if cool and wet conditions persist for an extended time. Control of Sclerotinia blight with iprodione averages only 45-55%, and there remains a need for more efficacious control strategies (1).

Sclerotinia blight is a difficult disease to control with registered fungicides. Research on adjuvants may provide much-needed improvement in disease management. The purpose of spray adjuvants is to improve the physical properties of a pesticide mixture, thereby enhancing the efficacy of the spray. Adjuvants to improve the performance of iprodione in the control of Sclerotinia blight are needed until other compounds with superior activity against *S. minor* become commercially available. A new fungicide, fluazinam (18) (tested by ISK-Biotech as ASC-66825 50WP and Rohm and Haas Co. as RH-3486 50WP), possesses greater efficacy than iprodione against *S. minor* (15, 16). However, the development and registration of experimental fungicides, as well as biological-control agents (12), will take several years of additional research.

Although adjuvants usually lack fungicidal properties, adjuvants do have the potential to alter the plant cuticle which constitutes the major barrier against biotic and non-biotic assaults. The application of some spray adjuvants alone significantly increased the development of disease in grapes (*Vitis vinifera* L.) caused by *Botrytis cinerea* Pers. ex Fries (8). There was a significant correlation between water loss from grapes and disease development which indicated that the increase in disease was due to disruption of the normal function of the epicuticular waxes on the berry. Most of the adjuvants that enhanced disease development contained petroleum oils. These oils may have contributed to the removal of protective waxes from the grapes. Some other adjuvants, which polymerize after deposition, form an epidermal coating on exposed areas of treated plants. This coating may persist for a few days to a few weeks, depending

[1]This investigation was part of the senior author's doctoral research program. Pinolene is a registered trademark of Miller Chemical and Fertilizer Corporation. Use of trade names implies neither endorsement of the products by Virginia Polytechnic Institute and State University nor criticism of similar ones not mentioned.

[2]Research Plant Pathologist, USDA Forest Service, Southeastern Forest Experiment Station, Otto, NC 28763, Professor of Plant Pathology, Tidewater Agricultural Experiment Station, Virginia Polytechnic Institute and State University, Suffolk, VA 23437, and Professor of Plant Pathology, VPI & SU, Blacksburg, VA 24061, respectively.

*Corresponding author.

on initial coverage, weathering and growth rate of the plant. The presence of the coating may limit the penetration of pathogens into their respective hosts (20).

The spray adjuvant pinolene is derived from pine resin and forms a terpenic polymer after application. The material has been promoted as an extender-sticker-spreader which surrounds and holds the pesticide on sprayed areas of the plant. Pinolene at 0.125% (v/v) was not reported to affect disease development on treated grapes as the adjuvant lacks oils thought to damage epicuticular waxes (8). Peanut leaves have a rough-waxy cuticle, based on water repellency (5). The presence of epicuticular waxes on the leaf surface resulted in a steep water-droplet contact angle of 127°25' (4). The use of high rates of pinolene at 10% (v/v) was shown to limit the severity of southern corn rust (*Puccinia polysora* Underw.) on maize seedlings (*Zea mays* L.) and leaf rust (*P. recondita* Rob. ex Desm.) on wheat seedlings (*Triticum aestivum* L.) (20). Pinolene was non-toxic to animals at tested rates (2). In addition, pinolene has been used as an adjuvant with a wide range of fungicides (7). Because of its apparent safety, lack of phytotoxicity at high rates on seedlings (20), and potential benefit, pinolene was one of several materials chosen for evaluation as a spray adjuvant with iprodione as a means of improving control of Sclerotinia blight of peanut.

The purpose of this research was: 1) to evaluate the performace of iprodione alone and with wide range of spray adjuvants, and 2) to determine the economic benefit obtained by the addition of pinolene to iprodione sprays for control of Sclerotinia blight of peanut.

Materials and Methods

Field Trials

Peanut (Florigiant in 1985-1987 and NC 9 in 1988-1990) were planted and managed according to standard practices for peanut production in Virginia (10). Planting dates ranged from 27 Apr to 13 May. The experimental design consisted of four randomized complete blocks with 12.2-m rows spaced 0.9 m apart. Each block was separated by a 2.1-m alleyway. Disease incidence was monitored monthly and recorded as the number of infection centers in the two center rows of each plot (11). Peanut-digging dates ranged from 28 Sep to 15 Oct, and peanuts were combined approximately one week later. Yields were based on weight of harvested peanuts from the two center rows and a moisture content of 7% (w/w). Values were determined from a 500-g composite sample from each treatment in accordance with Federal-State Inspection Service methods. Statistical analyses on diesase incidence, yield and value were determined by Fisher's least significant difference test using a probability value of 0.05.

Fungicide sprays with and without adjuvants were applied to the two center rows of four-row plots using a CO_2-pressurized backpack sprayer equipped with TeeJet® spray nozzles (Spraying Systems Co., Wheaton, IL 60187). Sprays were applied using one of two methods: 1) low-volume sprays were delivered at 140 L/ha with three $D_2$13 (disk-core combination) nozzles per row and a pressure of 345 kPa; 2) high-volume sprays were applied at 335 L/ha with one 8008LP nozzle per row at 165 kPa. The adjacent outer rows of each plot functioned as guard rows.

Adjuvants and Fungicides

The fungicide, iprodione (Rovral®), was obtained from Rhône-Poulenc Inc., Research Triangle Park, NC 27709. Iprodione (1.12 kg/ha) was applied as Rovral® 50WP at 4-wk intervals with and without adjuvants after Sclerotinia blight became active in fields. Three applications were made in 1985 (18 Jul, 14 Aug, 12 Sep) and 1986 (10 Jul, 7 Aug, 4 Sep). As commonly recommended by manufacturers of spray adjuvants, all adjuvant rates are expressed as percent of spray volume in Table 1. Pinolene (Nu-Film-17®) and Spray-Aide® were obtained from Miller Chemical and Fertilizer Crop., Hanover, PA 17331. Pinolene is a terpenic derivative containing 96% di-1-p-menthene, and Spray-Aide® is an acidifying surfactant containing 70% alkylaryl polyoxyethylene glycol phosphate ester. Chem Wett Plus® and SoyOil 937® were obtained from Coastal Chemical Co., Greenville, NC 27834. ChemWett Plus® contains 80% alkylaryl polyethylene glycols and organic solvents, and is classified as a spreader and activator. SoyOil 937® is a formulation of 93% soybean oil and 7% emulsifier. This adjuvant functions as a spreader to improve coverage of the pesticide on the targeted crop. Buffer P.S.® was obtained from Helena Chemical Co., Memphis, TN 38137. Buffer P.S.® contains 30% alkylaryl polethoxy ethanol phosphates and organic phosphatic acids and is classified as a spreader and buffering agent. Acetic and hydrochloric acids were obtained as technical grade chemicals and were tested to determine the effects of lowered pH on performance of iprodione.

Following the trials in 1985 and 1986, testing focused on the use of pinolene with iprodione. Due to the formulation change by the manufacturer, iprodione was used as Rovral® 50WP in 1987 and 1988, and as Rovral® 4F in 1989 and 1990. Treatments were applied using only high-volume sprays. Iprodione, with and without pinolene, was applied at 4-wk intervals after Sclerotinia blight became acitve in the field. Three applications were made in 1987 (31 Jul, 28 Aug, 25 Sep). Two applications were made in 1988 (3 Aug, 1 Sep), 1989 (20 Jul, 16 Aug) and 1990 (26 Jul, 22 Aug).

Results

Evaluation of Adjuvants During 1985 and 1986.

The application of iprodione using either low- or high-volume sprays without adjuvants suppressed disease incidence by 30 and 33% in 1985, and 20 and 16% in 1986, respectively (Table 1). The level of disease of disease suppression with iprodione alone was significant in 1985. During 1985, low-volume sprays of iprodione significantly suppressed disease incidence by 49, 48, 48 and 36% when sprays were amended with Spray-Aide®, ChemWett Plus®,

Table 1. Preliminary evaluation of spray adjuvants used with iprodione for control of Sclerotinia blight of peanut in 1985 and 1986.[1]

Year, treatment and adjuvant rate (v/v)[2]	Disease incidence[3]	Yield (kg/ha)[4]	Value ($/ha)[5]
1985			
untreated	49.0 a	2875 b	1940 c
Low-volume spray			
iprodione (1.12 kg/ha) alone	34.5 b-d	3847 a	2633 ab
+ 0.83 N acetic acid, 1.0%	39.5 ab	3758 a	2558 b
+ Buffer P.S., 0.13%	37.0 a-d	3783 a	2580 ab
+ ChemWett Plus, 0.83%	25.3 cd	3922 a	2614 ab
+ 1.0 N hydrochloric acid, 0.75%	31.5 b-d	3960 a	2735 ab
+ pinolene, 0.42%	25.5 cd	4111 a	2808 ab
+ SoyOil 937, 1.0%	37.5 a-c	3758 a	2532 b
+ Spray-Aide, 0.06%	24.8 d	3783 a	2522 b
High-volume spray			
iprodione (1.12 kg/ha) alone	33.0 b-d	3884 a	2656 ab
+ 0.83 N acetic acid, 1.0%	37.3 a-c	3720 a	2512 b
+ Buffer P.S., 0.13%	30.8 b-d	3821 a	2618 ab
+ ChemWett Plus, 0.83%	nd[6]	nd	nd
+ 1.0 N hydrochloric acid, 0.70%	36.8 a-d	3884 a	2620 ab
+ pinolene, 0.18%	26.0 cd	4338 a	3005 a
+ SoyOil 937, 0.42%	29.3 b-d	4036 a	2748 ab
+ Spray-Aide, 0.06%	31.0 b-d	3809 a	2600 ab
Least Significant Difference	(12.5)	(626)	(426)
1986			
untreated	44.8 a	1933 c	1283 c
Low-volume spray			
iprodione (1.12 kg/ha) alone	35.8 ab	2363 bc	1591 bc
+ ChemWett Plus, 0.83%	35.8 ab	2610 a-c	1782 ab
+ pinolene, 0.42%	30.8 b	3114 a	2124 ab
+ Spray-Aide, 0.06%	37.5 ab	2966 ab	2025 ab
High-volume spray			
iprodione (1.12 kg/ha) alone	37.5 ab	2745 a-c	1848 ab
+ ChemWett Plus, 0.83%	30.5 b	3028 ab	1967 ab
+ pinolene, 0.18%	30.0 b	3176 a	2229 a
+ Spray-Aide, 0.06%	37.8 ab	2474 a-c	1621 bc
Least Significant Difference	(9.6)	(732)	(492)

[1]Means followed by the same letter(s) in a given year are not significantly different at P=0.05 according to Fisher's least significant difference test.

[2]Three applications were made each year (18 Jul, 14 Aug, 12 Sep 1985; and 10 Jul, 7 Aug, 4 Sep 1986). Rates of spray adjuvants are expressed as percent of spray volume. Low-volume sprays were applied with three $D_2$13 nozzles/row at 140 L/ha and high-volume sprays were applied with one 8008LP nozzle/row at 335 L/ha.

[3]Disease incidence represents the number of infection centers in two 12.2-m rows at harvest. An infection center was a point of active growth by *Sclerotinia minor* and included 15.2 cm of row length on either side of that point.

[4]Yield based on weight of peanuts adjusted to 7% moisture (w/w).

[5]Value was determined from a 500-g composite sample from each treatment in accordance with Federal-State Inspection Service methods.

[6]nd=not determined.

pinolene and hydrochloric acid, respectively. High-volume applications of iprodione also significantly suppressed disease incidence by 47, 40, 37 and 37% when sprays were amended with pinolene, SoyOil 937®, Buffer P.S.® and Spray-Aide®, respectively.

All applications of iprodione with and without various adjuvants produced significant yield and value increases in peanut when compared to untreated plots in 1985. Although not significantly better than other spray adjuvants, pinolene was the best-performing spray adjuvant based on peanut yield and value, regardless of the application method. Applications of iprodione with pinolene, using low-and high-volume sprays, increased yields by 264 and 454 kg/ha, repsectively, compared to peanuts treated with iprodione alone. These yield increases equaled values of $175 and $349/ha.

In 1986, Chem Wett Plus®, pinolene and Spray-Aide® were selected for evaluation with iprodione, based on results of field tests in the preceding year. Compared to untreated peanuts, low-volume applications of iprodione with pinolene provided 31% disease suppression, whereas high-volume applications provided 33% disease suppression, respectively. In addition, the use of high-volume applications of iprodione with ChemWett® provided 32% disease suppression. These results were significant compared to untreated plots. Treatments of iprodione with either pinolene or Spray-Aide® applied at low volumes significantly improved both the yield and value of peanuts compared to untreated peanuts, whereas iprodione alone did not. Using high-volume sprays, applications of iprodione with ChemWett Plus® or pinolene significantly increased both the yield and value of peanut. Iprodione alone in high-volume sprays, provided a significant increase only in value of peanut, compared to untreated peanuts. Pinolene was again the best-performing spray adjuvant based on peanut yield and value, regardless of the application method. Low- and high- volume applications of iprodione with pinolene increased yields by 751 and 431 kg/ha, compared to peanuts treated in the same manner with iprodione alone, respectively. Similarly, these yield increases equaled values of $533 and $381/ha. Varying the method of application from low-volume D_213 nozzles delivering 140 L/ha or high-volume 8008LP nozzles delivering 335 L/ha did not significantly change the performance of iprodione alone or iprodione with pinolene during these two years of testing.

Evaluation of Pinolene with Iprodione from 1987 to 1990.

Disease incidence at harvest was 13 and 15% less in plots treated with both iprodione and pinolene as compared to plots treated with iprodione alone in 1987 and 1989, respectively (Fig. 1). Addition of pinolene to the fungicide spray did not improve disease control in 1988 or 1990. Yearly differences between disease incidence in plots treated with iprodione alone or iprodione with pinolene were not significant.

Yields from plots treated with both iprodione and pinolene were improved 327, 127 and 269 kg/ha above yields from plots treated with iprodione alone during 1987, 1989, and 1990, respectively. Corresponding increases in value were $224, $217, and $250/ha, although none of these yearly differences were significant at P=0.05. No increase in yield or value was obtained with the addition of pinolene in 1988.

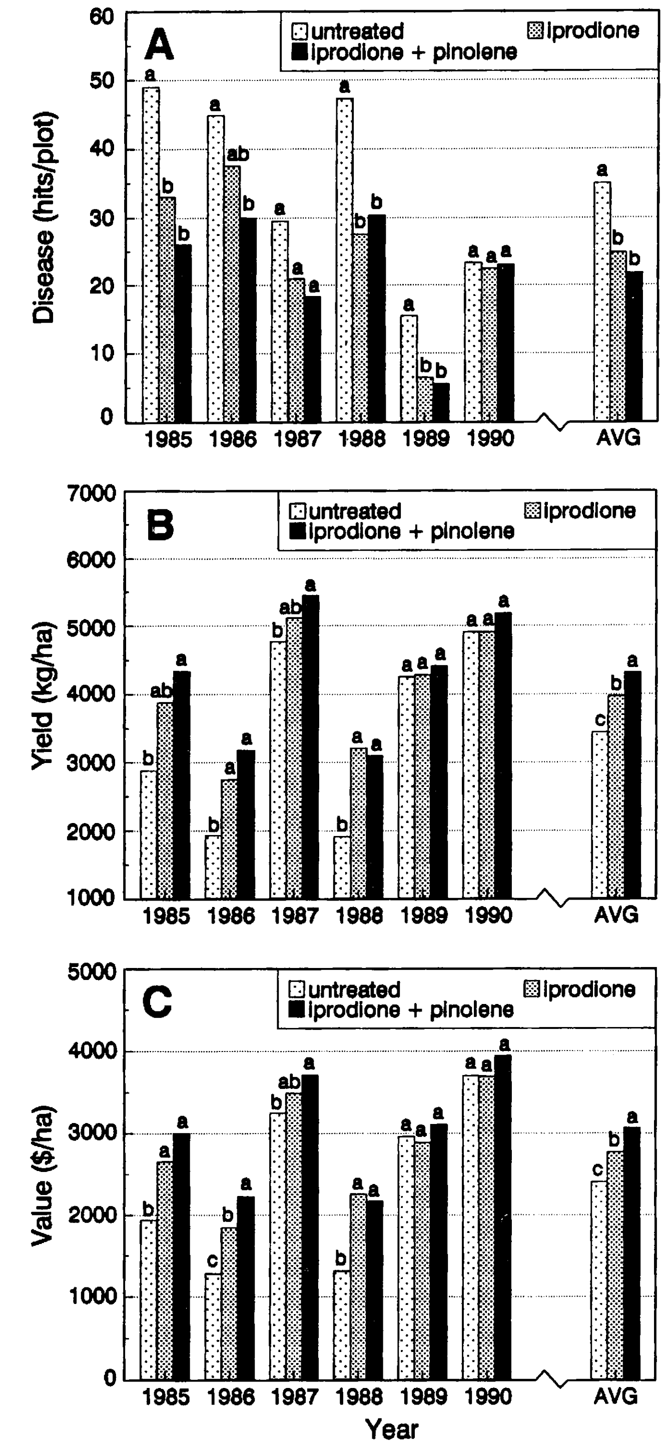

Fig. 1. Disease incidence (A), yield (B) and value (C) of peanuts untreated and treated with iprodione at 1.12 kg/ha alone and with pinolene at 0.18% of spray volume for control of Sclerotinia blight on peanut. Three high-volume applications at 335 L/ha were made in 1985, 1986 and 1987; two in 1988, 1989 and 1990. The same letter(s) above bars within a group indicate that differences are not significant at P=0.05 according to Fisher's least significant difference test.

Effectiveness of Pinolene During the 6-Yr Period.

Compared to untreated plots, high-volume applications of iprodione alone suppressed disease incidence an average of 29%, and increased yield by 534 kg/ha, which equaled a value of $368/ha, during the period from 1985 to 1990 (Fig.

1). Similarly, the use of iprodione and pinolene resulted in an average of 38% disease suppression and an increase in yield of 882 kg/ha, which equaled a value of $659/ha. This increase of yield and crop value obtained by the addition of pinolene to iprodione was significant when analyzed over the 6-yr period. Thus, the use of pinolene resulted in an average yield increase of 348 kg/ha, which represented an additional value in peanut of $291/ha. The increase in disease control obtained by the addition of pinolene to iprodione was 12%, but this level of improved disease control was not significant atr P=0.05.

Discussion

According to Miller Fertilizer and Chemical Co., manufacturer and distributor of pinolene, this adjuvant functions first as a spreader by improving the uniformity of inital pesticide deposition and second as a sticker to prevent losses of fungicide from rainfall. Later, the active ingredient is also thought to act as an extender since the polymerized pinolene suppresses the oxidation and hydrolysis reactions of fungicide degradation. This role of pinolene may be important because the heterocyclic ring structure of iprodione is susceptible to base-catalyzed reactions and rearrangement with loss of fungicidal activity (3). The 1990 technical bulletin for Rovral®, published by Rhône-Poulenc, states that iprodione will completely degrade in an aqueous suspension at pH 9 in less than 24 hr. The fungicide label recommends that the spray solution should be buffered to a pH of 5.0 to 7.0. Depending on the weather and growth stage of peanuts, applied fungicides can be exposed to high levels of UV light and high temperature which may catalyze undesirable degradative chemical reactions.

Either spray technique appeared to be effective in delivering iprodione. The large droplets produced by high-volume 8008LP nozzles would limit the functioning of pinolene as a spreader, whereas the fine droplet produced by low-volume $D_2$13 nozzles would maximize this function. Currently, the use of 8008LP nozzles is the most widely used method for application of iprodione in control of Sclerotinia blight. The larger droplets are thought to be more effective in penetrating the canopy and reach the site of fungal activity at the soil surface. However, the good performance of low-volume nozzles suggests that some redistribution of fungicide occurred from the peanut canopy to the lower stems, even when pinolene was used.

The addition of spray adjuvants which function as acidifying agents, such as acetic acid, hydrochloric acid and Spray-Aide®, lowered the pH of tank mixes of iprodione from 7.6 to acidic values of 5.6, 5,5 and 6.5, respectively. Measurements of pH were recorded during application at 1 hr after preparing the tank mix. These reductions in pH values had no significant effect on the performance of iprodione for control of Sclerotinia blight of peanut, suggesting that decomposition of iprodione in mildly alkaline water was not of sufficient magnitude to affect the efficacy of applied fungicide. Other tested adjuvants did not alter the pH of the iprodione spray mixture.

Iprodione with pinolene performed well during 1985 through 1987 with yield improvements attributed to use of the adjuvant ranging from 329 to 454 kg/ha. During this period, three treatments were made. During 1988, 1989 and 1990, only two applications of iprodione were made, and the benefits of pinolene were not as apparent as in the preceding 3 yr. The reduction in the number of fungicide treatments may have limited availability of iprodione during critical periods for disease control. Disease pressure was not heavy in 1989 and 1990, and this may also have limited the differences between various treatments. Nonetheless, the addition of pinolene to iprodione also resulted in more consistent and improved performance of this fungicide. Compared to untreated plots, use of iprodione alone increased yields significantly during two of 6 yr, whereas use of iprodione with pinolene significantly increased yields during four of 6 yr. These findings have resulted in the recommendation for peanut growers in Virginia to use iprodione with pinolene for control of Sclerotinia blight (10). A preliminary report on the benefits of spray adjuvants with iprodione and the use of other fungicides for control of Sclerotinia blight in 1986 has been published (9).

Fungicides with and without spray adjuvants must be evaluated for efficacy to control a specific disease in a given crop before any conclusions can be made regarding the performance of an adjuvant. One or two years may not be a sufficient period to adequately assess the performance of a spray adjuvant, especially when improvements in disease control are modest. Unusually high or low disease pressure can easily mask the normal activity of an adjuvant. The search for effective fungicide-adjuvant combinations requires the same or even more intensive field tests than evalutations of fungicides alone, but economic benefits of even modest improvement in disease management can be important. The average cost of using pinolene with iprodione was $2.78/ha for each application, based on a cost of $4.76/L for the adjuvant. The average seasonal cost associated with use of pinolene was $6.95/ha, which compared favorably to an additional peanut value of $291/ha.

Acknowledgments

Sincere appreciation is extended to Mike Arrington, Barron Britt, Steve Byrum and Jean Ratliff for technical assistance.

Literature Cited

1. Brenneman, T. B., P. M. Phipps, and R. J. Stipes. 1987. Control of Sclerotinia blight of peanut: Sensitivity and resistance of *Sclerotinia minor* to vinclozolin, iprodione, dicloran, and PCNB. Plant Dis. 71:87-90.
2. Clarke, A. R. 1969. Pinolene-Toxicology. pp. 1-8. *in* Pinolene-Toxicological and Biological Properties-Research Results. Miller Chem. and Fert. Corp., Hanover, PA.
3. Cooke, B. K., R. S. T. Loeffler, and A. C. Pappas. 1979. The structual rearrangement of iprodione in ethanolic solution. Pestic. Sci. 10:393-398.
4. Cu, R. M. 1991. Development and evalutation of a computerized leafspot advisory program for effective use of cultivar resistance, fungicide, and spray adjuvant to control early leafspot of peanut. Ph.D. Dissertation, Va. Polytech. Inst. and State Univ. 115 pp.
5. Holloway, P. J. 1970. Surface factors affecting the wetting of leaves Pestic. Sci. 1:156-162.
6. Kohn, L. M. 1979. A monographic revision of the genus *Sclerotinia*. Mycotaxon 9:365-444.
7. Nesmith, W. C. 1980. List of materials available for testing in 1980. Fungic. Nematicide Tests 35:254-261.
8. Marois, J. J., A. M. Bledsoe, R. M. Bostock, and W. D. Gubler. 1987. Effects of spray adjuvants on development of *Botrytis cinerea* on *Vitis Vinifera* berries. Phytopathology 77:1148-1152.
9. Phipps, P. M. 1987. Evaluation of fungicides for control of Sclerotinia blight of peanut, 1986. Fungic. Nematicide Tests 42:127.
10. Phipps, P. M. 1990. Disease control. pp. 54-66. *in* C. W. Swann (ed.), 1991 Peanut Production Guide, Va. Coop. Ext. Serv., Info. Ser. No. 275, Va. Polytech. Institute and State Univ., Blacksburg, VA.

11. Phipps, P. M., and D. M. Porter. 1986. Evaluating chemicals to control soilborne diseases of peanut. pp. 217-220. *in* K. D. Hickey (ed.), Methods for Evaluating Pesticides for Control of Plant Pathogens, APS Press, St. Paul, MN.
12. Phipps, P. M., F. D. Smith, and D. M. Porter. 1991. Evaluation of biological agents and certain plant nutrients for control of Sclerotinia blight of peanut, 1990. Biol. Cultural Tests for Control of Plant Dis. 6:48.
13. Pommer, E. H., and G. Lorenz. 1987. Dicarboximide fungicides. pp. 91-106. *in* H. Lyr (ed.), Modern Selective Fungicides, John Wiley & Sons, Inc., New York.
14. Porter, D. M., and M. K. Beute. 1974. Sclerotinia blight of peanuts. Phytopathology 64:263-264.
15. Smith, F. D., P. M. Phipps, and R. J. Stipes. 1989. Effect of RH-3486 on dicarboximide-resistant isolates of *Sclerotinia minor*. Phytopathology 78:863. (Abstr.)
16. Smith, F. D., P. M. Phipps, and R. J. Stipes. 1991. Evaluation of fungicide ASC-66825 against *Sclerotinia minor* and other pathogens of peanut using agar assays and field trials. Phytopathology 81:704. (Abstr.)
17. Sturgeon, R. V. 1986. Peanut disease loss estimates for major peanut producing states in the United States for 1984 and 1985. Proc. Am. Peanut Res. Educ. Soc. 18:24-26.
18. Thomson, W. T. 1990. Agricultural Chemicals, Book IV-Fungicides 1991 Revision, Thomson Publications, Fresno, CA. 198 pp.
19. Wadsworth, D. F. 1979. Sclerotinia blight of peanuts in Oklahoma and occurrence of the sexual stage of the pathogen. Peanut Sci. 6:77-79.
20. Ziv, O., an R. A. Frederiksen. 1983. Control of foliar diseases with epidermal coating materials. Plant Dis. 67:212-214.

Accepted July 13, 1991