

EFFECT OF COLLETOTRICHUM COCCODES (BLACK DOT)
ON YIELD OF RUSSET BURBANK POTATO

by
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Black dot of potato caused by Colletotrichum coccodes is characterized by the development of abundant, small, black sclerotia on senescent and dead potato roots, stolons, and stems. Foliage and belowground plant parts become infected. Two phases of the disease exist in that plant foliage is independently infected from belowground stems, roots and stolons. Injuries to plant foliage from wind blown soil and wet periods from rain or sprinkler irrigation facilitate foliar infection. The fungus persists in soil, on plant debris, and on tubers.

Tuber borne inoculum increases the amount of belowground plant infection over the amount of infection expected on the basis of soil-borne inoculum. Soil fumigation in several studies has not reduced the proportion of plants infected by C. coccodes.

Colletotrichum coccodes is widespread in Washington potato fields and infects plants early in the growing season. However, disease symptoms usually do not become evident until much later. This is characteristic of several species of Colletotrichum which cause latent infections in their host. Latent infections remain quiescent and do not develop symptoms until the host undergoes stress or a physiological change such as flowering or senescence.

Colletotrichum coccodes has previously been considered a weak pathogen of potato because earlier workers did not use presently available techniques to isolate the fungus and detect latent infections. As a result the effect of infections on yield of potato is not fully understood. The purpose of this work was to determine the effect that C. coccodes has on potato yields.

PROCEDURES

Foliage of Russet Burbank was inoculated in two experiments in the greenhouse and in the field in 1991 and 1992. Plants were grown in five gallon containers in the greenhouse; plots were 20 ft long in the field. Treatments in all experiments were replicated and arranged as randomized complete blocks. Field plots were fumigated with methyl bromide in 1991 and new potato ground was used in 1992 so that Verticillium wilt would not be a confounding factor. Plant foliage in the greenhouse and field was lightly wounded with sterile sand blown from a sand blaster before inoculation with spores of C. coccodes.

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Plants were placed in a mist chamber for 24 hr after inoculations in the greenhouse or plots were sprinkler irrigated at night in the field to create a wet period for infection. Additional treatments in the greenhouse and the field consisted of contaminating soil with sclerotia of C. coccodes at planting to inoculate belowground stems, roots and stolons.

RESULTS

Dark brown to black lesions developed within five days on leaves, petioles and stems of inoculated foliage in the two tests in the greenhouse and in the field in 1991 and 1992. Chlorotic and blighted tissue was evident on many inoculated leaves. Significantly more colony forming units of C. coccodes were recovered from the sap of inoculated than non-inoculated plants (Tables 1,2,3).

Total yield of Russet Burbank was significantly reduced by 32% and 19%, and mean tuber weight was significantly reduced ($P = 0.05$) by 29% and 43% in the two greenhouse tests, respectively (Table 1). In the field, total weight was significantly reduced by 8% in 1991 and 12% in 1992, and weight of No. 1's was significantly reduced by 12% in 1991 and 18% in 1992. Number of tubers/plant of No. 1's was significantly reduced both years in the field (Tables 1 and 2). Other yield components and specific gravity were not significantly affected. Sand blasting by itself did not affect yield. Inoculation of belowground stems, roots and stolons did not result in a reduction of yield in the greenhouse (Table 1) and field (Table 3).

DISCUSSION

Research in Idaho and Washington has demonstrated that black dot is a yield reducing disease in the Pacific Northwest. Infection of potato foliage by C. coccodes in research plots has consistently resulted in decreased yields in Washington; whereas, infection of belowground plant parts has not. Inoculum in soil is important in the spread of the pathogen and disease development. A reduction in specific gravity has not been measured in Washington, but lower specific gravities were detected in Idaho. Previous work has shown that infection by Verticillium does not increase susceptibility of Russet Burbank to C. coccodes. However, infection by both pathogens results in increased death of potato plants and reduced yield beyond that observed with either pathogen alone.

Work in Washington and elsewhere has demonstrated that C. coccodes is a primary pathogen of potato. Two phases of the disease exists -- infection of below- and aboveground plant tissues. Management needs to be aimed at reducing tuber- and soil-borne inoculum, and in preventing foliar infections. Much progress has been made the last few years in understanding the nature of potato black dot, but additional research is needed to develop satisfactory management practices.

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Table 1. Number of colonies of *Colletotrichum coccodes* and yield of Russet Burbank potato when foliage was either wounded or not wounded and inoculated or not inoculated in the greenhouse with *C. coccodes*.

	Wounded		Not Wounded	
	Foliar inoculation	Non-inoculated	Soil inoculation	Non-inoculated
TEST I				
Colonies per cm stem	26.1**	5.8	--	--
Total weight (g)	173.7**	256.1	199.5	187.4
No. tubers/plant	5.4	5.9	4.6	4.5
Mean wt. of tubers (g)	34.0*	48.0	47.1	41.8
TEST II				
Colonies per cm stem	2.2*	0.1	--	--
Total weight (g)	214.1*	263.2	198.9	205.1
No. tubers/plant	6.7	5.0	4.4	5.8
Mean wt. of tubers (g)	35.4**	62.1	46.7	37.8

* and ** significantly different from the mean of the non-inoculated control at $P=0.05$ and 0.01 , respectively.

Table 2. Number of colonies of Colletotrichum coccodes and yield of Russet Burbank potatoes either wounded or not wounded and inoculated or non-inoculated with C. coccodes in 1991.

	Wounded		Not Wounded
	Inoculated ^a	Non-Inoculated ^a	Non-Inoculated
Colonies of <u>Colletotrichum</u>			
per cm stem	9.9**	1.6	2.2
Weight (CWT)			
Total	642.4*	698.4	687.3
No. 1	468.0*	529.8	528.7
No. 2	174.4	168.7	162.5
Number of tubers/plant			
Total	6.5	6.7	6.7
No. 1	4.1*	4.5	4.6
No. 2	2.3	2.2	3.0
Mean tuber weight (oz)			
Total	7.7	8.1	7.9
No. 1	8.8	9.1	9.0
No. 2	5.8	5.8	5.6
Specific gravity	1.078	1.075	1.078

^a * and ** significantly different from the non-inoculated at P=0.05 and P=0.01, respectively, using single degree of freedom contrasts.

Table 3. Number of colonies of Colletotrichum coccodes and yield of Russet Burbank potato when foliage was either wounded or not wounded and inoculated or not inoculated in the field with C. coccodes in 1992.

	Wounded		Not Wounded	
	Foliar inoculation	Non- inoculated	Soil inoculation	Non- inoculated
Colonies per cm stem	2.4*	0	2.2**	0.2
Weight (CWT)				
Total	443.6*	485.0	507.2	518.6
No. 1	327.9*	381.9	389.0	414.1
No. 2	104.5	103.1	118.2	115.6
No. tubers/plant				
Total	8.9	9.3	9.6	9.6
No. 1	4.9*	5.5	5.5	5.9
Mean tuber weight (oz)				
Total	4.9	5.2	5.2	5.4
No. 1	6.6	6.9	7.0	6.9
Specific gravity	1.08	1.09	1.09	1.09

* and ** significantly different from the mean of the non-inoculated controls of the wounded and not wounded treatments at P=0.05 and 0.01, respectively, using single degree of freedom contrasts.