COSTS AND BENEFITS OF CONTROLLING POTATO DISEASES [1]

by
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SUMMARY

Most tuber-borne diseases are effectively controlled by use of certified seed. Seed piece treatment with fungicide is of no value for the control of tuber rots if seed is planted the same day it is cut. Powdery mildew in rill irrigated potatoes, and late blight in western Washington can be economically controlled by foliage applied fungicides. Research has shown that fungicides do not provide an economic benefit in controlling early blight and Sclerotinia wilt in eastern Washington. Yield losses due to Verticillium wilt can be reduced by soil fumigation and rotations with nonsusceptible crops. Soil fumigation, based on soil sampling, will economically reduce damage by root-knot nematodes.

Losses due to potato diseases are measured by reduced yields, poor tuber quality and costs of control programs. Costs for control may be justified when diseases are prevented from causing economic loss. However, there is no economic benefit when disease organisms are not effectively controlled, when controls are applied for diseases that do not cause economic loss or when costs out-weigh realized benefits. Therefore, it is important to know when yield or quality might be reduced by disease and the cost of control practices to prevent such losses.

Tuber-borne diseases are a constant threat to Washington potato production and can cause large yield losses and poor tuber quality. Diseases such as ring rot, black leg, leaf roll, giant hill, mosaic, calico, purple top, witches broom and spindle tuber can be controlled by using seed lots that have passed rigid seed certification standards and have been shown to be free of the disease in Washington's Northwest Foundation Seed Trials. Seed certification also removes seed lots from certification that are infected with the root-knot nematode.

Seed certification and the Northwest Foundation Seed Trials complement one another and without them tuber-borne diseases would eventually make production unprofitable. Costs for Russet Burbank certified seed were $189 to $238 per acre in 1981 ($8.50/cwt for seed, $2 to $2.30/cwt for transportation, 18-22 cwt seed/acre). The Northwest Foundation Seed Trials are partly funded by the Washington State Potato Commission (Table 1), taking about 1/1000 of the Commission's budget. Therefore, costs to Washington commercial growers are very small. For example, a commercial grower would need to sell 1,667 tons of potatoes before contributing $1 towards the Northwest Foundation Seed Trials.

Fungicides such as Captan are applied to seed pieces to control tuber rots. Costs for potato growers are about $.50/cwt of seed for material and application or $9-11 per acre if 18 to 22 cwt per acre of seed are planted. Research results (1, 2, 10, 13, 14) indicate that seed piece treatment with fungicides is of no value if seed is planted the same day it is cut. Warming the whole seed 7 to 10 days at 50 to 60°F and 90% relative humidity prior to cutting, and planting shallow (3-5 inches) in moist soil at soil temperature greater than 45°F and rising

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[1] Mention of a product in this report does not constitute a recommendation of the product by Washington State University over other products.

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will favor seed suberization (healing) and normal emergence. Even chemical seed treatments will not control organisms attacking seed planted in excessively wet or dry soils. If pre-cut seed is stored longer than 5-7 days, fungicide treatment would provide protection against Fusarium seed piece decay. Seed treatments presently used do not protect against black leg and other bacterial seed piece rots.

Fungicides are applied in Washington for the control of foliar diseases such as powdery mildew, late blight, early blight and Sclerotinia stem rot. Powdery mildew does cause yield losses in rill, but not in sprinkler-irrigated potatoes. Control must start before appearance of stem and petiole lesions. Timely applications of sulfur to control this disease will cost about $44 per acre (Table 2) and will prevent yield losses in rill-irrigated potatoes (4).

Late blight usually occurs annually by late August or September in western Washington and can be economically controlled with fungicides. A serious epidemic of late blight has been recorded only once in eastern Washington and application of fungicides is not often justified in the Columbia Basin (3).

In Washington, the early blight organism causes lesions on the lower, yellow, senescent foliage in June or July and on upper foliage in August and September. Verticillium wilt and nutrient deficiencies will cause senescent foliage and predispose potato to early blight infection. Two to four applications of fungicide are often applied by growers in an effort to control this disease. The cost of three fungicide applications for early blight control by aircraft was $28 to $33 per acre in 1981 (Table 3). Research in Washington (5, 9) and Oregon (12) has demonstrated that fungicides applied by aircraft and through center pivot irrigation systems may reduce early blight severity, but will not increase yields. Applying fungicides for control of early blight is not economically profitable in Washington because the disease is mild or occurs late. Proper crop rotation, avoiding irrigation during cool, wet weather, fumigating soil for control of Verticillium wilt, and maintaining good soil fertility will enable plants to resist early blight infections.

Fungicide applications for control of Sclerotinia stem rot cost about $42 per acre (Table 4). Research has shown that fungicides do not effectively control this disease in potatoes. Sclerotinia stem rot can be reduced by allowing the soil surface and foliage to dry between irrigations, especially early in the season when cool temperatures are optimum for infection. Irrigation water must be reduced to avoid excessive wetting of foliage at first appearance of white mold infections. Excessive rates of nitrogen fertilizers need to be avoided to limit dense vine growth that create a favorable environment for infection and disease development.

Fumigation in 1981 for control of Verticillium wilt cost from $210 to $221 per acre (Table 5). This included the fumigant and application costs for Vapam®, Telone C-17®, and DD-PIC®. Controlled experiments have demonstrated that fumigation will help reduce Verticillium wilt and yield decline in infested fields cropped the previous year to potatoes and with a history of two to five previous crops of potatoes. However, rotation of potatoes with crops not susceptible to the Verticillium wilt fungus for at least two years between potato crops will reduce yield decline (6, 7, 8, 11). Rotational crops proven effective are corn, legumes and field peas followed by a late planting of sudan grass, but not small grains. Soil fumigation following non-susceptible crops provides little or no additional control of Verticillium wilt or economic benefit (6, 7, 8). Soil fumigation for control of Verticillium wilt will also control root-knot nematodes.

Fumigation for control of root-knot nematode alone will cost less than for Verticillium wilt control since lower rates and less expensive chemicals such as DD® and Telone II® are used (16). Some processors pay a bonus for potatoes from fumigated land which partially reimburses growers for this expense. Fumigation of soils for nematode control where such control is not needed is an unnecessary expense. Soil sampling to determine population and species of root-knot nematodes will help determine if fumigation is needed (15). Sampling costs are $5 to $6 per acre for collecting the samples and $2 to $2.40 per acre for determining kinds and populations of nematodes.

APPENDIX

Table 1. Funding in 1982 for the Northwest Foundation Seed Trials.

Source of Funds	Amount
Washington State Potato Commission	$ 838.00
Out-of-state seed growers (70 samples at $50/sample)	3,500.00
In state seed growers (10 samples at $25/sample)	250.00
TOTAL	$4,588.00

Table 2. Chemical Control Costs for Powdery Mildew in 1981.

	Fungicide		Application		
	Price	Rate	Cost By Air	No.	Cost of 6
Sulfur	$4.55/gal	.5 gal/A	$4-6/A	5-7	$43.65/A

Table 3. Chemical Control Costs for Early Blight in 1981.

	Fungicide		Application			
	Price[1]	Rate	Cost by Air	No.	Cost of 3 Air	Cost of 3 Sprinkler
Bravo®	$31.50/gal	1.5 pt/A	$4-6/A	2-4	$32.70	$17.70
Dithane M-45®	$ 2.22/lb	2 lbs/A	$4-6/A	2-4	$28.32	$13.32
Du-ter ®	$ 8.60/lb	8-10 oz/A	$4-6/A	2-4	$27.90	$16.13

Table 4. Chemical Control Costs for Sclerotinia Stem Rot in 1981.

	Fungicide		Application		
	Price[1]	Material/ Season	Cost by Air	Irrigation System[2]	Cost of 3 By Air (6 lbs)
Botran®	$4.15-4.50/lb	6-8 lbs/A	$4-6/A	$0-.25/A	$42/A

Table 5. Fumigation Costs for Verticillium Wilt in 1981.

	Fumigant		Application			
	Price[1]	Rate	Irrigation System[3]	Ground	Labor	Cost/Acre
Vapam®	$4-4.20/gal	50/A	$1.24/A	---	$10/A	$211-221/A
Telone C-17®	$7.10/gal	26/A	--	$25-35/A	--	$210-220/A
DD-PIC®	$7.25/gal	30/A	Application included			$218/A

1 *Price quotes received from agriculture chemical suppliers.*

2 Power cost at $.015/kwh, 75 psi and 10 ft left, and equipment maintenance. This is not a cost if application is made when crop is normally irrigated.

3 Power cost for 1.25 acre-inch irrigation water at .015/kwh, 75 psi and 10 ft left, and equipment maintenance.

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