Impact Of Seedborne Potato Virus Y On Yield Of Russet Norkotah Potatoes

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Summary

Experiments to investigate the impact of varying levels of PVY infection on the yield of Russet Norkotah potatoes grown in short-season areas were planted at Central Oregon Ag Research Center (COARC), Madras and Klamath Experiment Station (KES), Klamath Falls in 2003. Seedlots with PVY readings of 0.74 and 27.45 percent were tested alone and blended to achieve a range of PVY infection levels. Effects of PVY infection levels on yield and grade of Russet Norkotah were minor and not statistically significant at either site. The effect of early plant death at COARC caused by hail damage may have masked any effects that could have occurred later in the growing season.

Introduction

Potato Virus Y (PVY) is one of the most common virus diseases of potato worldwide. It can impact production of certified seed and also crops grown for processing or fresh market. Seed potato growers generally must meet established tolerances for PVY in order to certify their crop. Significant time and resources are expended to produce seed potato crops that contain very low or undetectable levels of the virus. Seed certification standards in Oregon require field inspection and post-harvest sampling and inspection to determine disease incidence and ensure seed lots are relatively free from diseases of concern. Commercial crops grown in Oregon must be planted using certified seed. Seed crops for recertification must be planted using seed that meets minimum standards that vary for different seed classes. Seed lots with PVY infection levels of 5 percent or more are not eligible for recertification under Oregon seed certification standards.

Compounding the challenge to produce virus-free seed potatoes, several potato varieties express visual PVY symptoms poorly, if at all. Russet Norkotah is among the more difficult varieties for visual detection of PVY symptoms. The lack of visual symptoms creates a challenging situation for producing certified seed of Russet Norkotah, because certification methods rely heavily on visual inspection procedures to detect and subsequently remove PVY-infected plants. The mild or absent symptom expression causes seed and commercial producers to conclude that PVY infection does not impact yield.

A few studies have examined the effect of varying levels of PVY infection on yield in areas with long growing seasons (Rykbost 1999, Nolte, et. al. 2004). Minimal information is available for short-season areas such as Central Oregon and the Klamath basin (Rykbost 1999). The objective of this study was to evaluate the impact of PVY infection on the yield of Russet Norkotah in short-season areas

Materials and Methods

Standard Russet Norkotah seed lots with greenhouse PVY readings of 0.74 (Lot A) and 27.45 percent (Lot B) were obtained from a Klamath County seed grower. Seed was hand cut, treated with Tops® MZ (thiophanate methyl-mancozeb, Gustafson) at KES or Maxim® MZ (fludioxonil-mancozeb, Syngenta) at COARC, and suberized at approximately 55°F and 95 percent relative humidity for 7 (COARC) to 10 (KES) days before planting. Seed lots were kept separate until immediately before planting. Five treatments included complete lots of each seed source and blended lots comprised of 1/3-2/3, 1/2-1/2, and 2/3-1/3 from each seed source. Plots were arranged in a randomized complete block design with five replications. Individual plots were two rows with 30 seedpieces in each row. Border rows on each side of plot rows were planted with seed from Lot A. Planting dates were May 7 and May 22 at COARC and KES, respectively.

At COARC, seed was spaced at 9 inches in 36-inch rows. All fertilizer was banded at planting at 195 lb/acre of N, P_2O_5, and K_2O, and 85 lb/acre of S. The insecticide Admire® (imidacloprid, Bayer) was applied in the seed furrow at planting at 0.17 lb a.i./acre. Weed control was achieved with Eptam® (EPTC, Syngenta), Sencor® (metribuzin, Bayer), and Matrix® (rimsulfuron, E.I. Dupont de Nemours and Co., Inc.) applied at labeled rates. Irrigation was applied to meet crop needs with solid-set sprinklers (17.25 inches). A hail storm on August 5 stripped most leaves and broke stems, effectively killing the crop. Potatoes were harvested with a two-row level-bed digger and hand picked on September 24. All tubers from each plot were graded to USDA grade standards. Yield and grade data were statistically analyzed using ANOVA procedures.

At KES, seed was spaced at 9 inches in 32-inch rows. All fertilizer was banded at planting at 160 lb/acre N, 80 lb/acre P_2O_5 and K_2O, and 140 lb/acre S. In-furrow applications of Vydate® C-LV (oxamyl, Dupont) (1.0 lb a.i./acre), Admire® (imidacloprid, Bayer) (0.17 lb a.i./acre), and Quadris® (azoxystrobin, Zeneca Ag Products) (0.10 lb a.i./acre) were made to control nematodes, insects, and fungal diseases. Weed control was achieved with Dual® (metolachlor, Syngenta) (1.0 lb a.i./acre) and Prowl® (pendimethalin, BASF) (1.0 lb a.i./acre) applied pre-emergence and incorporated with a rolling cultivator on June 3 and Matrix® applied post-emergence at 2 oz/acre on July 2. Herbicide applications were made with a conventional ground sprayer in 30 gal/acre solution. Two additional applications of Vydate® C-LV at 1.0 lb a.i./acre were made through the solid-set irrigation system on July 16 and August 1. Four foliar fungicide applications were made using standard products during the growing season. Approximately 20 inches of irrigation was applied with solid-set sprinklers. Vines were desiccated using Reglone® (diquat dibromide, Seneca) at 1.5 pints/acre on September 5. Potatoes were harvested with a one-row digger-bagger on September 24. All potatoes from each plot were weighed at harvest. Approximately 120 lbs/plot were graded to USDA standards. Data were statistically analyzed using MSUSTAT software.

When plants were approximately 10-12 inches tall, three leaflets per plant were collected from 20 plants in each plot of the treatments comprised of either Lot A or Lot B.

Samples were ELISA tested at the Idaho Crop Improvement Laboratory for PVY content. Sample dates were June 30 at COARC and July 7 at KES. As results were consistent between replications and locations, it was decided it was not necessary to sample the blended treatments.

Results

Laboratory plant analyses confirmed that the virus content in both seed lots of Russet Norkotah matched previously determined greenhouse PVY readings fairly well. At both sites, 2 plants out of 100, or 2.0 percent of Lot A tested were positive for PVY, compared with a greenhouse test of 0.7 percent. Lot B tests indicated 32 and 37 percent PVY infection at COARC and KES, respectively, compared with the greenhouse reading of 27.5 percent. Results were sufficiently consistent between replications that it was decided there was no justification for testing the blended treatment plants.

At COARC, no PVY response trend was evident. The effect of early plant death caused by hail damage may have masked any effects that could have occurred later in the growing season. While yields were slightly higher at COARC, the yield of U.S. No. 1s greater than 12 oz was about 1/3 lower than at KES.

Effects of PVY infection levels on yield and grade of Russet Norkotah were minor and not statistically significant at either site (Table 1). A trend was observed at KES for a slight yield reduction with increasing proportion of Lot B seed. Total U.S. No. 1 yields declined from 354 cwt/acre for Lot A to 324 cwt/acre for Lot B, a reduction of approximately 1 cwt/acre for each percent of seedborne infection level. The reduction was observed in larger U.S. No. 1 and off-grade tubers. Total yield was 48 cwt/acre lower for Lot B. KES findings are similar to the results of 1996 and 1997 studies.

Literature Cited

Rykbost, K.A., D.C. Hane, P.B. Hamm, R. Voss, and D. Kirby. 1999. Effect of seedborne Potato Virus Y on Russet Norkotah performance. Am J Potato Res 75:91-96.

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Acknowledgments

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Table 1. Impact of varying levels of seedborne PVY infection on yield and grade of Russet Norkotah potatoes grown at Central Oregon Ag Research Center (COARC), Madras and Klamath Experiment Station (KES), Klamath Falls in 2003.

	Yield U.S. No. 1's				Yield			
Seed Lot	4-6	6-12	>12	Total	<4	Twos	Culls	Total
	cwt/acre				cwt/acre			
				COARC				
100 % Lot A	44	247	90	381	39	1	26	448
2/3 Lot A + 1/3 Lot B	47	216	91	355	40	1	30	425
1/2 Lot A + 1/2 Lot B	50	233	109	392	38	1	22	452
1/3 Lot A + 2/3 Lot B	51	220	90	361	42	1	22	425
100 % Lot B	49	233	105	388	35	0	26	449
LSD 5%	ns	ns	ns	ns	ns	ns	ns	ns
				KES				
100 % Lot A	82	106	166	354	22	55	25	456
2/3 Lot A + 1/3 Lot B	105	101	134	340	22	66	8	436
1/2 Lot A + 1/2 Lot B	89	93	152	334	26	62	17	439
1/3 Lot A + 2/3 Lot B	90	84	132	306	18	53	31	408
100 % Lot B	93	97	134	324	25	45	14	408
LSD 5%	ns	ns	ns	ns	ns	ns	ns	ns

Size grades at KES were 4-8 oz and 8-12 oz