

# **COMPARING WINTER GREENHOUSE SEROLOGICAL TESTING WITH VISUAL READINGS FOR POTATO CULTIVARS NOT READILY EXPRESSING VISUAL PVY SYMPTOMS**

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## **Summary**

Seedlots of potato cultivars not readily expressing visual Potato Virus Y (PVY) symptoms were selected from all those submitted for winter greenhouse testing from the 2000 and 2001 Oregon seed crop. The seedlots were visually inspected for the presence of mosaic viruses and, in addition, 100 leaflet samples were randomly collected from each seedlot and ELISA tested for PVY. In 2000, there were no measurable differences ( $P = 5\%$ ) between the two detection methods for any of the individual seedlots, seed classes, or cultivars. In 2001, ELISA tests picked up significantly more PVY than visual evaluations among individual seedlots. There were no differences in the two evaluation methods for seed generation or cultivar in the 2001 seedlots.

## **Introduction**

Tolerances established for certifying potato seed are traditionally based on the ability to detect mosaic viruses visually. In addition, these standards are customarily based on a single cultivar, Russet Burbank, in which symptoms are readily discernable by visual inspection. In recent years, new cultivars have been released that express mosaic symptoms somewhat differently than Russet Burbank or, in some cases, very poorly or not at all. As these cultivars have been widely grown across the United States and Canada, mosaic levels in seedlots have increased and seed growers have faced downgrades in certification classes or even the failure to certify some seedlots at all. The economic impact has been severe at times.

Some states have responded to the mosaic epidemic by raising the mosaic tolerances for each seed class. Although more seedlots may be certified with higher tolerances for mosaic infection, this action does nothing to address the real causes of infection and may even contribute to the spread of the viruses. Some certification agencies have advocated serological, PCR or other types of testing to positively quantify mosaic levels in seed lots, particularly the cultivars not readily expressing visual Potato Virus Y (PVY) symptoms. Since seed classification disease tolerances have traditionally been based on visual inspections, seed growers have been reluctant to adopt mosaic testing programs. In addition, the ability to detect mosaic viruses has increased as more technologically advanced tests have been developed. So, the desire and ability to produce virus-free seedlots has been influenced by these new cultivars and how mosaic tolerances should be established.

Oregon seed growers have recognized the issues detailed above and their economic impacts and wish to base any revisions in mosaic tolerances on scientifically based research. This study was designed to aid in the setting of early seed generation

classification tolerances for mosaic viruses in cultivars not readily expressing visual mosaic symptoms.

## **Materials and Methods**

Each winter, Oregon seed growers submit tuber samples from a number of seedlots for pathogen screening in the greenhouses at Oregon State University. Visual inspections are normally performed on each seedlot to quantify virus infection levels, off-types, chemical injury, and other diseases. ELISA tests may occasionally be performed on plants that exhibit indistinct symptoms to aid in diagnosis.

In 2000, a total of 47 seedlots were selected from those submitted for greenhouse testing as part of the traditional Oregon potato seed certification process. The selected seedlots included 30 Norkotah, 11 Gem, 5 Shepody and one Winema seedlot. Seed classification generations included Prenuclear, Nuclear, G1, G2, and G3.

Thirty-four seedlots were selected in 2001. The selected seedlots included 23 Norkotah, 8 Gem Russet, one Shepody and two Winema. Seed classification generations included Prenuclear, Nuclear, G1, G2, and G3. Average PVY infection levels were higher in the 2001 seedlots than the seedlots submitted in 2000.

Each Norkotah, Shepody, Gem and Winema seedlot was subjected to a dormancy-breaking treatment, after which a spherical seed piece was hand cut from each tuber and planted in the soil floor of the greenhouse. Plants were allowed to grow for about 6 weeks. Visual PVY readings were made on submitted seedlots. In addition, 100 leaves were randomly collected from each seedlot and ELISA tested for PVY. ELISA tests were initially performed on groups of five leaves. If PVY was detected in the bulked sample, each of the five leaves was individually tested. Comparisons were made between visual and ELISA readings and also among seed generations.

## **Results**

### ***2000.***

PVY infection levels ranged from 0 to 31.2 percent in the visually read lots and from 0 to 59 percent in the ELISA-tested samples. Results are shown in Tables 1 and 3. Both evaluation methods, visual observation or ELISA, could detect the presence of PVY infection equally well. There were no measurable differences ( $P = 5\%$ ) between the two detection methods for any of the individual samples, seed classes, or cultivars.

Occasionally, mosaic was observed visually but not detected in any of the samples submitted for ELISA testing (Table 3). Many of the seedlots that were read visually contained several hundred plants. Only 100 leaflets were randomly selected for ELISA testing, so differences are likely due to sampling error.

### ***2001.***

Whereas only 50 percent of the seedlots submitted in 2000 were infected with PVY, over 82 percent of the seedlots evaluated in 2001 were infected with PVY. Infection levels

among the visually-read seedlots ranged from 0 to 28 percent PVY infection. PVY detected by ELISA tests ranged from 0 to 42 percent in the same seedlots (Table 4). Comparisons of the two PVY evaluation methods were not statistically different ( $P = 5\%$ ) for seed generation or cultivar (Table 2). However, ELISA tests picked up significantly more PVY than visual readings among individual seedlots. In some of the lots, visual readings detected only a fraction of the PVY found by ELISA testing the same lots.

Table 1. Average of PVY infection levels detected visually and by ELISA for each seed generation and cultivar tested from the 2000 potato seed crop in Oregon.

Planted seed generation	Cultivar	Average PVY detected visually %	Average PVY detected by ELISA %
Prenuclear	All	0.00	0.00
Nuclear	All	0.16	0.00
G1	All	0.60	1.17
G2	All	1.85	3.41
G3	All	0.00	0.00
All	Gem	0.07	0.09
All	Norkotah	2.06	2.10
All	Shepody	1.02	12.00
All	Winema	0.00	0.00

No comparisons were statistically different (5 percent).

Table 2. Average of PVY infection levels detected visually and by ELISA for each seed generation and cultivar tested from the 2001 potato seed crop in Oregon.

Seed Generation	Cultivar	Average PVY detected visually %	Average PVY detected by ELISA %
Prenuclear	All	1.30	2.00
Nuclear	All	5.39	7.25
G1	All	0.67	1.00
G2	All	1.22	2.07
G3	All	6.30	8.09
All	Gem	0.51	0.86
All	Norkotah	3.51	4.83
All	Shepody	0.00	0.00
All	Winema	3.40	4.50

No comparisons were statistically different (5 percent).

Table 3. PVY infection levels detected visually and by ELISA for all potato seed generations and cultivars tested from the 2000 Oregon seed crop.

Planted		PVY Detected			PVY detected
seed generation	Cultivar	Plants observed	visually	Leaves tested	by ELISA
		no.	%	no.	%
Prenuclear	Gem	165	0.00	100	0
Prenuclear	Gem	37	0.00	36	0
Nuclear	Gem	40	0.00	33	0
Nuclear	Gem	134	0.00	100	0
Nuclear	Gem	259	0.00	100	0
Nuclear	Winema	319	0.63	100	0
G1	Gem	209	0.00	100	0
G1	Gem	277	0.00	100	0
G1	Gem	695	0.00	100	0
G1	Gem	503	0.20	100	0
G1	Gem	324	0.00	100	0
G1	Norkotah	912	3.40	100	7
G2	Gem	323	0.62	100	1
G2	Norkotah	1,317	0.46	100	0
G2	Norkotah	522	31.23	100	21
G2	Norkotah	1,054	0.00	100	0
G2	Norkotah	642	0.47	100	1
G2	Norkotah	673	0.15	100	0
G2	Norkotah	669	0.15	95	0
G2	Norkotah	540	0.37	100	1
G2	Norkotah	616	3.73	100	4
G2	Norkotah	696	3.59	100	6
G2	Norkotah	1,587	0.25	100	0
G2	Norkotah	1,603	0.12	100	0
G2	Norkotah	768	0.00	100	0
G2	Norkotah	967	0.00	100	0
G2	Norkotah	1,730	0.00	100	0
G2	Norkotah	1,311	0.00	100	0
G2	Norkotah	863	0.00	100	0
G2	Norkotah	924	0.00	100	0
G2	Norkotah	873	0.00	100	0
G2	Norkotah	858	0.00	100	0
G2	Norkotah	510	0.00	100	0
G2	Norkotah	987	0.00	100	0
G2	Norkotah	1,004	0.10	100	0
G2	Norkotah	669	0.00	100	0
G2	Norkotah	634	0.00	97	0
G2	Norkotah	687	0.00	100	0
G2	Norkotah	1,149	1.39	100	1
G2	Norkotah	802	0.00	100	1
G2	Norkotah	397	9.82	100	13
G2	Norkotah	389	6.43	100	8
G2	Shepody	859	3.96	100	59
G2	Shepody	847	0.00	100	0
G2	Shepody	414	0.00	100	0
G2	Shepody	617	0.00	100	0
G3	Shepody	1,917	1.15	100	1
Average	Average		1.45		2.64

No comparisons were statistically different.

Table 4. PVY infection levels detected visually and by ELISA for all potato seed generations and cultivars tested from the 2001 Oregon seed crop.

Planted seed generation	Cultivar	Plants observed	PVY Detected		
			visually	Leaves tested	
		no.	%	no.	PVY Detected by ELISA %
Prenuclear	Gem	463	1.30	100	2
Nuclear	Gem	140	0.00	100	0
Nuclear	Gem	366	0.27	100	1
Nuclear	Gem	108	21.30	100	28
Nuclear	Gem	73	0.00	100	0
G1	Gem	342	1.46	100	3
G1	Gem	740	0.54	100	0
G1	Gem	335	0.00	100	0
G2	Norkotah	1,598	0.31	100	0
G2	Norkotah	262	0.00	100	0
G2	Norkotah	797	0.38	100	0
G2	Norkotah	1,328	0.23	100	0
G2	Norkotah	434	1.15	100	0
G2	Norkotah	1,384	0.36	100	0
G2	Norkotah	340	6.18	100	14
G2	Norkotah	1,023	0.78	100	1
G2	Norkotah	663	3.32	100	1
G2	Norkotah	726	0.96	100	0
G2	Norkotah	674	1.48	100	8
G2	Norkotah	717	2.23	100	6
G2	Norkotah	705	0.28	100	0
G2	Norkotah	877	0.68	100	1
G2	Shepody	296	0.00	100	0
G3	Norkotah	915	23.17	100	26
G3	Norkotah	539	28.20	100	42
G3	Norkotah	1,175	2.55	100	2
G3	Norkotah	1,162	1.20	100	0
G3	Norkotah	1,889	0.79	100	0
G3	Norkotah	1,796	0.28	100	1
G3	Norkotah	1,640	4.45	100	5
G3	Norkotah	1,479	1.83	100	3
G3	Norkotah	507	0.00	100	1
G3	Winema	292	4.79	100	8
G3	Winema	449	2.00	100	1
Average			3.31		4.35

T Test was significant (3.33 percent )