

## **SIMULATED HAIL TIMING: INFLUENCE ON YIELD AND QUALITY OF THREE POTATO CULTIVARS**

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Frontier Russet → medium early  
Shepody → medium early  
Russet Burbank → late

### Introduction

Hail is a potential threat during every cropping season. Potato growers and the insurance industry are interested in having an accurate method for estimating potato crop loss due to hail. The new varieties Shepody and Frontier Russet are assuming increasing economic importance, but very little is known about their relative response to hail damage compared with Russet Burbank. This trial evaluates the three varieties for their response to simulated hail damage.

### Procedures

Twenty pounds of N/ac and 100 pounds of  $P_2O_5$ /ac as monoammonium phosphate, plus 10 pounds of Z/ac as zinc sulphate, were broadcast on an Owyhee silt loam in the fall of 1992 at the Malheur Experiment Station. A soil sample taken from the top foot on April 15, 1993 showed a pH of 7.3, 1.5 percent organic matter, 8 CEC, 8 ppm nitrate-N, and 7 ppm ammonium-N, (total of 45 lbs N/ac), 26 ppm phosphorus, 569 ppm potassium, 2,900 ppm calcium, 280 ppm magnesium, 257 ppm sodium, 7.1 ppm zinc, 7.2 ppm iron, 14.4 ppm manganese, 1.3 ppm copper, 7 ppm sulfur, and 0.6 ppm boron. The field was bedded into 36-inch hills in the spring of 1993. Prowl at 1 lb ai/ac and Dual at 2 lbs ai/ac were sprayed on May 6 and incorporated during planting. Two ounce seed pieces of Russet Burbank, Shepody, and Frontier Russet were planted May 7 at 9-inch spacing. On May 14, urea at 45 lbs N/ac and Thimet 20G at 3 lbs ai/ac were sidedressed. Bravo 500 at 0.6 pint ai/ac was applied for preventive control of leaf fungi, plus Uniroyal ZKP, on June 25. Petiole samples from Russet Burbank plants were collected from the check plots every two weeks during tuber bulking to help keep nitrogen non-limiting. Due to low petiole nitrate levels the trial was fertilized with Uran at 30 lbs N/ac on July 5 and July 20, and at 20 lbs N/ac on July 30.

The crop was irrigated with a solid set sprinkler system with nozzles spaced 40 feet by 42 feet. Fifteen granular matrix sensors (GMS, Watermark Soil Moisture Sensors Model 200SS, Irrrometer Co., Riverside, CA) were used to measure soil water potential in the check (no hail) plots. Granular matrix sensors were offset 6 inches from the hill center and centered 8 inches below the hill surface (top of GMS was 6 inches from the soil surface). Granular matrix sensors had been previously calibrated to soil water potential. Sensors were read five times per week from June 14 to September 3. The crop was irrigated when soil water potential in the first foot reached -60 kPa. Due to an unusually wet winter and spring the soil water potential in the second foot of soil was -16 kPa and in the first foot of soil was -38 kPa on June 14. This indicated a



las pérdidas fueron mayores p la produccion comercial q p la total

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The hail treatments resulted in significant losses in both yield and grade (Tables 4 and 5 respectively). The decreases in marketable yield were greater than the decreases in total yield, specially for Russet Burbank and Frontier Russet, due to an increased proportion of undersized tubers with hail (Table 5). The July 23 (late July) hail date was among the lowest in total and marketable yield, and yield of US Number One tubers in relation to the check for all three varieties. In 1992, the late July treatment was also among the lowest in US Number One tuber yield for all varieties. Over all varieties, the late July hail resulted in the highest amount of undersize tubers, reflecting the abrupt cessation of tuber growth with weak regrowth. The late July and mid August treatments were among the lowest in total and marketable tuber yield in 1992 (Table 6). For Russet Burbank and Shepody, the August 13 hail date was among those resulting in the least reduction in US Number One tuber yield and grade. For Frontier Russet the July 2 hail date was among those resulting in the least reduction in US Number One tuber yield and grade. From visual observations it was found that the plants hailed on at the earliest date recovered the quickest and most vigorously. The plants hailed on at the last date never recovered. → las plantas dañadas temprana → se recuperan u. servida →

The July 23 hail treatment was among the lowest in stem-end fry color for all varieties (Table 5). Shepody had the lightest frying tubers on all hail dates. The July 23 and the August 13 hail treatments were among the lowest in specific gravity (Table 5).

The estimated tuber yield at each plant growth stage is shown in Table 1 and Figure 3. The plants in this trial were found to recover from the hail damage by producing new leaves and resuming growth, especially after the first two hail dates. Potato fields that have suffered hail damage are susceptible to diseases that can rapidly kill the plants. If potato plants had died at the time of hail treatments, both yield and tuber size would have been severely reduced. However, actual yield reductions in July hail-damaged plots were much less than the plant growth data would suggest, mainly due to rapid recovery of plants after July hail damage.

The results of the 1992 and 1993 trial show that the late July hail treatment resulted in the largest losses in yield for all varieties (Tables 6 and 7). The early July and mid-August hail treatments resulted in similar losses in yield in both years. The potato plants hailed in early July regrew vigorously and hence still had time to use the remainder of the season for tuber bulking (Figure 3). The plants hailed in late July did not regrow as vigorously and hence probably were not able to resume tuber bulking. The plants hailed in mid-August did not regrow, but most of the seasons' tuber bulking had already taken place.

#### Literature cited

Anonymous, 1990. Potato loss instructions. National Crop Insurance Services. Overland Park, Kansas, NCIS 6453 Potato/90. p. 12

Jones, J.P. and Painter, C.G., 1974. Tissue analysis: A guide to nitrogen fertilization of Idaho Russet Burbank Potatoes. University of Idaho, College of Agriculture, Cooperative Extension Service, Agricultural Experiment Station, Current information series # 240, June 1974.



Table 3. Growth stage of three potato varieties at three simulated hail application dates according to Table 2. Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1993.

Variety	Hail date/DAI*	Height	Canopy Description	Tuber Size	Hill Weight	Average <sup>1</sup>
R. Burbank	July 2/21	R-3	R-4	R-5	R-2	R-3.5
	July 23/42	R-6	R-6	R-7	R-5	R-6
	August 13/63	R-6	R-9	R-8	R-6	R-7.25
Shepody	July 2/19	R-2	R-4	R-5	R-2	R-3.25
	July 23/40	R-5	R-6	R-7	R-5	R-5.75
	August 13/61	R-5	R-9	R-8	R-7	R-7.25
Frontier R.	July 2/19	R-1	R-3	R-3	R-1	R-2
	July 23/40	R-5	R-6	R-6	R-4	R-5.25
	August 13/61	R-5	R-8	R-8	R-6	R-6.75

\* DAI, days after the onset of tuber initiation

<sup>1</sup> Average of canopy description, tuber size and hill weight

Table 4. Yield response of three potato cultivars to simulated hail timing. Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1993.

Potato yield by market grade												
Variety	Treatment	#1				#2			Total Marketable	Undersize	Rot	Total Yield
		4-6 oz	6-10 oz	> 10 oz	Total	6-10 oz	> 10 oz	Total				
----- cwt/ac -----												
R. Burbank	No hail	90.9	152.7	112.2	355.8	34.9	21.2	56.1	411.9	114.7	0.65	527.2
	Hail on 7-2	103.2	124.0	68.9	296.2	29.1	15.8	44.9	341.1	119.8	0.81	461.7
	Hail on 7-23	91.0	52.3	46.5	189.7	42.5	28.1	70.6	260.3	126.9	1.89	389.1
	Hail on 8-13	113.0	131.1	79.3	323.4	27.1	11.9	39.0	362.4	108.6	0.47	471.5
Shepody	No hail	39.7	72.7	234.0	346.5	24.2	50.7	75.0	421.5	39.9	0.78	462.1
	Hail on 7-2	44.3	78.9	156.3	279.6	25.1	49.1	74.2	353.8	51.7	1.71	407.1
	Hail on 7-23	39.7	82.5	141.9	264.1	17.9	25.4	43.3	307.4	44.0	0.43	351.8
	Hail on 8-13	41.5	76.5	171.4	289.3	24.8	35.8	60.5	349.9	37.8	1.15	388.8
F. Russet	No hail	66.2	101.4	117.8	285.5	24.5	29.7	54.2	339.7	76.8	2.09	418.6
	Hail on 7-2	57.8	106.8	79.2	243.8	19.3	29.3	48.6	292.4	82.0	0.58	375.0
	Hail on 7-23	58.9	61.9	44.9	165.7	26.8	28.7	55.5	221.3	100.9	4.19	326.3
	Hail on 8-13	60.8	93.8	64.0	218.6	21.3	18.9	40.2	258.8	89.2	2.58	350.5
Average	No hail	65.6	109.0	154.7	329.3	27.9	33.9	61.8	391.1	77.1	1.17	469.3
	Hail on 7-2	68.4	103.2	101.5	273.2	24.5	31.4	55.9	329.1	84.5	1.03	414.6
	Hail on 7-23	63.2	65.5	77.8	206.5	29.1	27.4	56.5	263.0	90.6	2.17	355.8
	Hail on 8-13	71.8	100.4	104.9	277.1	24.4	22.2	46.6	323.7	78.5	1.40	403.6
LSD(0.05) Treatment		17.7	20.9	39.1	48.4	7.8	ns	ns	59.9	ns	ns	66.4
LSD(0.05) Variety		ns	21.1	29.7	26.2	ns	10.8	ns	25.7	21.6	3.72	29.2
LSD(0.05) Treatment X Var.		ns	42.1	ns	ns	ns	ns	ns	ns	ns	ns	ns



Table 7. Two-year averages of US Number One tuber grade and tuber quality response of three potato cultivars to simulated hail timing. Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1993.

Variety	Hail timing	US #1 total			Stem-end fry color			Specific gravity		
		1992	1993	Avg.	1992	1993	Aver.	1992	1993	Avg.
		----- % -----			--- % reflectance ---					
R. Burbank	No hail	57.3	67.3	62.3	38.4	36.1	37.3	1.084	1.092	1.088
	Early July	47.3	65.0	56.2	38.0	39.3	38.7	1.085	1.096	1.091
	Late July	47.1	49.5	48.3	33.0	35.4	34.2	1.081	1.085	1.083
	Mid August	57.9	68.4	63.2	35.2	36.0	35.6	1.080	1.082	1.081
Shepody	No hail	72.1	75.0	73.6	47.7	41.9	44.8	1.083	1.084	1.084
	Early July	78.2	68.7	73.5	47.3	42.4	44.9	1.083	1.088	1.086
	Late July	63.3	75.6	69.5	45.9	37.8	41.9	1.080	1.080	1.080
	Mid August	76.2	75.0	75.6	47.6	41.8	44.7	1.080	1.082	1.081
F. Russet	No hail	80.9	67.9	74.4	35.6	31.1	33.4	1.088	1.088	1.088
	Early July	74.7	65.1	69.9	36.3	33.9	35.1	1.084	1.095	1.090
	Late July	77.9	52.2	65.1	36.6	32.7	34.7	1.087	1.093	1.090
	Mid August	78.0	62.2	70.1	36.8	28.5	32.7	1.082	1.078	1.080
Average	No hail	70.1	70.1	70.1	40.6	36.4	38.5	1.085	1.088	1.087
	Early July	66.7	66.3	66.5	40.5	38.5	39.6	1.084	1.093	1.089
	Late July	62.8	59.1	61.0	38.5	35.3	36.9	1.083	1.086	1.084
	Mid August	70.7	68.5	69.6	39.9	35.4	37.7	1.081	1.081	1.081
LSD(0.05) Trt		5.3	4.0		ns	3.0		0.004	0.0036	
LSD(0.05) Var		2.1	4.4		1.8	2.1		0.002	0.0025	
LSD(0.05) Trt X Var		4.3	8.7		ns	ns		ns	ns	



Figure 3. Tuber development over time for three potato cultivars without hail. Days are the number of days from the onset of tuber initiation, June 12, 1993. Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1993.

