

**Progress Report to the Agriculture Research Foundation
Oregon Potato Commission
1996-1997**

Title: Soil fumigation and the impact on yield in early, mid and late season cultivars.

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\$13,000 for 1996

Significant Accomplishments:

Soil fumigation with metam sodium reduced soil borne fungal numbers and increased yield in early and in full season cultivars. Generally as levels of metam sodium increased, soilborne fungal numbers decrease and yields increased.

Objective:

To determine whether soil fumigation with metam sodium is cost effective for use in early season cultivars Norkotah, Shepody, and Ranger Russet.

Procedure:

Two blocks, one to test Shepody and Russet Norkotah, the other to test Ranger Russet and Russet Burbank (each paired because of similar dates of maturity), were set up in a randomized complete block design with three fumigation treatments: 1. No fumigation; 2. 27.5 gallons of metam sodium/A (32.7%); and 3. 55 gallons of metam sodium/A (32.7%). Metam sodium was applied by water through the center pivot system. Blocks were on the Experiment station in Hermiston. The block containing Shepody and Russet Norkotah were planted on April 5th and vine killed on August 6th, or 123 days. The block containing Russet Burbank and Ranger Russet were planted on April 15 and vine killed on September 17th or 155 days. Each treatment had four replications. These rates of fumigant were used because 55 gallons (based on old product) is still a typical rate when growing Russet Burbank and this was the rate used in previous studies using Russet Burbank.

Soil samples were taken at three times, prior to fumigation in the Spring, post fumigation in the Spring prior to sowing, and prior to harvest, to determine populations of three common soilborne plant pathogenic fungi; *Fusarium*, *Pythium*, and *Verticillium*. Plots were individually dug and tubers graded and yields were determined. Yields were used to compare efficacy of fumigation and were compared

with soil fungi information and with information obtain during previous years testing with Russet Burbank.

Results and Conclusions:

Previous work with Russet Burbank showed metam sodium reduced reports soilborne fungi and increased yields (OPC Progress reports 1992-1995). The benefit of using metam sodium in long season Russet Burbank is reasonable since the longer pathogenic fungi can impact the plant the more reduction in yield can occur.

Three pathogenic soilborne fungi were monitored, Pythium, Fusarium, and Verticillium for each cultivar tested. Numbers of each of these fungi were decreased through fumigation. Generally numbers decreased with increasing levels of fumigation, though the decrease was not always significant different (Table 1). Reduce fungal levels in metam sodium treatments at the final sample indicates that fumigation impacted populations through the season. The reduce levels were similar to what would have been expected based on earlier work with fumigation in Russet Burbank potatoes.

Yields of each of the cultivars tested where impacted by fumigation (table 2). Short season cultivars, Russet Norkotah and Shepody, both showed a significant increase in total yield and total yield of US#1 potatoes. Yields of Russet Norkotah increased the most at the highest rate of fumigant. Actual total yields increased 86 and 50 hundred weight per acre in Norkotah and Shepody, respectively. A further increase in yield of tubers greater than 12 oz was also seen with Norkotah. Average tuber weight, yield of US #1 between 4 & 12 oz, and specific gravity was unaffected.

Longer season cultivars, as expected, were impacted even greater by fumigation. These cultivars grow longer and therefore might be expected to yield more if not heavily infected with soilborne fungal pathogens. Total yield and total US #1's were increased, particularly at the higher fumigation levels. Total yield increased 115 & 99 hundred weight in Russet Burbank and Ranger Russet, respectively. Higher yields of larger tubers were also seen, though not always significant over no fumigation. No difference was seen in average tuber weight or specific gravities.

The average cost of metam sodium fumigation/A at the highest rate used here is about \$140 (approximately 40 gallons of the 42 % formulation or $\$3.50/\text{gallon} \times 40 \text{ gallons} = \140). Field preparation, labor for application, and other costs make this figure higher. Returns for individual growers would be different but yield increases this year would seem to justify the use of metam sodium for short season cultivars as well as those reporting some resistance to early dying (Ranger Russet).

This study needs to be repeated to confirm the results seen during the first year of this study.

Table 1. Impact of three rates of metham sodium (Vapam) on soil populations (cfu/g) of *Pythium*, *Fusarium*, and *Verticillium*.

Cultivar	Vapam ¹ Rate gal/A	Pre Pythium	Pre Fusarium	Pre Vert.	Post Pythium	Post Fusarium	Post Vert.	Final Pythium	Final Fusarium	Final Vert.
R. Burbank	0	115.4	5720	1	100.8	3850.0 a	5	44.7	6148.2	18a
R. Burbank	27.5	142.9	7810	4.5	47.9	3135.0 ab	2.5	36.6	5536.9	10.5b
R. Burbank	55.0	132.0	5775	6.5	49.5	2493.2b	4	27.4	5555.0	6b
		NS ²	NS	NS	NS	P=.05 ³	NS	NS	NS	P=.05
Ranger	0	135.7	6288.8	2	77.1	3831.3	1	69.7	6105.6	27.5
Ranger	27.5	126.5	6617.6	4.5	45.8	2860.0	1.5	45.8	5591.9	15
Ranger	55.0	113.6	5591.9	5	12.8	2346.8	0	29.4	4546.9	8
		NS	NS	NS	NS	NS	NS	NS	NS	NS
Norkotah	0	137.6	6013.2a	10	108.5	3208.2 ab	2	82.5b	5536.3	7
Norkotah	27.5	161.3	8543.2b	6	97.4	4290.0 b	5.5	40.4a	5958.7	4.5
Norkotah	55.0	161.3	7205.0 ab	4	36.7	2108.2a	2	23.8a	4748.2	2.5
		NS	P=.05	NS	NS	P=.05	NS	P=05	NS	NS
Shepody	0	154.0	7333.7	12	133.9c	5023.7	7.5	71.6b	6471.9	7b
Shepody	27.5	128.3	9955.0	6.5	71.5b	3867.6	5.5	36.7a	6471.3	2.5a
Shepody	55.0	159.5	7095.0	10	23.9a	2107.6	1	9.2a	5426.3	2a
		NS	NS	NS	P=.05	NS	NS	P=.05	NS	P=.05

1. Rate of Vapam using the old formulation.
2. NS Treatments are not significantly different.
3. Numbers followed by the same letter in each column by cultivar are not significantly different.

Table 2. Impact on yield with the use of metham sodium at three rates.

Cultivar	Vapam ¹ Rate gpa	Total Yield cwt	Total US# 1 cwt	Total % US# 1	US#1 cwt >12	US#1 cwt 4- 12	Avg. tuber wt.	S.G. ²
R.Burbank	0	683a ³	471a	69a	62ab	409a	6.5a	1.077a
R.Burbank	27.5	699a	529ab	76ab	58a	471 a	5.9a	1.078a
R.Burbank	55	798a	636b	80b	103b	533a	6.6a	1.082a
		NS ⁴	P < .05	P < .04	P < .07	NS	NS	NS
Ranger	0	793a	691a	87a	308a	383a	8.7a	1.082a
Ranger	27.5	846ab	722ab	85a	327a	395a	8.3a	1.084a
Ranger	55	892b	775b	87a	360a	416a	8.4a	1.085a
		P < .02	P < .06	NS	NS	NS	NS	NS
Norkotah	0	547a	449a	82a	124a	325a	8.5a	1.070a
Norkotah	27.5	583ab	500ab	86ab	172ab	327a	8.7a	1.069a
Norkotah	55	633b	550b	87b	191b	359a	8.5a	1.069a
		P < .07	P < .07	P < .07	P < .05	NS	NS	NS
Shepody	0	553a	484a	88a	278a	307a	10.4a	1.071a
Shepody	27.5	626b	558b	89a	308a	250a	9.0a	1.071a
Shepody	55	603ab	537b	89a	312a	224a	11.1a	1.072a
		P < .05	P < .01	NS	NS	NS	NS	NS

1. Rate of Vapam using the old formulation.

2. Specific Gravity

3. Numbers followed by the same letter in the same column by cultivar are not significantly different.

4. NS Treatments are not significantly different.