GALLIAN, JOHN J.[1], DEL J. TRAVELLER[2], and RONALD L. ROEMER[1]. [1]University of Idaho, Twin Falls R&E Center, P.O. Box 1827, Twin Falls, ID 83303-1827, and [2]Amalgamated Sugar Co., P.O. Box 127, Twin Falls, ID 83303-0127. Fumigation with 1,3-dichloropropene for rhizomania control in Idaho using two application methods.

Rhizomania, caused by beet necrotic yellow vein virus (BNYVV) and vectored by the soil fungus *Polymyxa betae*, is one of the most serious diseases of sugarbeet and was first diagnosed in Idaho in 1992. Since that time, more than 11,000 acres have been detected to be infested and the acreage increases each year. Since 1994 the performance of resistant varieties has been field tested in Idaho, and it is clear that rhizomania control will primarily be resistance to BNYVV. In 1995, growers began planting back into known rhizomania-infested fields on a limited basis with resistant varieties, and since then there has been considerable grower interest in fumigation in addition to planting resistant varieties for control, especially in the sandy soils near Rupert, Idaho, where the disease is severe. It was not feasible for growers to plant susceptible varieties and incur the additional cost of fumigation, and information was needed on whether fumigation could economically be used with rhizomania resistant varieties.

Results from a preliminary study in 1994 in which only a rhizomania susceptible variety was planted and 1,3-dichloropropene (Telone II) was broadcast applied, there was a significant increase in root yield at 12 and 20 gal/acre application rates, and in recoverable sugar at 12, 16 and 20 gal/acre. These results were encouraging and field studies were continued in 1995. The purpose was 1) to examine the cost effectiveness of fumigation with Telone II for control of rhizomania in Idaho when resistant varieties were part of the cropping system, and 2) to determine whether control could be improved and/or rates decreased using a bedded in-row fumigant injection method of application.

MATERIALS AND METHODS

Field preparation, fumigation and planting. The test was conducted in Rupert, Idaho, in a field that had serious loss from rhizomania in 1993. The portion of the field used had been uniformly fall fumigated in 1993 with Telone II at 12 gal/acre and planted to a susceptible sugarbeet variety in 1994. Disease in 1994 was uniform and symptoms were severe.

Soil was a course sandy loam, and the field was fall disked and 60 lb/acre nitrogen and 100 lb/acre P_2O_5 was spring applied and incorporated with a disk and roller harrow immediately prior to fumigant application. Fumigation treatments were applied March 29-April 5, after soil temperature at 2 ft had reached 5.5° C (42° F). Experimental design was a randomized complete block with 10 fumigation treatments and eight replications. Row spacing was 22 inches and plots were six rows wide and 40 ft long, with a 45 ft alley between each tier of plots. The alleys provided adequate space for the tractor to reach and maintain calibration speed through the length of the plot. For broadcast application, the tractor was positioned with five shanks 16 inches deep spaced 22 inches apart such that each shank injected fumigant between the rows. Immediately following injection, the soil was sealed with a disk and cultipacker. With in-row application using a six row injector, fumigant was injected 12 inches deep in the rows and beds shaped directly over the point of injection in a single operation. Telone II rates were 8, 12, 16 and 20 gal/acre. Untreated checks were shanked the same as other treatments but without fumigant.

On May 4, two of the four center rows of each plot were planted with rhizomania susceptible WS-91, and the other two with resistant Beta 4581 using a six row Milton planter with six inch seed spacing. The two outside rows were planted to WS-91. Twenty lb/acre Temik was applied at planting banded over the row and another 12 lb/acre with a cultivation on June 20 to control nematode and sugarbeet root maggot. Several rainstorms immediately following planting provided adequate moisture for germination and emergence, and stand was excellent. Weed pressure was extremely heavy and weed control was accomplished with 2 pt/acre Betamix on May 12, 3 pt/acre Betamix on May 17, 2 pt/acre Poast on May 30, 3 pt/acre Betamix on May 31, and 2 pt/acre Betamix Progress on June 16. Eptam was applied at 3 pt/acre on July 13, and plots were hand weeded on July 5 and August 1. Plots were cultivated six times. Additional nitrogen at 15 lb/acre each was applied as Uran on June 28 and July 3.

Harvest and data collection. Plots were harvested on September 27-28. Tops were flailed and crowns removed with a commercial sugarbeet topper. Twenty-five ft was measured in each plot and five ft of roots at the ends of the rows outside the plots to be harvested were hand dug and discarded. The four center rows were lifted, two rows at a time by variety, using a Farmhand commercial harvester with the elevator chain removed to allow roots from each variety/plot to remain in place on top of the ground. Every root was rated for symptoms of rhizomania on a 0 to 9 scale developed by Robert Lewellyn, USDA, with 0 = no rhizomania symptoms and 9 = plants killed. Roots were weighed and two samples of at least eight roots each per variety/plot were analyzed for percent sugar and conductivity by the tare laboratory of Amalgamated Sugar Company at Paul, Idaho. Data were analyzed using least squares means analysis, SAS Systems Inc.

RESULTS AND DISCUSSION

The results for 1995 are summarized in Table 1. Three of the five treatments were significantly higher in root yield with bedded WS-91 and one with bedded Beta 4581 than with broadcast. Seven of eight treatments were significantly higher than the untreated checks with bedded, while only two were higher with broadcast. All disease ratings except one were lower with bedded

Table 1. Performance of rhizomania resistant and susceptible sugarbeet varieties in response to two application methods and four rates of fumigation with 1,3-dichloropropene (Telone II®), Rupert, Idaho, 1995.

Telone II			Root Yield	Sugar Content	Gross Sugar	Conduc-tivity	Extrac-tion	Recoverable Sugar		Disease[c]
gal/A	Applic.[a]	Variety[b]	(T/A)	(%)	(lbs/A)	(mmhos)	(%)	(lbs/A)	(lbs/T)	Rating
8	br	Beta 4581	22.35	14.22	6362	0.801	83.63	5323	238.2	4.6
8	br	WS 91	10.54	13.27	2803	0.768	83.80	2347	222.8	6.5
12	br	Beta 4581	20.74	14.62	6068	0.768	84.21	5113	246.4	4.4
12	br	WS 91	9.54	13.52	2574	0.729	84.39	2173	228.3	6.8
16	br	Beta 4581	21.87	14.71	6413	0.811	83.66	5363	246.3	4.1
16	br	WS 91	16.17	13.70	4426	0.739	84.60	3745	232.0	5.6
20	br	Beta 4581	21.22	14.61	6189	0.808	83.66	5183	244.9	4.3
20	br	WS 91	15.64	13.80	4300	0.719	84.34	3628	233.0	6.0
0[d]	br	Beta 4581	20.99	14.30	6012	0.760	84.20	5065	241.1	4.2
0[d]	br	WS 91	8.69	12.46	2244	0.718	83.90	1899	210.0	6.9
8	be	Beta 4581	23.32	14.00	6529	0.819	83.50	5451	233.7	3.3
8	be	WS 91	15.50	13.63	4246	0.719	84.56	3595	230.7	4.9
12	be	Beta 4581	23.84	14.40	6862	0.819	83.47	5733	240.6	3.2
12	be	WS 91	18.28	13.85	5067	0.719	84.62	4293	234.4	4.5
16	be	Beta 4581	21.42	14.63	6219	0.794	83.84	5204	245.8	3.6
16	be	WS 91	18.57	13.63	5113	0.741	84.22	4337	230.2	4.6
20	be	Beta 4581	23.70	14.44	6840	0.817	83.49	5713	241.4	3.3
20	be	WS 91	19.61	14.11	5534	0.688	85.08	4716	240.5	4.3
0[d]	be	Beta 4581	19.58	14.55	5641	0.756	84.31	4739	245.8	4.2
0[d]	be	WS 91	11.40	13.65	3105	0.747	84.19	2611	230.2	6.1
LSD (.10)			2.80	0.89	817	n.s.	n.s.	709	n.s.	0.9
CV (%)			18.1	7.4	18.7	20.1	2.7	19.3	9.5	8.1

Fumigation treatments applied March 29-April 5. Test planted May 4 and harvested September 27-28.

[a] Application methods: broadcast (br) or injected in the row and bedded (be). Fumigant was shanked 16" deep with both methods.

[b] Beta 4581 is a commercial variety marketed as resistant to rhizomania and WS 91 is susceptible.

[c] Disease rating: 0 = no rhizomania symptoms; 9 = plants killed.

[d] Untreated checks were shanked without fumigant.

application compared with the corresponding variety and rate with broadcast application. When comparing the WS-91 untreated checks, sugar content, gross sugar and recoverable sugar/acre are significantly higher in the bedded treatment than the broadcast, and there was also a trend for higher root yield and lower disease rating. The shanking may have improved water relations resulting in less disease development. The same effect was not seen in this experiment with the resistant variety Beta 4581.

The return for fumigation was calculated using the Amalgamated Sugar Company contract based on $23.00 net return for sugar per 100 lb, $9.50 per gallon for Telone II and $20.00 per acre application cost. The best treatment compared with the untreated checks was resistant variety Beta 4581, 12 gallons of fumigant per acre, and bedded in-row application. The return was $662.00 per acre compared with $663.00 for the corresponding untreated check. There appears to be an advantage in disease control to the bedded in-row application over the broadcast application according to this study, but the cost effectiveness of fumigation is questionable if application is made for control of rhizomania alone. Many Idaho sugarbeet growers are also potato growers, and Telone II is one of the products applied to potatoes primarily for control of root knot nematode. Fumigation for rhizomania control may be cost effective in Idaho, however, if a single fumigation benefits more than one crop in the rotation. Improved varietes resistant to rhizomania that are becoming available have yielded as well as many standard varieties under disease-free Idaho conditions. Some have yielded as much as 30% higher under severe disease conditions than the resistant variety used in this test. With these improved varieties, there may be no need for the additional cost of fumigation.