TWO YEARS EXPERIMENTATION WITH TERRACLOR® (PCNB) FOR CONTROL OF RHIZOCTONIA. PCNB RESIDUES IN TUBERS

Gene D. Easton, Richard C. Maxwell,
Charles R. Oldenburg and R. R. Legault[1/]

Introduction

Experiments were conducted near Othello, Pasco, and Prosser, Washington in 1964 and again near Othello and Prosser in 1965 to determine if application of Terraclor®[2/], pentachloronitrobenzene (PCNB), to the soil would control Rhizoctonia solani Kuhn and increase potato quality and yield. Potatoes from all experiments were analyzed for PCNB residue after harvest.

A PCNB 2 lb. per gallon emulsifiable concentrate formulation is registered with the USDA for row application at the time of planting. The registration specifies that a maximum of 10 lbs. active ingredient may be applied per acre. Registration was granted on the basis that there would be no residues of PCNB in the potatoes at harvest when directions for use are followed. Therefore, no tolerance nor exemption from the requirement of a tolerance has been established for this chemical in potatoes.

The registration of PCNB applied as a broadcast treatment at 195 lb. active ingredient per acre and as a preplant row treatment at 65 lb. active ingredient per acre has recently been deleted from the USDA Summary of Registered Pesticide Uses.

Method of Application

PCNB was broadcast on the soil surface as either a water emulsion of a liquid concentrate (2 lbs./gal.) or as 10% granules. The chemical was mixed into the soil to a depth of 5 to 6 in. by a tractor mounted rototiller. Potatoes were planted 1 to 3 weeks after treatment.

In the row treatments, a water emulsion of PCNB liquid concentrate (2 lbs./gal.) was sprayed in a 14 in. band centered on the row

---

1/ Assistant Plant Pathologist, Department of Plant Pathology, Washington State University Irrigated Agriculture Research and Extension Center, Prosser, Washington; Assistant Agricultural Scientist, Scientific Aide, and Chairman, Department of Agricultural Chemistry, Washington State University, Pullman, Wash.

2/ This trade name is used to define specifically the product worked with in these studies. Use of the trade name does not constitute a guarantee or warrantee of the product by Washington State University or that the behavior of similar products would be the same or different from the one used.

with equipment attached to the planter. The opening discs, furrow shoe and closing discs of the planter served to mix the chemical.

Effect of PCNB on Rhizoctonia Control and Production

In 1964 and 1965 the Rhizoctonia organism severely infected stems (lesions) and infested tubers (black scurf) in 5 of the 8 experiments (tables 1A, 1B, 1C, 2A and 2B). Soil in 3 experiments was relatively free of the Rhizoctonia organism (tables 1D, 2C and 2D).

In general, there were slightly more stems without lesions and the weight of tubers with black scurf was slightly decreased where Rhizoctonia was severe and where the plots were treated with approximately 15 lbs. of active PCNB per acre. This reduction of lesions and black scurf was statistically significant in only 2 of the experiments (table 2A and 2B). The Rhizoctonia organism did not appear to be eliminated in any plot treated with PCNB.

Percent U. S. No. 1 tubers by weight and number, and yield (cwt. / A.) were not significantly increased in any of the 5 experiments where Rhizoctonia was severe (tables 1A, 1B, 1C, 2A and 2B).

Analysis of Potatoes for PCNB Residue

After harvest, representative samples of potato tubers were collected, thoroughly scrubbed under running water to remove all visible soil particles, and analyzed for PCNB residue.

In the 1964 experiments (table 1) the peels were analyzed separately from the peeled portions to determine where the PCNB residue was concentrated. Residue values for the whole potato were calculated from residues found in the peel and peeled portion.

Potatoes from the 1965 experiments (table 2) were not peeled prior to analysis.

Results of PCNB Analysis

The results of the chemical analyses in 1964 showed that almost the entire amount of PCNB residue occurred in the peels (table 1). PCNB residues were less than 0.007 p.p.m. in all samples of peeled tubers.

In all experiments, as the rate of application of PCNB per acre increased, the PCNB residue in the potato increased. In general, the broadcast applications resulted in lower PCNB residues in the potatoes than did the row applications. Presumably this was because more of the chemical was in close proximity to the potatoes in the row treatments.

There is some variations in amounts of PCNB residue found in potatoes from the same treatments at different locations. For example, the potatoes from the row treatments near Prosser (table 1C) contained about 3 times as much PCNB as those from the Pasco (table 1D) row treatments at the same rates of application. Factors such as climate, soil and weather conditions at time of and subsequent to application may have influenced residue. It should also be noted that the potatoes from Pasco were stored for 22 weeks before being analyzed, whereas the potatoes from Prosser were stored only 13 weeks. Other unpublished research studies by the authors have shown that PCNB residue in potatoes declines during storage. This may explain why more PCNB was found in the Prosser potatoes. On the basis of these storage experiments it can be inferred that higher residues would have been present in the potatoes immediately after harvest than at the times the analyses were made.

Small amounts of PCNB residue were found in potatoes from the untreated plots, presumably as the result of contamination by drift during application of PCNB to nearby plots. Windy, dusty conditions are prevalent in early March and April.

Summary

Experimentation during the past 2 years has not shown PCNB at any rate from 7.5 to 30 lbs. active ingredient per acre, to satisfactorily control Rhizoctonia stem lesions or tuber black scurf. The total yield and percent of U.S. No. 1 tubers by weight and numbers were not increased significantly on soils treated with PCNB.

Analyses for PCNB in potatoes grown in Washington soils during 1964 and 1965 clearly showed that residues were present when PCNB was applied in the ways described in this paper.

In the 1965 experiments where PCNB emulsifiable concentrate was applied to the row at the rate of 7.5 lbs. active ingredient per acre, PCNB residues in the tubers were greater than 0.2 p.p.m. Even though the PCNB was applied in accordance with present USDA registration (less than 10 lbs. active ingredient per acre), this residue would subject the crop to seizure by federal or state Food and Drug Authorities.

1964 PCNB Experiments

Table 1. The EFFECT OF PCNB ON THE RHIZOCTONIA ORGANISM, POTATO PRODUCTION AND PCNB RESIDUE IN TUBERS.

Lbs. PCNB per acre	Mean% clean stems (no Rhiz. lesions)	Mean% tubers with black scurf	Mean% U.S. No. 1 tubers Weight	Mean% U.S. No. 1 tubers Number	Mean yield cwt./A.	PCNB residue[1] 14 weeks after harvest Mean p.p.m. PCNB Peel	Whole
A. Broadcast treatment with 10 % granules of PCNB at Othello, Washington.							
0	25	86	77	76	477	0.007	0.001
10	26	88	85	79	553	0.096	0.013
20	47	63	84	78	584	0.306	0.043
40	35	52	82	75	492	0.606	0.116
B. Broadcast treatment with 2 lb./gal. emulsifiable concentrate of PCNB at Othello, Washington							
0	25	86	77	76	477	0.007	0.001
10	43	87	88	84	477	0.166	0.023
20	53	58	87	82	446	0.360	0.053
40	54	65	86	81	600	0.593	0.066
C. Row treatment with 2 lb./gal. emulsifiable concentrate of PCNB at Prosser, Washington						PCNB residue[1] 13 weeks after harvest	
0	8	64	70	73	316	0.382	0.060
7.5	0	42	70	76	282	0.490	0.077
15	8	40	65	72	310	1.345	0.215
30	13	34	65	69	261	1.992	0.272
NOTE: Strong winds and dry conditions at time of PCNB application and planting may account for contamination of PCNB in untreated plots.							
D. Row treatment with 2 lb./gal. emulsifiable concentrate of PCNB at Pasco, Washington						PCNB residue[1] 22 weeks after harvest	
0	55	0	89	88	484	0.018	0.002
15	63	0	83	81	430	0.418	0.053
30	75	5	88	84	422	0.620	0.082

1/ PCNB residues were less than 0.007 p.p.m. in all samples of peeled tubers.

1965 PCNB Experiments

Table 2. THE EFFECT OF PCNB ON THE RHIZOCTONIA ORGANISM POTATO PRODUCTION, AND PCNB RESIDUE IN TUBERS.

Lbs. PCNB per acre	Mean % clean stems (no Rhiz. lesions)	Mean % tubers with black scurf, weight	Weight	Number	Mean yield, cwt. /A.	PCNB residue 7 weeks after harvest p. p. m. PCNB Whole
A. Broadcast treatment with 2 lb. /gal. emulsifiable concentrate of PCNB at Othello, Washington.						
0	9	49	52	57	407	0.019
30	30*	37	58	57	319	0.074
B. Row treatment with 2 lb. /gal. emulsifiable concentrate of PCNB at Othello, Washington						
0	17	47	57	38	385	0.083
7.5	40*	40	61	38	421	0.203
15	35*	28*	58	43	370	0.451
30	42*	22*	59	39	378	0.759
C. Row treatment with 2 lb. gal. emulsifiable concentrate of PCNB at Othello, Washington						PCNB residue 5 weeks after harvest
0	33	14	48	55	639	0.058
7.5	44	11	47	57	581	0.226
15	47	2*	58*	61	588	0.318
30	40	2*	51	58	603	0.457
D. Row treatment with 2 lb. /gal. emulsifiable concentrate of PCNB at Prosser, Washington						PCNB residue 10 weeks after harvest
0	75	3	72	74	450	0.052
7.5	78	3	72	72	450	0.362
15	76	1	66	65	457	0.397
30	82	0	69	68	450	0.918

*Values significantly different from the control at 5% level.