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Potato Ring Rot Control and Reports of Progress, Disease Control Research

G.H. Starr

W.F. Buckhholtz

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POTATO RING ROT CONTROL

and report of progress

DISEASE CONTROL RESEARCH

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   W. F. Buchholtz

Plant Pathology Department
Agricultural Experiment Station
South Dakota State College
Brookings, South Dakota

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RING-ROT PROBLEMS

G. H. Starr

SUGGESTIONS FOR GROWING RING-ROT-FREE POTATOES

A. Where grower has ring-rot in the potatoes that he now is growing.

1. Dispose of all potatoes known to contain ring-rot and do not use any for seed the following year.

2. As soon as the crop is removed from storage, clean out all bins and the entire storage cellar where ring-rot infected potatoes have been stored. Ventilate well to allow all surfaces to become dry.

3. Disinfect the cellar thoroughly by spraying the soil, bin boards and all surfaces that have come in contact with the stored potatoes. Copper sulphate (1 pound to 10 gallons of water) or formaldehyde (1 pint to 15 gallons of water) may be used. Chlorinated compound such as B-K and others have been used successfully for this purpose. For a 2000 pp.m. of B-K use 6½ ounces per 10 gallons of water. These should probably be recommended in the order given. After spraying, the cellar should be closed up tightly for several hours, especially where formaldehyde or chlorine compounds are used. Later, it should be ventilated to dry it out.

4. Disinfect all equipment that has been used in connection with the digging, sorting and storing of the potato crop.

   a. For sack disinfection, steam sterilization is recommended where available. A few minutes' exposure to steam will kill all ring-rot bacteria. Copper sulphate (at strength given above) may be used especially on older bags if the discoloration of the bags is not considered as impairing their value. In using copper sulphate, soak the bags well in the solution for a few minutes, drain off and spread out to dry. If formaldehyde is used, soak the bags in the solution (of strength given above) for a few minutes, drain off excess solution and cover for one hour or more to allow fumes to act. Later, spread out to dry. Mercurnol or any other acid solution should not be used on burlap bags.

   b. For baskets, sorters and similar equipment copper sulphate, formaldehyde or chlorine compounds may be used as disinfectants. Where either formaldehyde or chlorine compounds are used, the spraying can best be done in the cellar at the same time that the cellar is disinfected. This gives a better concentration of the active vapors with more effective results.

   c. For the disinfection of planters and diggers, copper sulphate may be used at the strength previously mentioned. All parts of these machines

that come in contact with the potato seed pieces should be thoroughly sprayed with the disinfectant. Where two or more seed lots are to be planted, such as foundation seed and a questionable lot, the better seed should be planted first and the questionable one last, in order to avoid a possibility of ring-rot spread.

5. Secure the best certified or foundation seed that can be obtained in the state. This should be sufficient to plant an acreage that will produce enough seed potatoes for your entire acreage the following year.

   a. Do not store such potatoes in your cellar with other potatoes of questionable ring-rot content. If possible, place new seed in storage where ring-rot has not been present in the past or, if present, has been completely eliminated by thorough disinfection.

6. If a seed lot contains soft-rot tubers which contaminate other tubers with a slimy ooze, it is best to treat this seed about two weeks previous to planting time with corrosive sublimate (Mercuric chloride) 1:500 or 4 ounces to 15 gallons of water for 20 minutes or with acid-mercury (Mercurnol) for a period of 3 minutes.

7. Plant certified or foundation seed in fields well isolated from others. <u>This is important.</u> Too often growers will get the best seed obtainable and then plant it along side of potatoes containing ring-rot or virus diseases, thus contaminating the better seed.

B. Where the grower does not have ring-rot in his present potato crop.

1. Practice sanitation and disinfection of storage cellar.

2. Do not store other potatoes of unknown ring-rot content in your own cellar.

3. Caution visitors or buyers who may wish to cut potato tubers in your cellar not to use a knife that may be contaminated with ring-rot bacteria from other cellars.

4. Do not borrow planters, diggers, sorters, picking bags or any other equipment from your neighbor nor permit him to borrow yours. Ring-rot bacteria may be introduced in this way.

5. Do not purchase new lots of seed potatoes just to see what they are like. So often, ring-rot and other diseases are introduced in this manner. When you get good seed, stick to it and exclude seed from other sources.

C. Suggestions for reducing ring-rot in commerical plantings where seed is known to contain some ring-rot.

1. Treat seed potatoes with acid-mercury (Mercurnol) two weeks before planting, as directed under A-6.

2. At planting time, cut the potato tubers with a rotary cutting knife where the cutting surface is disinfected by running in a chemical solution (mercuric chloride) or preferable, in a bath of boiling water.

3. If the rotary knife is not available, the seed may be treated after being cut by dipping in corrosive sublimates (1:500), 4 ounces to 15 gallons of water, for a period of 5 to 10 minutes.
This seed should be planted right after treatment or spread out to dry if the planting process is delayed. (The treatment of cut seed is limited in its use, as in some parts of the country, reduction in stands result.)

D. Eliminating ring-rot by hill-selection.

If a small amount of ring-rot is found in an otherwise desirable strain, it is possible to select healthy hills from fields planted with such seed and thus eliminate the ring-rot disease.
In some cases re-selections may have to be made as some of the original hill units may have had slight ring-rot in them.

E. Reducing ring-rot by roguing.

Where a small amount of ring-rot is found in a potato field and the potato crop is to be put in storage, it will be advantageous to rogue out ring-rot plants, removing all the tubers. If such infected tubers are not removed, they will break down in storage, be disagreeable to handle and cause much loss. This method is not practical where ring-rot reaches considerable proportions.

F. Miscellaneous information on ring-rot.

1. Disinfectants tested as bacteriocides in 10-second exposures.

a. Effective:

1. Mercuric chloride (1 pint to 15 gallons).
2. Acid-mercury (Mercurnol).
3. Boiling water.
4. Furfuryl alcohol (full strength).
5. Iodine.
6. Lysol (3 to 5 per cent).
7. Kreso kip (3 to 5 per cent).

b. Moderately effective:

1. Phenol (1 per cent).
2. Copper sulphate and tri-basic copper sulphate (1 lb. to 10 gal).
3. Ethyl alcohol (70 and 95 per cent).
4. Mercuric oxide.
5. Chlorine compounds.

a. B-K (2000 to 8000 ppm.).
b. Steri-chlor (2000 to 8000 ppm.).
c. Caskior (2000 to 8000 ppm.).
d. HTH (2000 to 8000 ppm.).

c. Slightly effective to non-effective:

1. Sodium chloride.
2. Soap (Ivory).
3. Wettable sulphur.
4. Cinnex 20.
5. Semesan Bel.
6. Formaldehyde (1 pint to 15 gallons).
7. Fermate.
8. Spergon.
9. Thiosan.
10. Arasan.

2. Effect of freezing.

Ring-rot bacteria will remain viable in infected tubers frozen continuously for several months.

Taken from SYMPOSIUM ON BACTERIAL RING ROT OF POTATOES

Annual meeting, Canadian Phytopathological Society, Toronto, Ontario, June 26-28, 1944.

The Present Status of Bacterial Ring Rot in Canada

H. N. Racicot

Bacterial ring rot was first found in Canada in the province of Quebec in 1931. It was immediately named "bacterial wilt," although the cause of the disease was not actually known. It was recognized in New Brunswick in 1937 and was found in the same year in stored tubers in Alberta. In 1938, it was found in Prince Edward Island, Ontario, Manitoba and Saskatchewan. One case was found in Nova Scotia in 1938, and two in 1942, and one case was found in British Columbia in 1943, but there is reason to believe that in each of the cases in these two provinces the disease has been completely eradicated.

Although there is perhaps no province that is absolutely free from bacterial ring rot, there are three provinces, namely, Prince Edward Island, Nova Scotia, and British Columbia, in which little ring rot appears to exist. The disease is, however, quite general in Quebec and New Brunswick, and Ontario, Manitoba, and Saskatchewan probably have a scattering of it in most parts. In Alberta it is largely present in the Lethbridge district, which is probably the largest commercial potato growing area in that province.

Ring rot overwinters largely in slightly infected tubers, but may also overwinter on contaminated bags and on bin walls. It does not overwinter in the soil but may do so in tubers that survive in the ground all winter. The percentage infection in a lot of potatoes on a farm increases rapidly due to the spread by the knife used by the planter in cutting tubers into sets. Ring rot is spread locally by the exchange of seed potatoes and machinery between neighbors; and the use of contaminated second-hand bags as containers for seed potatoes and cut sets may also introduce the disease on a farm. It is spread from district to district by means of infected potatoes used for seed, and

particularly when table stock potatoes are used for planting. However, there is no doubt that before the cause and seriousness of the disease was known and a "no tolerance" standard adopted, it became widely distributed through certified seed potatoes.

The control of bacterial ring rot consists largely of two main lines of action: (1) the prevention of its introduction on a farm or in an area where it is not present, and (2) its eradication where it already exists. In the first case, purchasing exclusively nothing but certified seed potatoes for planting, together with the disinfection of all used bags brought on the farm, is the best guarantee of keeping ring rot off it. Preventing the movement of infected table stock potatoes from one province into another, particularly into one free from ring rot, especially in the spring when a lot of people buy table stock potatoes for planting, would go a long way in preventing its introduction on new farms. In the second case, in order to eradicate the disease when it is present on a farm, all the potatoes without exception should be disposed of. If sold, they should be marketed at such a time and place that they are not likely to find their way on to another farm and be planted there. Also, the storages, machinery, tools, bags, etc., should all be thoroughly disinfected. Ring rot free seed should then be purchased for planting.

This outline would be most incomplete if the difficulties encountered in controlling ring rot were not pointed out. The experience obtained with certified seed potatoes has made it possible to recognize the outstanding difficulties and how best to overcome them. The greatest difficulty encountered is that of detecting the disease when it is present only in very small amounts. This is made even more difficult when insect injuries, late blight, and fungous wilts are prevalent, since ring rot symptoms on the plants usually show up late in the season when these troubles are likely to be present also. During a wet season there is likely to be little or no wilting of the plants. The surest way of detecting ring rot is by following the digger at harvest time and watching carefully for diseased tubers. After this, the best time again is about a month after harvest when there has been sufficient time for additional infected tubers to break down in storage. Even when all visibly affected tubers are left on the field, four weeks after storing there are bound to be additional tubers showing symptoms of the disease.

The second greatest difficulty in controlling ring rot is that of preventing the spread of infection from farm to farm. There are many ways in which spread of infection can take place: the exchange or common use of machinery; carelessness on the part of an inspector or prospective purchaser who may cut diseased tubers on one farm and then cut healthy tubers on another without first disinfecting his knife; walking over diseased tubers or contaminated floors in a warehouse and then going back to the farm and walking over the potatoes in a large bin; the exchange of empty bags that may have served to market a diseased crop for the farmer's own bags that have been filled with potatoes for the market, and the use of the former without first disinfecting them; getting a small lot of potatoes from a neighbor to finish the planting of a field without making sure that they are free from ring rot; bringing on the farm indiscriminately small lots of potatoes to "try something new," etc. To keep his own potatoes free from ring rot, a farmer must adopt the utmost sanitary precautions.

Sufficient experimental work has been conducted on bacterial ring rot to show conclusively that the organism does not overwinter in the soil, but may overwinter in tubers that survive in the ground all winter. It is also now well known that the knife used in cuttings sets, and the picker-type of planter, are the most efficient disseminating agents of ring rot. It has been demonstrated satisfactorily that the inorganic mercuric chloride and cyanide are the most efficient disinfectants for knives and cut sets, while saponified cresols (such as Lysol) are also excellent for disinfecting knives, but that the organic mercury disinfectants (Semesan, Semesan Bel, etc.) are very inefficient. All disinfectants found efficient for disinfecting cut sets to prevent their infection at seed cutting time, have reduced the yield more than a small percentage of ring rot would have done. Smearing the surface of sound tubers with the organism in the fall and planting them in the spring, either whole or cut into sets, has resulted in a small percentage of infection.

Storing tubers in a box whose walls had been smeared with the organism, even when the tubers were handled roughly, did not result in infection. One experiment with a bag contaminated in the fall with the organism and stored all winter in a potato cellar clearly demonstrated that the organism could live on the bag all winter and cause infection of freshly cut sets planted in it.

Experiments have demonstrated that in the short growing season existing in Canada, aerial insects would be unable to spread the disease sufficiently early for tubers to become infected. More information is required on whether or not the organism can overwinter or oversummer on machinery and bin walls.

On metal plates in the winter, both inside and outdoors, the organism is known to survive only 60 days. It is important that farmers disinfect all used jute bags that are left on their farms. In spring, summer, and early fall this can be done conveniently by soaking them in formalin and hanging them on the fence to dry, but when the temperature falls below freezing, this method is no longer practical. Therefore, the manner in which bags can be disinfected with formaldehyde gas under farm conditions in winter should be worked out. Experimental work should also be performed on methods of cleaning and disinfecting graders in commercial warehouses, with suitable tests to check their efficiency, as frequently these graders are used to grade one lot of potatoes after another, and they should be disinfected between each lot. More information is also needed on whether or not irrigation water can spread the disease under ordinary farm practice.

Estimated scab lesions per tuber on potatoes grown in plots with fertiliser additions, Codrington and Clark counties, 1944

Treatment	Scab lesions per tuber (estimated)		
	Steinmetz	Fox	Fletcher
1, 13 (None)	38.95	15.3	1.35
2 (Nitrogen)	30.6	13.4	0.6
3 (Phosphorus)	44.0	12.5	1.1
4 (Potash)	36.3	10.7	1.4
5 (P & K)	41.6	14.6	1.0
6 (N, P, K)	43.0	14.1	1.3
7 (2N, P, K)	41.6	13.8	2.3
8 (N, K)	43.5	8.5	3.3
9 (N, 2P, K)	37.3	12.7	1.0
10 (N, P)	43.5	14.1	1.4
11 (N, P, 2K)	36.8	13.2	2.2
12 (2N, 2P, 2K)	36.3	11.6	2.0

(These observations were made on potatoes grown in the Agronomy Department field trials with fertilisers in 1944).

Degree of scab infection, 1942 to '44, late blight infection of foliage in 1942 and late blight tuber rot in '44, on named varieties of potatoes at Brookings.

Variety	Scab estimates			Late blight estimates	
	1942	1943	1944	1942 (foliage)	1944 (tuber rot)
Bliss Triumph	++	++++ (pit)	1 - 10	+++	+
Cobbler	+++	+	1 - 10	-+	-
White Jarba	+	++	1 - 10	+++	-
Early Ohio	++++	+++	2 - 5	++++	-
Red Warba	++	++	1 - 5	++++	-
Chippewa	++	++ (pit)	1, 2 - 15	+++	+ ('43)
Houma	++	++	none	++	+
Mesaba	+++	+	2 - 10	+++++	-
Sequoia	+	+ (pit)	4 - 5	+	+
Katahdin	+	+? russet	1 to 4 - 5	++	++
Pontiac	Sl.tr.russet	+++ (russet and pit)	2,3 - 20	+	-
Sebago	Tr.russet	++ (no pit)	3 - 10	+	+
Mohawk (46,000)	V. sl.tr.,russet	+	2,3 - 10	++	+
Menominee (538-118)	++	+++	2,3 - 20	+	-
Kasota		++ (pit)	2,3 - 10		-
Pawnee		+ (russet)	3 - 10		+