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1. A Method of Avoiding Lettuce Rot.
2. Potato Scab Experiments.

LEXINGTON, KENTUCKY,

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Agricultural Experiment Station.

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KENTUCKY AGRICULTURAL EXPERIMENT STATION,

LEXINGTON, KY.

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1. A METHOD OF AVOIDING LETTUCE ROT.

BY H. GARMAN, ENTOMOLOGIST AND BOTANIST.

This disease is troublesome in Kentucky on lettuce grown under glass during winter and early spring. It appears to be due to several organisms, including what is known as lettuce mold (*Botrytis sp.*), but the result, so far as the grower is concerned, is *lettuce rot*, and the thing he wants most to know is how it may be checked or avoided.

From its manner of growth lettuce is not conveniently treated by spraying, and the same peculiarity of the plant renders it undesirable to spray the leaves with poisonous preparations, since, because of its quick growth, it must come to the table a short time after treatment, and the poison is thus likely to be retained.

The conditions under which the rot is most prevalent have suggested a remedy that, so far, in the Vivarium of my Division, works well, seems in fact to be all that could be desired.

Moisture on the leaves, or in contact with them, appears to be a necessary condition for the growth of the rot. When a hot-house is kept very damp and the plants are watered frequently by sprinkling, the rot often starts in the axils of the leaves and works outward, because the moisture retained in the axils gives the organisms causing the disease opportunity to get into the plant at these places. Likewise when the leaves rest on the ground, they begin to rot at their tips and the disease then works inward, leaf after leaf rotting away, as they come in contact with the ground.

Is it practicable to avoid these conditions?

It is practicable, and the remedy is a very simple one. Never water the plants from above. To avoid this lay several series of tile in each bench, the number of series depending of course on the width of the bench; close the joints with cement around the under two-thirds of their circumference; fit the end tile closely to the wooden frame at one end of the bench, and bore a hole through the frame so as to open into the tile. One can then keep the earth moist by introducing hose connected with a hydrant, or by using the spout of a watering-can, the rose having been removed. In other words, the plants are watered by the sub-irrigation method.

But water may drip from the glass overhead. If the joints between panes are not good, some water is likely to come through during showers, then run down the side, where it will splash the plants even if it does not drip directly on them. Much of this trouble can be obviated by shifting the glass over beds from time to time, so as to close the joints; and I would suggest in addition a series of panes set upright against the outer frame of the bed, where they will shield the plants from the splashing, and will at the same time not interfere with the light, as would boards.

To avoid the rot which creeps up from the tips of leaves resting on the soil, I have adopted a mulch of fine excelsior, as shown in the half-tone figure, and it answers the purpose perfectly. The fine chips produced at planing mills do not answer so well, since they soon become compacted and then soak up and retain moisture from the soil.

The central idea of the method is: *Keep the exposed surfaces of the plants dry.*

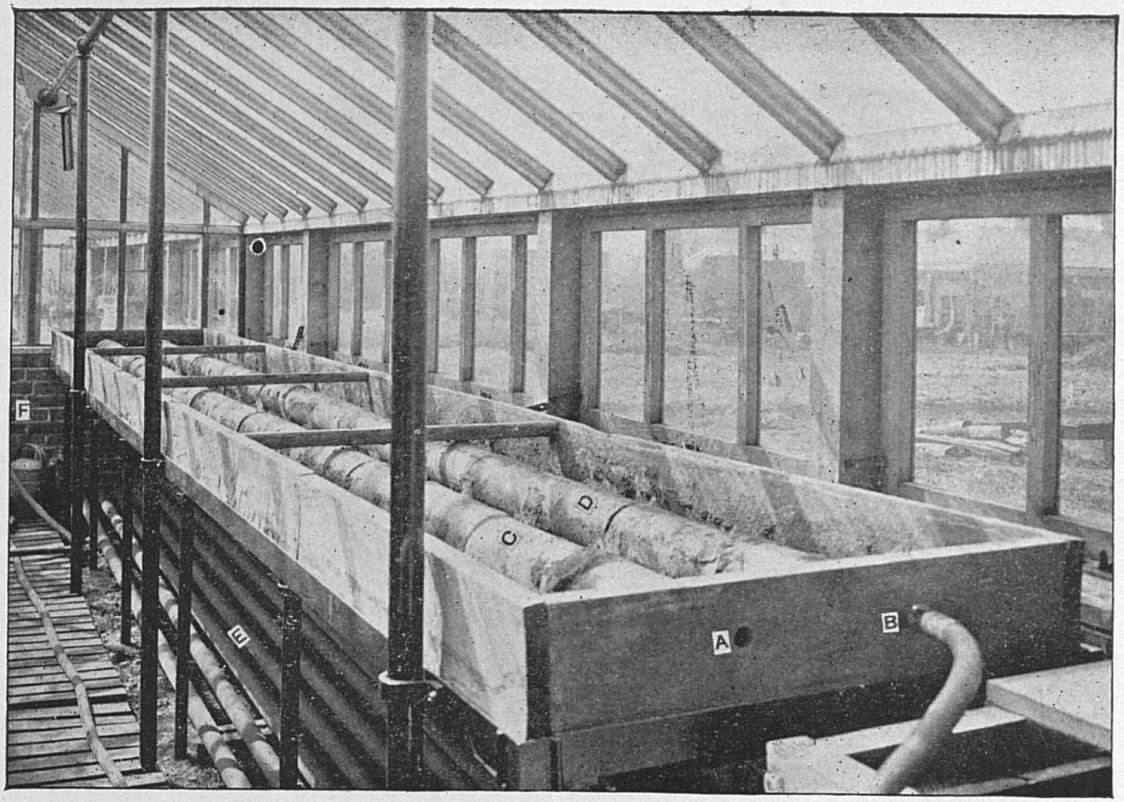

FIG. 1.—Bench used for lettuce experiment in the Vivarium of the Division of Entomology and Botany, the soil removed to show series of tile, *C*, *D*, used in watering. *A*, hole in wooden frame for introducing water; *B*, hose applied as in watering, the hydrant supplying water at left of *F*; *E*, hot water pipes connected with heater.

FIG. 2.—Experimental bench of lettuce as it appeared in the Vivarium, March 24, 1899. *A A*, openings in frame for watering; *B B*, excelsior mulching about plants; *C C*, iron frame supporting bench, the bottom being of heavy slate.

2. Potato Scab: Experiments Made in 1898.

BY H. GARMAN, ENTOMOLOGIST AND BOTANIST.

The following experiments with reference to treating seed potatoes to prevent scabbing, continue those reported in former bulletins. An acre of ground was divided into 10th-acre plots of eight rows each, half of each plot being planted with untreated seed and constituting a check on the adjacent rows planted with treated seed. The potatoes used for seed were Early Ohio, and were planted April 21, 1898. They were very badly scabbed. The treatment adopted was as follows:

Plot 1.—Seed for four rows soaked one hour iu a solution consisting of 4 ounces of corrosive sublimate dissolved in 30 gallons of water.
Check on the above: Seed for four rows not treated.

Plot 2.—Duplicate of Plot 1.
Check on above.

Plot 3.—Seed for four rows soaked one-half hour in a solution consisting of 6 ounces of corrosive sublimate in 30 gallons of water.
Check on above.

Plot 4.—Duplicate of Plot 3.
Check on above.

Plot 5.—Seed for four rows soaked for one-half hour in a mixture consisting of one pint of formol in 15 gallons of water.
Check on above.

Plot 6.—Duplicate of Plot 5.
Check on above.

Plot 7.—Seed for four rows soaked one hour in a mixture consisting of one-half pint of formol in 15 gallons of water.
Check on above.

Plot 8.—Duplicate of Plot 7.
Check on above.

Plot 9.—Seed for four rows soaked two hours in one-half pint of formol mixed with 15 gallons of water.
Check on above.

Plot 10.—Duplicate of Plot 9.
Check on above.

Objects of Experiments.

It had been previously demonstrated (See our Bulletin 72, February, 1898.) that corrosive sublimate, in solutions ranging from 4½ ounces in 30 gallons of water to 8 ounces in 30 gallons of water, was an effective remedy for the disease. The corrosive sublimate is very poisonous and somewhat costly, making it desirable, if possible, to find something else for the purpose, to which these objections do not apply.

Formol, or formalin, has of late been very extensively used as a preservative and germicide, for which purposes it has proved so useful that it was inevitable that it should soon be tested as a fungicide in field experiments made at the Agricultural Experiment Stations. Tests of this sort were made last year with favorable results at the Indiana Station, and it was decided last spring to use formol, at the Kentucky Station, side by side with corrosive sublimate with a view to a comparison of their effects as remedies for scab.

A further object kept in view was to get a solution that will disinfect seed potatoes quickly, and with the least possible injury.

Formaldehyde, Formol, Formalin, Formalose.— These names are applied by dealers to solutions of a gas obtained by the oxidation of wood alcohol. Formol and formalin are the names most commonly employed in this country for 40 per

cent. solutions in water. This 40 per cent. preparation is the one used in our experiments. In this condition it is sold for about 50 cents per pound at retail. Solutions of this strength when brought near the face are very irritating to the membranes of the eyes and nostrils, but one becomes somewhat accustomed to the fumes in time, and no permanent injury is done by them. As diluted for use on potato seed it is perfectly harmless and the hands may be freely immersed in it.

The great advantage formol has over corrosive sublimate is in its being a much less dangerous material to have about. A considerable quantity of the diluted formol can be taken into the mouth and swallowed without ill effect. Indeed some of the preservatives now sold to dairymen for use in milk consist largely or entirely of formol. If formol is as effective as corrosive sublimate in checking scab, there should, therefore, be no hesitation in employing it in place of the more poisonous substance. The experiments following will show to what extent this is true.

Corrosive Sublimate, Bichloride of Mercury, Mercuric Chloride.—Violent poisons like this are always to be avoided on the farm in favor of less poisonous ones, because of the danger to stock and to man himself, due to careless or ignorant help. Small quantities of those generally employed and recommended will do no harm, but in using them one must be constantly on his guard against mistakes and neglect. A solution of corrosive sublimate standing in a barrel may be the means of poisoning stock which get access to it. When treating potatoes such solutions should be kept under lock and key, if possible, in a room of a shed or barn where cattle can not reach them. When seed potatoes have been soaked and are spread out to dry preparatory to cutting, they should be kept where they can not be eaten by either poultry, hogs or cows. A single treated cut potato dropped on the ground in carrying the seed to the field may result in mischief. If there are no conveniences at hand for preserving the fluid safe from stock, after the potatoes have been treated the remainder of the solution should be disposed of at once by

digging a hole in some out of the way place, pouring the solution into it and covering with earth.

If, however, the solution can be stored in a tight vessel, a barrel with wooden hoops is preferable for the purpose, it will keep its properties for some time and can be used repeatedly. The solution is very destructive to metals and in course of time is liable to destroy iron barrel hoops.

It should be remembered though that corrosive sublimate forms an inert compound when it attacks the proteid matter of germs or fungi, and hence solutions cannot be expected to retain their properties indefinitely.

Field Notes.

June 23, the plants were observed to be in excellent condition, with no evident difference between treated and untreated plots.

July 6, the blossoms were noted as all gone and the growth of plants in treated and untreated plots was still alike. None grew as large as they should, possibly because of too frequent rains.

July 19, the plants were noted as turning brown, as if ripening, and on August 2 most of them showed little appearance of being alive.

The potatoes were harvested October 1. The yield and percentage of scab are shown in the table.

Results.

The results from the use of corrosive sublimate were in every case all that could be expected. The lots from treated seed were invariably smoother and finer than those from the untreated potatoes. The scab present in these lots was not such as would affect their market value in any degree. The average from the two plots planted with seed treated with corrosive sublimate solution containing 4 ounces of the sublimate, was 12½ per cent. scabbed and 1½ per cent. badly scabbed. The untreated rows of these same plots give an average of 76 per cent. scabbed and of 30½ per cent. badly scabbed.

SHOWING TREATMENT FOR POTATO SCAB, AND RESULTS.

Plot.	Treatment of Seed.	Per cent. scabbed.	Per cent badly scabbed.	Yield in pounds.
1	1 hr., 4 ozs. sublimate, 30 gals. water.	20	3	208½
	None.	83	34	238¾
2	1 hr., 4 ozs. sublimate, 30 gals. water.	5	None.	221½
	None.	69	27	313¼
3	½ hr., 6 ozs. sublimate, 30 gals. water.	29	2	229¾
	None.	89	57	273¼
4	½ hr., 6 ozs. sublimate, 30 gals. water.	45	None.	311¼
	None.	94	41	292½
5	½ hr., 1 pt. formol, 15 gals. water.	69	12	241½
	None.	91	49	314½
6	½ hr., 1 pt. formol, 15 gals. water.	58	11	249½
	None.	91	53	271
7	1 hr., ½ pt. formol, 15 gals. water.	46	11	272
	None.	96	54	285¾
8	1 hr., ½ pt. formol, 15 gals. water.	60	21	249½
	None.	89	39	265½
9	2 hrs., ½ pt. formol, 15 gals. water	96	24	269¼
	None.	83	27	306
10	2 hrs., ½ pt. formol, 15 gals. water.	84	28	233
	None.	84	30	262½

The stronger solution (6 ounces in 30 gallons of water) of corrosive sublimate used in plots 3 and 4 give no better average result, in fact the percentage of scabbed potatoes is somewhat higer (37 per cent), though the badly scabbed ones constitute a sligtly smaller percentage (1 per cent.). The time required in treating the seed of these plots was however only half as long, and this is a distinct gain where many potatoes are to be treated.

The treatment with formol did not come up to expectations in checking scab. The best result obtained was from plot 7, where 46 per cent. of the treated potatoes was scabbed, as against 96 per cent. of scabbed potatoes in the untreated half of this plot. The results as to badly scabbed potatoes are better (see table) but are not nearly so good as in the plots treated with corrosive sublimate, where indeed there were practically no badly scabbed potatoes.

A glance at the table will show that there is an increase in the number of scabbed potatoes from treated seed, passing from plot 7 to plot 10. In fact in plots 9 and 10 there is no apparent benefit from treatment. This result puzzled me for some time, for at first thought one would expect that ½ pint of formol for two hours would destroy more of the scab fungus than the same quantity for one hour, as used in plots 7 and 8. The table shows that the reverse of this was true, and I now think that the potatoes used for plots 7 and 8 may have exhausted the formol in the water to such an extent that it did not so completely disinfect the seed for plots 9 and 10. A repetition of the experiments another season will show how completely this hypothesis is justified.

Conclusion.

In our own experiments corrosive sublimate has shown itself much the most effective preventive of scabbing that has been tried. With from 4 to 4½ ounces in 30 gallons of water it is possible to prevent the disease almost entirely, the spots that occur being few and usually very small and superficial in character.

In the interest of a fair conclusion I must finally point

out that in every case but one (plot 4) the untreated rows yielded a few more pounds of potatoes than the treated, but when the worthless scabbed potatoes are thrown out, and the inferior quality of the remainder is considered, the advantage is still in favor of the treated potatoes.

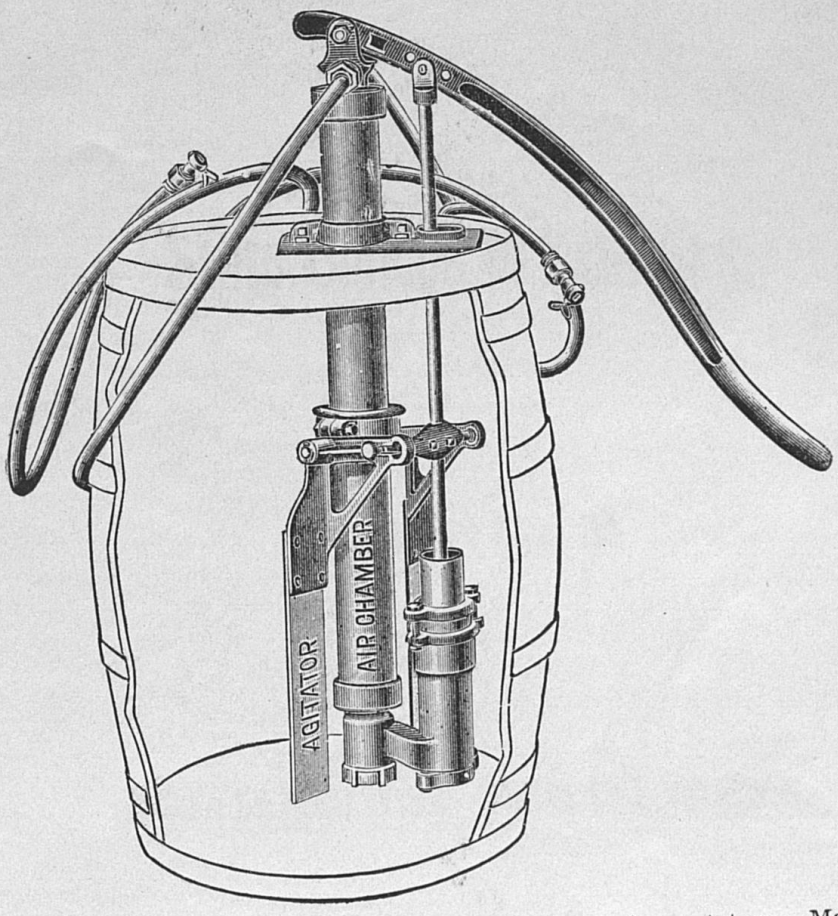

FIG. 3.—The Pomona Spray Pump, suitable for spraying potatoes. Manufactured by the Goulds Company.