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## THE FARMER'S ADVOCATE.

ers. They are made cumbrous like the coca-nut, or minute like the worm-seed mustard; and all thus to enable the baby plant to get a start in life without interference from the outside world. The same watchill care guards the seeds against fungus attacks. The leaves may be destroyed, the stem and roots invaded, and the fruit or seed covering may suffer but in all except a very few cases the seed itself is exempt.

Among the few cases of this kind there may be mentioned three where some fungus has succeeded in penetrating the plant's nursery so as to be able to attack the baby plant. One of these is the Anthracnose of Beans. In this case the fungus gains entrance by way of the pod when the plant is young and fleshy, grows into the tender seed inside, and kills it or causes a spot according to the development of the seed. In a bean that is merely spotted, therefore, the fungus is still alive in the tissue around the spot and will start into activity again with the spring A disease of this kind is very hard to growth. deal with because any treatment which would kill the fungus inside the seed would be extremely liable to hurt the seed also.

A second and very important example of a true seed disease occurs in the case of certain of the smuts of grains. Here the fungus parasite lives during the early part of the growth of the host within its tissues without doing any noticeable harm until the seed is to be formed. The fungus then grows into the young embryonic seed where it either displaces the seed entirely, as in the stinking smut of wheat, or else it may, as in the case of loose smut of wheat remain without killing the seed. In the latter case an affected seed shows no external evidence of the smut fungus within nor is the germinating power of the seed materially injured, so that when the seed is sown again in the spring the fungus grows along with its host. The hot water treatment devised by Jensen is intended to kill the fungus in the seed without injuring the seed itself.

Another similar case of disease deserves mention here namely the Ergot of Rye. In this disease the seed however does not grow after being attacked but develops into the large black Ergot grains which are only the seed coat filled with the fungus.

Still another possible example of a disease of recent discovery concerns the sugar beet where the fungus is said to be carried over the winter and from one field to another in the seed coat or rather the tissue of the seed ball. When the seed is sown again the fungus resumes its activity and causes a damping off of the seedling.

The number of diseases associated with seed is not so limited in class (2) as in class (4) and in the nature of the case are much easier of treatment generally. It is obviously a comparatively simple matter to destroy a few spores adhering to the outside of seeds by means of formalin, copper sulphate, corrosive sublimate or any of the well known fungicides. This process is well exemplified in the treatment of oats and the susceptibility to disease that is found in the stem, and is not, like the seeds mentioned in class (1), protected by special adaptations from fungus attack. In order to see clearly what part the seed potato plays in disease transmission, we may make a list of potato diseases, and note the various relationships that each bears to the seed.

It should be stated here that not all the diseases mentioned in this table are serious. A list including all those found at present in Ontario, which are sufficiently damaging or prevalent to make it worth while to consider control measures of some sort, would comprise.— Late Blight and Rot, Ordinary Scab, Early Blight, Black Leg, Dry Rot and Wilt, Khizoctonia, Leaf Roll, Curly Dwarf.

In this list the diseases are arranged according to their relative importance, and while others may differ as to the relative positions of the last four or five, [I think no one will deny that the first two are correctly placed. A reference to the table already given will show with the exception of early Blight, which is a comparatively unimportant disease with us, and the last three, which are of even less importance, all the dis-eases mentioned are transmitted through the seed. If this fact is properly appreciated, it tecomes obvious that the production of clean seed would in a great measure solve the problem of potato diseases. In other words if we could usa for seed only those tubers which are free from Scabs, Black Leg, Late Blight, Dry Rot, etc., we might expect to always harvest perfectly clean and healthy potatoes.

Uniortunately like many other plausible things, this method is too good to be true. At least it is only partly true, and another glance at the table shows the reason why it is only partly true. Several of our worst diseases are there noted as 'llving over in the soil as well as on the seed potato, and fit is of very little use to plant a clean potato in infested soil and then expect a healthy crop. We can expect the ''clean method to work perfectly in the case of Seed'' those diseases which are not present generally in the soil, Like Leaf Roll, Curly Dwarf, and even Black Leg, but we know that Rhizoctonia is to be found almost universally in our soils, and it is thought by some that Common Scab is always present also. We do not know that the Late Blight fungus winters in the field, and the evidence seems to be against it, but on the other hand the ease with which the spores of this fungus are carried from one field to another, so that the disease may become widely epidemic during the summer, prevents us from getting the results we could reasonably expect from a "clean seed" program. It is very fortunate that this, the worst disease of the potato, can be so well controlled by the use of Bordeaux spray.

Referring again to the list of potato diseases which we may expect to meet in Ontario we may attempt to sum up the situation in each with reference to possibilities of control. LATE BLIGHT AND ROT .- It is believed that the disease is started each year from tubers in which the fungus passed the winter, but which did not rot because of favorable storage conditions. Spraying the potatoes in the field with Bordeaux mixture three or four times during the summer will give satisfactory control of this disease as a rule. The results of twenty years of experimental spraying at the Vermont Agricultural Experimental Station were published some time ago and they are entirely in favor of this theatment. During this period there were several seasons in which there was no Blight at all, but the average yield per acre for the whole period, even with these years included, was as follows .-

in the soil where it is believed by some to be more or less universal. Certain soils containing lime or much barnyard manure are liable to have more scab than those in which commercial fertilizers are used, or those which have considerable natural acidity. Because of this broad distribution the scab, is one of the most difficult diseases to control. Still, if a formula for scab for potatoes were needed it would be as follows: \*clean acid soil—commercial fertilizers—clean seed."

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Where the soil is known to be clean, seed may be freed from the scab organism by treating it with corrosive sublimate, 1 lb. in 200 gal. for three hours. (See circular, Div. of Bot., Central Exp. Farm, Ottawa.)

EARLY BLIGHT.—Not usually serious with us. Spraying as for Late Blight is quite effective in controlling it.

BLACKLEG.—This is a bacterial disease in which the stalk is rotted at and below the surface of the ground, after which the bacteria make their way along the stem to the tuber. If this happens early, and the weather is warm and moist, the tubers may be entirely rotted, the rot showing first as a very black, putrid mass in its centre. Otherwise the bacteria may penetrate but a short distance into the tuber and there remain in a dormant condition till spring, when, with the coming of growth, they make their way into the stalk which arises from the bud. 'As the presence of these dormant bacteria may be actuated in the seed potato by a blackening in the stem end, one has only to take a slice off this, when cutting the seed, in order to be sure of planting none of these carriers of disease.

DRY ROT AND WILT.—Although some soils may contain the fungus causing this disease, a good deal of infection probably arises from affected tubers when these are planted. All such should be discarded.

RHIZOCTONIA.—This fungus is said to be a normal inhabitant of many soils, and I have found it on practically every lot of potatoes that I have examined in Ontario. It occurs as little black blots of varying size on the outside of the potato. These fungus clots resemble scab spots somewhat, but when wet they turn very black, whereas a scab spot remains brown. Such spots are purely superficial, and do no harm to the tuber beyond disfiguring it. In some cases, however, the fungus causes a rot of the stalks at the surface of the ground, but I have not met with this stalk rot very often in this Province.

LEAF ROLL.—As the name indicates, this disease shows itself in a rolling or folding of the leaves lengthwise, and this feature is often accompanied by slender growth and yellow color. Although it may arise from several causes this curling of the leaves is always a sign of weakness or disease, and such plants should always be removed during the summer from fields from which seed is to be taken. Many kinds of Leaf Roll are hereditary, though not infectious, and the DECEMBER

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EDITOR THE FA This evening THE FARMER'S issue of Deceml had the same t and help anothe of your paper; s house, and whe look down the twice a month a that was the ma I got a hoe and long enough to scraped the insi which paid me the roots of the which attack th close, wishing yo many happy ret

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In many other cases we could use this method to splendid advantage if it were not that various diseases have a nasty habit of passing the winter in other ways, so that our precaution in this regard would be all in vain. Wheat rust is an example of such disease. Since the spores are liable to live over winter in the fields, and few that might be killed on the seed would make no material reduction in the next year's rust infection.

In the third class where diseases are carried over to the next generation by various other means used in propagation, we are chiefly concerned in potato troubles since the potato is almost the only field crop where a vegetative method of propagation is used. In greenhouse work, where cuttings are frequently employed, diseases may live over in the cuttings as in the carnation and chrysanthemum rusts. Nurserymen also take care to avoid certain diseases liable to be introduced into a new generation by buds or grafting. "Yellows" in the peach is the most important disease in this connection in Ontario.

Before taking up the question of potato diseases it may be noted that since the potato tuber in its anatomical relationships may be characterized as merely a short, fat stem, it retains all Average yield per acre for 20 years :

(1) from sprayed fields......268 bushels.

(2) from unsprayed fields...163 bushels.

Gain in bushels per acre, because of spraying 105. reckoned as a percentage basis, gain is 64 per cent.

The figures given are so clear and striking as to need no further comment, and we may, therefore, express the formula for Blight control as "clean seed plus spraving."

ORDINARY SCAB.—The Scab Fungus lives over in the scab spots on the potato and in the earth surrounding the tuber. It is also found

#### TABLE OF POTATO DISEASES.

Disease.	Part of plant affected.	Transmitted by
Early Blight	Leaves	Dead leaves and other hosts.
Bacterial Blight	Tops	Soil probably.
Late Blight (including Rot)	leaves and tubers	Seed.
Ordinary Scab	Tubers	Seed and Soil.
Powdery Scab	Tubers	Seed and Soil.
Silver Scurf	Tulers	Seed and Soil.
Canker	Tubers	Seed and Soil.
Blackleg	Tubers and stem	Seed and Soil.
Rhivoctonia	Tubers and stem	Seed and Soil.
Dry Rot and Wild	Tulers and tops	Seed and Soil.
Lenf Holl	Tops	Seed.
Curl- lewarf	Tops	Seed.
Spindling Sprout .	Tops	Seed.
Minare	Tors	Not known.
house have been a	Tulers	Not transmitted.
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disease, therefore, should be and can be controlled by the simple process of "rogueing" already mentioned.

CURLY DWARF.—The name very aptly describes this disease, which, like Leaf Koll, is hereditary but non-infectious. Rogueing the field in summer will be all that is necessary in dealing with it.

Beginning with the seed we may summarize the various operations that might be used to grow a clean crop of potatoes, either for seed or otherwise.

1. Pick over the seed, discarding tubers which show Dry Rot, purplish discolorations (these are likely to be dormant Late Blight), Scab and other suspicious features.

2. Soak the seed in corrosive sublimate, 1 b. in 200 gals. for three hours. Spread out to dry, and when dry cut up into sets. This treatment frees the tubers from Scab. Rhizoctonia, Dry Rot spores, etc.

3. In cutting sets first take a slice off the stem end. Wilt and Blackleg will show here as discolorations, and these diseases can be practically all eliminated at this stage of the work.

4. Plant in as clean a soil as possible, preferably on acid soil that has had no potatoes in it for several years; where possible use commercial fertilizers instead of barnyard manure.

5. Spray well three or four times with Bordeaux, beginning about the first of July. This will protect from Early and Late Blight.

6. "Rouge" the field during the summer at least once, and preferably twice. This is usually done in any case to eliminate plants of other varieties, and this work may be extended to include the removal of all cases of Leaf Roll, Curly Dwarf, Blackleg, Mosaic, and Spindling Sprout.

7. For formulas and detailed ins ructions regarding the sprays and chemicals to be used consult the bulletins of the Central Experimental Farm, Ottawa, and those of the Ontario Agricultural College, Guelph.

In conclusion I would point out that we in Ontario are as yet remarkably free from a great number of diseases of the potato that are serious

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