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THE EFFECT OF ROTATION ON YIELD AND DISEASE IN POTATOES

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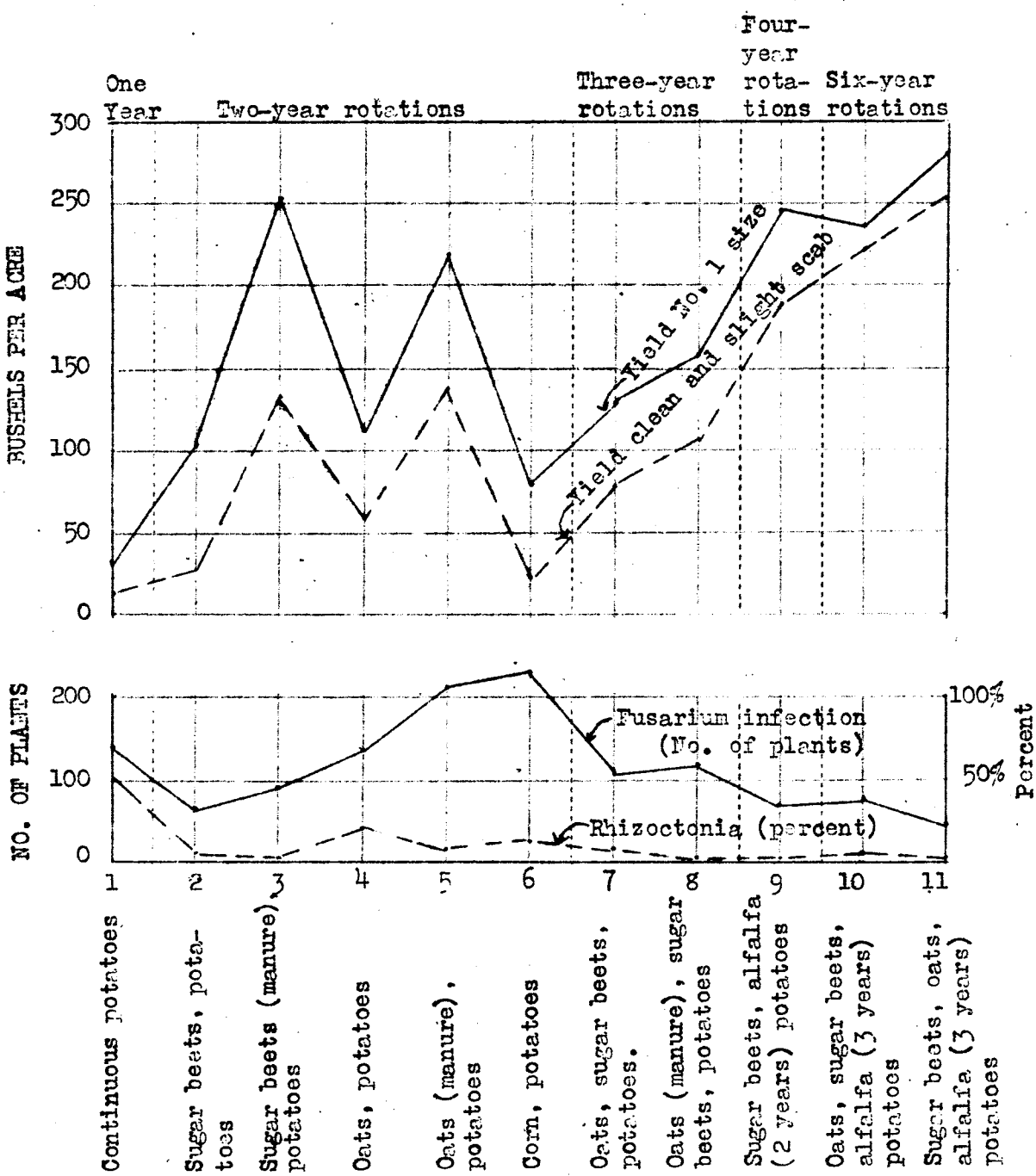
The work reviewed in this write-up was taken from the results of Goss and Afanasier on the rotation plots at the Scottsbluff, Nebraska, Experiment Farm. The plots were started in 1912, and these records were taken after 20 years of the rotations shown in the following table. The soil is well-drained, fine, sandy loam with an average pH of 7.5.

Rotation	Length of Rotation	Total yield No. 1 size	Yield of clean and slight scab	Yield of severe common and pitted scab	Rhizoctonia tuber infection	Average number of plants infected with fusarium
	Years	Bu. per acre	Bu. per acre	Bu. per acre	Percent	
1. Continuous potatoes	1	33.5	14.8	11.3	45	137
2. Sugar beets, potatoes	2	103.0	26.7	76.3	5	62
3. Sugar beets (manure), potatoes	2	253.4	134.0	119.6	3	90
4. Oats, potatoes	2	111.4	58.7	52.8	20	136
5. Oats, (manure), potatoes	2	219.0	137.8	81.5	7	203
6. Corn, potatoes	2	79.2	22.9	56.4	13	216
7. Oats, sugar beets, potatoes	3	126.6	77.0	49.8	9	107
8. Oats (manure), sugar beets, potatoes	3	158.6	106.3	52.3	1	114
9. Sugar beets, alfalfa (2 years), potatoes	4	245.7	190.0	55.8	0	60
10. Oats, sugar beets, alfalfa (3 years), potatoes	6	238.9	221.7	17.2	2	75
11. Sugar beets, oats, alfalfa (3 years), potatoes	6	279.2	257.4	21.7	0	49

In the graph the same information is shown graphically. The effect of manure (12 T. per acre) preceding potatoes in the 2-year rotations is apparent on yield. The yields with alfalfa are as high or higher, however, with many more marketable potatoes. (The difference between the solid line and the dotted line represents the yield of severe common and pitted scab.)

Length of rotation.—The effect of the longer rotations containing alfalfa was, in general, to increase total yield, increase the yield of marketable tubers, and decrease the amount of severe scab, fusarium infection, and rhizoctonia on the tubers. While manure increased the total yield in the shorter rotations, it actually increased the scab and fusarium infection.


One Year
Two-year rotations
Three-year rotations
Four-year rotations
Six-year rotations
BUSHELS PER ACRE
300
250
200
150
100
50
0
Yield No. 1 size
Yield clean and slight scab
NO. OF PLANTS
200
100
0
100%
50%
Percent
Fusarium infection (No. of plants)
Rhizoctonia (percent)
1
2
3
4
5
6
7
8
9
10
11
Continuous potatoes
Sugar beets, potatoes
Sugar beets (manure), potatoes
Oats, potatoes
Oats (manure), potatoes
Corn, potatoes
Oats, sugar beets, potatoes.
Oats (manure), sugar beets, potatoes
Sugar beets, alfalfa (2 years) potatoes
Oats, sugar beets, alfalfa (3 years) potatoes
Sugar beets, oats, alfalfa (3 years) potatoes

Effect of crops in the rotation.--The greatest proportion of scab and the most severe scab followed the sugar beets in the 2-year rotations. (The potato scab fungus also attacks and lives on sugar beets.) The 3-year rotations with oats, sugar beets, and potatoes produced more scab and a greater percentage of severe pit scab than did the 2-year rotation of sugar beets and potatoes. The effect of alfalfa preceding potatoes (4- and 6-year) has been to decrease scab. The use of corn and oats in the short rotations (Nos. 4, 5, and 6) considerably increased the amount of fusarium.

"Considering both yields and disease, the best rotations are those with alfalfa preceding potatoes and with 3- to 6-year intervals between potato crops."

Sources of Material:

Goss, R. W. and M. M. Afanasier. Nebr. Bul. 317. 1938.
Goss, R. W. American Potato Journal. 13:91-96. 1936.

FERTILIZER NEEDS OF THE POTATO

Walter C. Sparks

Potatoes, like most crops, will get a better start in spring if they have a plentiful supply of available nitrogen. Some of the things growers can do to insure a plentiful supply of nitrogen are:

1. Apply ammonium sulfate, sodium nitrate, or other nitrogen-bearing commercial fertilizer immediately before or at planting time.

2. Mix manure with the soil by disking or with a plow.

3. Turn under green manures as long as possible before planting the crop. It takes time for the green manures to decay and to produce a new supply of nitrogen. Farmers are often disappointed in green manures because they do not allow time for them to decay.

A lack of available nitrogen may be brought about by: (1) dry, hard soil during the fall after removing the crop; (2) a late, cold spring; and (3) spring plowing.

Soil in different sections of the State does not respond the same to fertilization; consequently no blanket recommendation which will cover the entire State can be given. However, recommendations have been drawn up for general areas on the basis of Experiment Station results and experience of growers. These recommendations follow.

In the San Luis Valley and Fruita districts of the Western Slope, a complete fertilizer with a high phosphate content is recommended. A 10-18-5 fertilizer, containing nitrogen, phosphorus, and potash, used at the rate of 150 to 250 pounds per acre has given good results in these sections.

On lighter, sandier soils of other potato-growing sections, an incomplete fertilizer has given good results. A fertilizer containing nitrogen and phosphate at the rate of 6 parts nitrogen to 30 parts phosphorus with no potash, or one having 10 parts nitrogen to 20 parts phosphorus, has given increases in yield.

In addition to knowing what to use, it is well to know why a certain element is necessary. The following table shows the parts that nitrogen, phosphorus and potassium play in the nutrition of the potato.

Element	Uses	Deficiency symptoms	Excess	Other remarks
Nitrogen (N)	A constituent of the protoplasm. Needed for the formation of proteins. Needed for foliage growth and good green color.	Light green vines. Small light green stems, long varieties more pointed. Decreases the number of stolons and tubers.	Causes tubers to be knobby, split, and growth crack. Delays or inhibits tuber formation.	Increasing nitrogen content delays maturity, increases tuber size, causes thin skin, and removes netting in Burbank.
Phosphorus (P)	A constituent of the neucleoproteins. Influences cell divisions essential for albumin and fat formation. Stimulates root development.	Foliage crinkly and dark green. In acute cases lower leaves become purplish. Plants stiffly erect. Leaves fail to expand to normal size. Rusty brown lesions in form of isolated flecks occurring internally.	Phosphates are rarely in excess in alkaline soils. Any excesses are tied up by the soil and are unavailable to the plants.	Increasing phosphorus results in better netting on Burbank, reduces turgidity and air checking of tubers, improves cooking quality and hastens maturity.
Potassium (K)	Stimulates starch formation. Essential for protein synthesis. A constituent of the chlorophyll molecule (green color in leaves).	Foliage darker green than normal. Leaf reduced in size. Internodes remain short. Plants have a humped-up droopy appearance. Foliage becomes crinkled, and veins appear shrunken. Later the older leaves become a trifle yellowish with a bronzing which develops from tips and margins and gradually involves entire plant.	Removes netting and gives smooth skin. Lowers yield.	In most sections of Colorado increasing the potassium has given no response and in certain areas has actually decreased yields when used alone. In a complete fertilizer it is beneficial.

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