EFFECT OF PLANT RESIDUES AND NITROGEN APPLICATIONS ON YIELD, SPECIFIC GRAVITY, RUSSET SCAB AND SILVER SCURF

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Potato scab, caused by *Streptomyces scabies* (Thaxt.) Waks. & Henrici and silver scurf, caused by *Helminthosporium atrovirens* (Harz) Mason & Hughes, are serious diseases in the Red River Valley area of North Dakota and Minnesota. The use of various rotations and the incorporation of green manure crops for the control of potato scab has been widely studied. Alfalfa and rye have been reported to reduce scab in some instances (3, 5, 11, 12) and to be relatively ineffective in others (4, 7, 8). Potato scab has been reported to be more severe following cultivated crops or summer-fallow than following small grain (2), possibly due to the incorporation of straw. Other crops, soybeans (6, 7, 10) and cowpeas (12) have reduced scab, while barley (6, 10), peas (6), blue grass (4) and clover (7, 11) have not been effective when used as green manure crops.

In Idaho (9) the source of nitrogen added to the soil was considered to be a factor in the severity of potato scab. A higher incidence of scab occurred when nitrate nitrogen was added instead of ammonium nitrogen with N-Serve, a material to prevent nitrification.

No reports of field studies on the effect of plant residues on silver scurf could be found. However, excessive nitrate fertilization has been reported to aggravate the disease (1).

MATERIALS AND METHODS

This study, carried out during a three year period 1955-1957, was concerned with the breakdown of certain crop residues and their effects on the development of potato scab and silver scurf, potato yields and quality.

Plots were located on soils of the Glyndon silt loam series at the Walsh County Agricultural School, Park River, North Dakota. A split plot design of four replicates was used with crop residues as the main plots and treatment levels as sub-plots. Each plot was 13 ft by 30 ft with four rows of potatoes in each. The fields had been summer-fallowed prior to planting and had had no legume in the rotation history.

Wheat straw, freshly cut green rye and freshly cut alfalfa were the residues used. The treatment plots within each crop residue consisted of a check, a basic rate of crop residue, double and triple the basic rate, nitrogen only, and double the basic rate plus nitrogen. The basic rate for wheat straw (from bales) was arbitrarily set at 1500 lb/acre, and the basic rate for green rye and alfalfa was determined by samples taken from a growing field. Sixty pounds per acre of nitrogen was applied broadcast as ammonium nitrate and disced in.

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Duplicate experiments were initiated in 1955 and 1956, and each was continued over a two year period. During the last week of May, in both years, the rye and alfalfa were mowed and raked in growing fields and then hauled to the plot area. Rye cut in 1955 was well headed and mature, and no doubt was much like the straw in composition. In 1956 rye was in the shot blade stage. Samples of the green rye and green alfalfa were air dried and the actual amount of air dry material applied per acre was determined. All residues were uniformly spread over plots at rates shown in Table 1, then incorporated by thorough rototilling. Red Pontiac potatoes were planted immediately afterward.

Yield data and specific gravity readings were taken on the harvested two middle rows of each plot. Forty U.S. No. 1 (size A) tubers were picked at random from each plot. Each individual tuber was examined and the amount of russet scab, raised scab, pitted scab, and silver scurf recorded (expressed as percentage of the total tuber surface).

The exact locations of the plots in each original experiment were retained and replanted to Red Pontiac potatoes the following year. However, each treatment plot was split and random halves of each received 60 lb/acre nitrogen as ammonium nitrate. The same records were taken as in the original plots.

**RESULTS AND DISCUSSION**

 Marketable yields for the three years are presented in Table 2. In 1955, yields were slightly increased by the addition of 2400 lb/acre of alfalfa. However, these increases were not apparent in plots treated similarly the following year on the adjoining field.

In 1956, the 1955 residue treatments were split, half being treated with 60 lb/acre of nitrogen, the other half receiving no fertilizer. The new plots where residues were applied in 1956 were treated in a similar way in 1957. There was no carry over effect on yield the following year from the various residues, with the exception of an apparent increase from alfalfa in 1956, though the yields in the check plots were unusually low in this group of treatments. There was a general increase in yield from 60 lb of nitrogen in 1956 from the plots established in the previous year. In similar plots in the adjoining field, yields were generally higher but there was no yield response to nitrogen in 1957.

The specific gravity of tubers is shown in Table 3. Though there were significant increases and decreases when compared with checks in particular treatments, these effects were not consistent in the comparable location and year. Neither plant residues nor nitrogen applications had an appreciable affect on the specific gravity of tubers.

**Scab Control:**

Over the 3-year period of this study data were collected on the percentage of tuber surface affected with raised scab (raised corky tissue on the surface), pitted scab (deep pits of varying size and shape), and russet scab (severe russeting or superficial cracking of the tuber skin). Most of scab found was of the russet type, making up 83 to 98% of the total scab found.

The percentage of surface area affected with russet scab is shown in Table 4. Alfalfa was the most consistently beneficial plant residue,