INCREASED TUBER YIELD OF PONTIAC POTATOES RESULTING FROM THE FOLIAR APPLICATION 2,4-D—MINERAL DUSTS

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INTRODUCTION

Growth and yield stimulatory effects of 2,4-dichlorophenoxyacetic acid (2,4-D), particularly in low concentrations, applied as a foliar dust or spray to relatively young plants, have been reported. Enhanced yield of sugar beets (11), cotton (1), pole and lima beans and bell peppers (14), beans (6, 7, 8, 16), and potatoes (17) have been obtained. A characteristic of most of the work involving the application of 2,4-D to potato plants is that the rates of application have been relatively high, e.g., 4 to 33.6 oz per acre. The use of these rates, applied at various stages of development of the potato plant, have given results which varied with the form of the herbicide, the rate of application, the variety of the potato, and the climatic conditions at and following treatment. As far as tuber production is concerned these rates of 2,4-D application have usually resulted in an unchanged yield (2, 5, 13) or lower tuber yields (3, 9, 10). Nelson and Nylund (9) used low concentrations of the herbicide on Red Pontiac potatoes but reported that rates below 4 oz per acre had little, if any, effect.

Ellis (1949) found that spraying potato plants with 2,4-D resulted in a higher set of tubers, but the results were not quite significant at the 5% level. The application of the herbicide at 4 oz per acre to Pontiac potato plants before or at tuber set increased the set of tubers by 16% and 12%, respectively, according to Nelson and Hylund (9). Over a three year period it was noted by these authors that the use of 2,4-D tended to increase the uniformity of size of the tubers at harvest. The total yield was decreased 9% when 2,4-D was applied at 4 oz per acre before tuber set. Rates below 4 oz had little effect on tuber size, but application at 8 oz per acre caused excessive reduction in yield. They conclude that as far as the production of potatoes of uniform size is concerned “the application of 2,4-D (4 oz per acre) is superior to early harvesting for maximum yields and specific gravity, while reducing the number of very large tubers”.

The inclusion of one or more plant micronutrients, Fe, Mn, B, Zn, Cu, etc., as salts or chelates, in dusts or sprays of 2,4-D has been found to lessen the toxic or deformative effect of higher concentrations of the hormone, or when used with low concentrations of 2,4-D to increase yield of wheat, buckwheat, sugar beets, beans, and potatoes (15, 16, 18), field beans (7, 8) and of barley and winter wheat (6). Sexsmith (12) reported that the yield responses of cereals grown in Alberta, Canada, were determined by the crop and stage of growth when treated. Significant increases, consistent increases that lacked significance, and unaltered yields were obtained. The foliar application of 2,4,5-trichlorophenoxyacetic acid in combination with nutrients has been found to increase the yield of tomatoes in Russia (19). The fruit was larger and sweeter, and contained less organic acid. Reviews of the subject have appeared recently (17, 18).

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Hormone-nutrient dusts are being used on potato plants in the United States, Canada, England, Scotland, Denmark and Sweden but very few studies of the effects of the foliar applied 2,4-D—mineral formulations have been reported in the literature. This paper describes the yield responses obtained when dusts containing 1% and 5% 2,4-D, alone and with minerals, were applied at 6 lb per acre, once and repeatedly, to uniform Pontiac potato plants during the first 34 days of growth. The effects of such foliar applications of dust on the storage properties, chemical composition and wound healing ability of tubers from field grown plants appear in a second paper.

Materials and Methods

Experiments 1 and 2

The effect of dust preparations containing minerals only, and 1% 2,4-D with minerals, on the tuber yield of Pontiac potatoes growing in plots of sandy loam and of heavy clay loam, at or near the University of British Columbia was investigated in Experiments 1 and 2.

Individual eye pieces of Pontiac potatoes, obtained from a commercial source, were planted in composted soil in pots made of sphagnum peat. After a growth of 23 days in the greenhouse, uniform plants were selected for treatment. Dusting was started at 11 a.m. on April 25. The air temperature was 71°F and the light intensity 7,500 foot-candles. Dust formulations at 6 lb per acre were applied to the 23-day-old plants after placing the pots of plants in a plywood box having a removable cover. Care was taken that the leaves of one plant did not overlap those of another plant. After replacement of the lid, dust equivalent to 6 lb per acre was blown into the box through small holes located in the sides near the top of the box. The even distribution of the dust by this method had been checked previously. The plants remained in the box for five minutes after dusting. The pots of potato plants were then removed to the greenhouse. One day after application of the dusts the plants were transplanted in the field by placing the peat pot, with its undisturbed plant, in the soil.

In Experiment 1 the 32 potato plants which had received a given treatment were planted in eight groups of four, randomly located in a sandy loam plot. The plants were spaced at two-foot intervals in rows two feet apart. The 36 plants per treatment in Experiment 2 were similarly planted in six groups of six plants in a plot of heavy clay loam.

Experiment 3

Experiment 3 was designed to discover the effect of 1% and 5% levels of 2,4-D in clay dusts containing 2,4-D alone, or the hormone with minerals, and of a dust containing only minerals, and repetition of the treatments.

The eye pieces of Pontiac potatoes were grown in peat pots in the greenhouse for three weeks. Plants carefully selected for uniformity, were then transplanted to a field of sandy loam soil by placing the peat pots in the soil. The plants were spaced 18 in. apart in rows two feet apart. Four schedules of dusting were begun on June 11, two days after transplanting to the field. At this time the plants were 23 days old and about seven inches tall. The schedule involved the application of dusts on June 11, 17,