Cultivar differences in the expression of potato leaf spotting disorder in Maine

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Summary

Ten potato cultivars were rated for a leaf spotting disorder at three locations in Maine in each of two years; there were consistent differences between cultivars and between locations. Cultivar Seminole had no symptoms but cultivar Plymouth had severe symptoms in both years. A comparison of preliminary data of soil analyses and leaf spotting scores for the three locations showed that higher levels of the disorder were associated with higher levels of phosphorus and lower levels of aluminum and iron. The effects of nitrogen and other elements on leaf spotting could not be discounted.

Introduction

Several factors have been implicated in the potato disorders variously named 'speckle leaf' (Hoyman, 1973; Vitosh & Chase, 1973), 'potato fleck' (McKeen et al., 1973), or 'potato speckle-bottom (PSB) disease' (Cipar et al., 1974). They include: air pollutants (DeVos et al., 1982; Heggestad, 1973; Johnston, 1972), nitrogen availability (Vitosh & Chase, 1973), zinc deficiency (Cipar et al., 1974), systemic insecticides (Hoyman, 1973), irrigation practices (Vitosh & Chase, 1973), soil acidity and manganese toxicity (McKeen et al., 1973), and soil fumigation (Cipar et al., 1974). McKeen et al. (1973) state that 'the potato fleck symptoms...may well be the "speckle leaf" disorder attributed to air pollution.... At the same time, nutrition and soil acidity may play a role in both conditions'. The similarity of this 'disease' to normal senescence has also been noted by Vitosh & Chase (1973) who showed that the severity of the symptoms varied from year to year. The symptoms have been observed in many potato producing areas (Vitosh & Chase, 1973; McKeen et al., 1973; Heggestad, 1973; Cipar, 1977; Cipar et al., 1974; Mosley et al., 1978; Hoyman, 1973) but have not yet been reported in Maine.

Some of the confusion over the symptoms and their causes may be because two different disorders may occur in the same field at the same time. Hooker et al. (1973), in a paper discussing air pollution injury, reported an additional 'unrelated potato

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leaf spotting'. They make a clear distinction between the symptoms as well as the causes of the two disorders.

Histologically, leaf spotting develops first in the spongy mesophyll and therefore is first seen macroscopically on the underside of the leaf; whereas the speckle leaf caused by air pollution develops first in the palisade mesophyll and is first seen on the upper leaf surface (Hooker et al., 1973). Furthermore, leaf spotting always appears first on the lower leaves, whereas air pollution injury usually appears first in the plant crown. Although the cause of leaf spotting is uncertain, a clear distinction between these disorders should be made and should help to elucidate their causes. From our studies of the literature, we have concluded that the speckle leaf is probably caused by air pollution whereas potato speckle-bottom disease (leaf spotting) is caused by some other factor, probably in the soil. The potato fleck disorder is probably the air pollution problem, although it is not always clear which disorder an author is dealing with. Although many recent papers have dealt with air pollution and the speckle leaf disorder, few have dealt with the leaf spotting that first develops on the underside of the leaf and on the lower leaves. The disorder dealt with in this report is the latter and we have therefore used the term leaf spotting.

In 1978 leaf spotting was seen among a collection of over one hundred potato cultivars grown at the Maine Agricultural Experiment Station, Aroostook Farm, Presque Isle, Maine. There were major differences among cultivars in their susceptibility and in this communication we report the results of preliminary experiments designed (i) to see if the differences were consistent from year to year and (ii) to relate soil elemental analyses to the disorder.

Materials and methods

Ten cultivars were selected from those observed in 1978 to have high, intermediate or low levels of resistance to leaf spotting. The experimental design was a randomized complete block with four replications and it was repeated at three locations c 400 m apart that had all been planted in 1977 with oats under-seeded with Timothy grass. The oats were harvested in 1977 and the grass in 1978. The experiment was planted at each site in 1979 and again in 1980. Location 1 was north of a stand of trees on a slight rise and bordered on the north by commercial potatoes; location 2 was isolated in a 1.6-ha field surrounded by woods; location 3 was east of a wooded creek and bordered on the east by a field of experimental potatoes.

A commercial fertilizer (14N:14P:14K) was applied at planting according to local practice. Location 1 received 54.5 kg N per ha; locations 2 and 3 received 49.9 kg N in 1979 and 52.2 kg in 1980. At all locations, aldicarb (Temik 15G, Union Carbide Co. Inc., 15 % a.i.) was applied at 0.7 kg a.i. per ha and mancozeb (Dithane M45, Shell Chemical Co., 80 % a.i.) at 1.7 kg a.i., in 1200 l water per ha at weekly intervals throughout the season to control late blight. Irrigation was not used in either year.

Soil sample for elemental analyses, one per replication (block), were taken 2 weeks after planting and then 30 and 60 days thereafter from the centre of the row between plots at a depth of 10 cm. The analyses were made by the Soil Test Laboratory of the Department of Plant and Soil Sciences, University of Maine, Orono.

At the last soil sampling date, the four plants in each plot were scored for leaf spotting on a scale: 0 = no spots; 1 = a few spots at the base of a plant; 2 = spotting on the lower half of plant; 3 = extensive spotting on the lower parts of plant with

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