THE INFLUENCE OF SEED TREATMENTS ON THE DEVELOPMENT OF SEEDLING BLIGHT OF OATS[1]

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Abstract

Several seed treatment materials were tested against seedling blight of oats caused by Pyrenophora avenae. Those containing organic mercury were effective in controlling visible symptoms of the disease and increasing emergence. Chemical treatment resulted in a variable increase in emergence and this increase did not appear to be associated with the control of seedling blight but rather with protection from other soil organisms. Seedling blight development appeared to be influenced considerably by environmental conditions, being particularly favored by cool soil temperatures.

Introduction

Seedling blight of oats caused by the fungus Pyrenophora avenae Ito & Kurib. (Imperfect state: Drechslera avenacsa (Curtis ex Cke.) Shoemaker = Helminthosporium avenae Eidam), has been common in Canada. Survey reports (6) indicate that the disease was present in some part of Canada every year for the past 30 years and was occasionally severe in both eastern and western Canada but usually not in the same season.

This disease' is considered to be of minor importance in most oat growing areas. However, it has caused considerable damage particularly in the winter crop area of the southern United States (1, 2, 3, 4, 5). The primary or seedling stage of the disease has been fairly common in most parts of eastern Canada in the past few years. In 1960, the secondary, or leaf blotch, stage was quite prevalent and undoubtedly caused considerable damage to the crop, although the earlier, or primary, stage was not unduly heavy. Because of the increased prevalence of this disease, it was felt that more should be known of its development and control under conditions in eastern Canada, There are no commonly grown varieties that are resistant (3, 4). A limited number of seed treatments have been effective in other oat growing areas (3, 4) but little is known about these and other chemicals in this area. This report summarizes the results obtained when oats treated with several chemical seed treatments were grown at Ottawa at different dates of seeding throughout the growing season.

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Materials and Methods

In 1959 an Ottawa strain of oats (5055-13) was found to have approximately a 25 per cent infection of seedling blight present in the field shortly after emergence. When the seed from this crop was plated on potato-dextrose-agar, an average infestation of *P. avenae* of 20 per cent was noted, This was a good source of naturally-infected seed and, in the spring of 1960, samples from it were treated with various seed dressings. Sixteen chemicals were included in the tests with each treatment consisting of a one-pound sample of seed, The chemicals were applied at concentrations recommended by the manufacturers (Table I). A small home-made treater with a tumbling action was used to apply the seed dressings uniformly, It worked equally well with dusts or liquids. Each seed sample was treated in a 1-litre stoppered Erlenmeyer flask and then kept in the same flask at room temperature until used.

In 1960 four replicates of 4-row plots with each row containing 100 seeds were planted for each treatment. A plot of untreated seed was included in each replicate. All treatments were planted in two different types of soil and the seeding was done on May 28. The same treated seed was used in additional tests in 1961 and in this case each row of 100 seeds was considered as a replicate with a total of four being used. Nine different dates of seeding were planted with all 16 seed treatments with a control included each time. The control consisted of 4 plots of 4 rows each of untreated seed placed at predetermined positions among the various treatments. The seed treatments were then randomized within each date of seeding. The first date of seeding was planted on April 24 and the next five at 10-day intervals and the last three at three-week intervals.

Emergence counts and disease notes were recorded approximately one month after planting. In most cases the disease notes were obtained by pulling the plants and examining the seedlings individually, This was necessary to insure proper identification of the disease and the extent to which it was present.

Results and Discussion

In the 1960 tests less than one per cent of the seedlings in the control plots showed disease symptoms typical of seedling blight. It was therefore impossible to evaluate the various seed treatments for disease control nor was there any evidence of a different amount of disease in the two soil types used, a sandy loam and a clay loam. The weather in 1960, when the planting was done and until the notes were taken, was quite warm. It was thought that this may have been the reason for the very low percentage of seedling blight present in the control plots.

Table 1. The effects of various seed treatments on the emergence of oats and the indicence of seedling blight.

Seed Treatment	Active Ingredient	Concentration oz/bu	Emergence[1] Percent	Seedling blight[2] Percent
Puraseed	6.35% phenyl amino cadmium lactate plus 6.35% phenyl mercury formamide	0.5	88.4*	0
Liquisan	2.25% methyl mercury 8-hydroxyquinolinate	0.75	88.1	0
Ceresan M	7.7% ethyl mercury-p-toluene sulfonanilide	0.5	87.4	0
Agrosol	1.8% methyl mercury nitrile	0.75	87.2	0
Gallotox	6.5% phenyl mercury acetate	0.75	87.2	0
Canuck organic mercury	7.06% phenyl mercury acetate and 1.06% ethyl mercury chloride	0.5	87.0	0
Panogen 15	2.2% methyl mercury dicyandiamide	0.75	86.7	0
Orthocide Dieldrin 60-15	60% N-(trichloromethylthio)-4-cyclohexene-1, 2-dicarboximide and 12.75% hexachloro-epoxy-octahydro-endo-exo-dimethanonaphthalene	1.25	86.3	6.9
Ceresan 100	3.10% ethyl mercury, 2,3 dihydroxy propyl mercaptide and 0.67% ethyl mercury acetate	0.75	86.1	0
Dexon	70% p-dimethylaminobenzenediazo sodium sulphonate	0.5	86.1	4.9
Agrox C.	7.0% phenyl mercury acetate and 1.06% ethyl mercury chloride	0.5	84.6	0
Half-ounce Leytosan	8.1% phenyl mercury urea	0.5	84.2	0
Puradrin	40% hexachloro-hexahydro-endo-exo-dimethanonaphthalene and 3% phenyl mercury formamide plus 3.45% phenyl amino cadmium lactate	1.25	83.7	0
Meragamma C.	40% gamma isomer of benzene hexachloride, 2.86% phenyl mercury acetate and 0.47% ethyl mercury chloride	1.25	82.8	0
Pandrinox	0.75% methyl mercury dicyandiamide and 34% Tech. heptachlor	1.25	82.1	0
Bunt-no-more	40% hexachlorobenzene	0.5	79.4	5.2
Control			77.8	

1. Average of 9 dates of seeding
2. Average of 7 dates of seeding

* L.S.D. 3.92 - 1% level

Table 2. The influence of seeding date and seed treatments on the emergence of oats and development of seedling blight.

Date of	Percent emergence		Percent seedling blight	
Apr. 24	87.0	76.2	7.4	10.5
May 25	86,0	73.9	9.9	10.9
June 6	78.1	71.1	3.4	6.7
June 15	88.1	82.3	2.6	4.4
July 6	79.6	73.4	0.8	0.6
July 27	85.4	79.3	0	0
Aug. 17	88.5	84.4	0	0

The same treated seed was planted in the 1961 tests, The incidence of seedling blight was higher in 1961 (Table 1) with an average of 7.4 per cent in the control plots and it was as high as 10.9 per cent in one date of seeding, May Z5, (Table 2). Good control of visible symptoms was obtained with the majority of the seed treatments. Only three compounds did not control, seedling blight and these did not contain mercury (Table 1). Previous work (3, 4) has shown that Ceresan M controls seedling blight of oats effectively in the southern United States. From the results of the present tests it would appear that any seed dressing containing organic mercury is quite effective against this disease, including Ceresan M and liquids as well as dusts.

Emergence counts of the oats were also recorded in 1961. All treatments were superior to the control in emergence and the majority were significantly better in this regard. Ten of the chemicals were equally effective in promoting seedling emergence, Included were Orthocide Dieldrin 60-15 and'Dexon, two of the chemicals that did not control seedling blight. The results suggest that all the chemicals tested were providing protection against soil organisms; that some were superior to others; and that this imprqvement in emergence was not because of the control of seedling blight, Even with the best treatment approximately 10 per cent of plants failed to emerge. This may have been due to seedling blight since the seed showed a 20 per cent infestation when plated on agar and approximately 10 per cent when planted in the fie'ld. However, the mercury compounds did eliminate all above-ground lesions (Table 1) and this would help to greatly reduce the inoculurn potential for the development of the secondary phase of the disease. Four combination fungicide-insecticides were included in the tests and the three that contained mercury gave relatively poor emergence totals. The same treated seed was used in both years as these tests were carried out to study the seasonal development of seedling blight as well as to obtain information on its control. Because of the extended storage of the seed and the volatile action of the mercury compounds which may have biased the performance of these chemicals, these data cannot be used as a recommendation to oat growers, However, they do show that oat seed can be treated and then stored for 15 months without lowering the subsequent emergence.

In 1961 seedling blight developed over an extended period (Table 2). The maximum amount developed from the seed that was planted on May 25 although the three earlier plantings produced appraximately the same amount.. After May 25 the amount of seedling blight dropped rather quickly and very little was found on the plants that had been seeded on July 6 or those planted on July 27 and August 17. The lowest average emergence was obtained with the seed planted on June 6 but emergence was also quite low from seed planted on July 6 and May 25. It would appear that the presence of seedling blight did not influence the emergence counts to any extent since a high disease rate did not necessarily correspond with low emergence. The same pattern of seedling blight development and emergence was evident with both the treated seed and the controls,

Weather data for the spring and summers of 1960 and 1961 were obtained from the Agrometeorology Section, Plant Research Institute, Ottawa. In late May and early June of 1960 the weather was quite warm. The average daily soil temperature just below the surface of the soil reached 70° F in late May and stayed more or less high during the rest of the summer. In 1961, a soil temperature of 70° was not reached until early in July although it was fairly high during the latter part of June, It would appear from the data that fairly low soil temperatures are necessary for the development of seedling blight. The greatest amount of seedling blight developed on the plants that were seeded on May 25 (Table 2) and the weather records showed that the soil temperatures following this planting ware quite low due to an unusually late snowfall.

Rainfall did not appear to be as closely associated with seedling blight development as was temperature. Conditions were dry in late April and in the early part of May 1960 but there was a heavy rainfall (1. 5 inches) at the end of May, just after the seed was planted, with several others during June. Rainfall was about the same during the spring and summer of 1961 except that no very heavy rain occurred at any one time, Total rainfall in May and June of 1960 amounted to 6. 50 inches with precipitation occurring on 24 days.

Ivanoff and Blount (4) have reported that in the southern United States the primary infection of seedling blight is favored by temperatures of from 75 to 82° F and a very high relative humidity with some excess moisture. The results of the present studies indicate that low soil temperatures favor seedling blight development and that temperatures exceeding 70° F greatly limit disease developm'ent. High levels of moisture would not appear to be necessary for disease development in the field.

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