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LEAF REDDENING IN OATS IN OREGON^{1/}

by

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The brilliant red coloration that occurs in the leaves of both fall-sown and spring oats in western Oregon is due to many factors. It is not necessarily a symptom of some specific disease but is often an indication of some abnormality or abnormalities in the life of the oat plant. The color itself is due to a plant pigment called anthocyanin. Under acid conditions this pigment is reddish but changes to a blue tone when the reaction becomes less acid. In red leaf the normal green of the leaf is replaced to some extent by this bright red or sometimes maroon coloration, which is very conspicuous in fields of winter oats during February to April in the Willamette Valley. In the coast region, red leaf is very often conspicuous in oat fields in fall-, winter-, and spring-sown oats. The malady is common also in some places in Sherman and Wasco Counties east of the Cascades in spring-sown oats.

The causes of leaf reddening in oats are many, but the following account for most of the cases in Oregon:

1. Heavy rains in winter or rarely in spring plus partial root drowning (oxygen decreased, carbon dioxide in water increased) accompanied by an excessive leaching of nitrogen.
2. High soil acidity-particularly in winter.
3. Low temperature injury to the green pigment-producing bodies (chloroplasts) in the leaves. Red pigment is favored by cold weather. Red leaf is very common on the non-winter-hardy red oats group, which include such varieties as Red Rustproof, Red Algerian, Kanota, and "Red Indian" (Red Rustproof type) seeded in the fall or late winter in western Oregon.
4. An excessive top growth induced by a long growing season in winter (1933-34) coupled with poor root systems growing in wet, colder soil.

^{1/} Cooperative investigations by the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture, and the Department of Botany, Oregon Agricultural Experiment Station, Corvallis, Oregon.

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5. Soil-borne root rots and foot rots. The most common and serious of these is the fusarium root rot (Fusarium culmorum) which attacks oats in all stages of growth from winter until harvest. The roots are rotted and appear brown and stunted. The base of the stem is decayed and brown, while red to purple stains or pinkish scurf occur on the leaf sheaths and decayed parts at the soil line. Sometimes small plants are killed but often the plant reaches normal size and the only injury is in reduction in the size of the grain from the injured plant. Plants affected with root rot have few to many red leaves. Red leaf is a fairly accurate means of detecting fusarium root rot in spring oats in Sherman and Wasco Counties adjacent to the Columbia Gorge area, and also, in a rather high percentage of instances, in the Willamette Valley after the month of April. In the latter area, however, red leaf is not specifically confined to any factor in late winter, as there are too many factors involved.

6. A disease known as red leather-leaf, which is caused by a leaf spotting fungus (Pseudodiscosia avenae Sprague and Johnson) is very abundant in the Willamette Valley during late winter and early spring. The leaves do not show any well defined spots but are scalded to an intense red color. They dry to a semi-leathery appearance with the tips and sometimes the whole leaf becoming brown. This scald is very common in the vicinity of Corvallis in February and March of most years. Some fields of spring oats, fall seeded for coverage, are strikingly pigmented and have been subjects for color photography. The principal cause in these cases was this obscure fungus parasite, which has never been reported outside of western Oregon, western Washington, and Klickitat County, Washington. While the fungus is actively parasitic during the rainy open weather of late winter and early spring it is checked by the dry weather that follows. A few sunny days in April usually stops it and permits the oats to make rapid recovery. However, it does inhibit the growth of winter oats, particularly those of the red oat group.

7. Minor leaf spots such as the leaf blotch (Septoria tritici avenae) or red eye spot (Helminthosporium avenae) or even the presence of rusts (Puccinia spp.) will induce red leaf in oats at times as will also powdery mildew (Erysiphe graminis avenae) to a slight degree.

8. Also insects may sometimes cause leaves to redden, particularly root boring kinds or even aphids.

Control

1. Seed treatment will not in general control red leaf but all oat seed grain should be treated with New Improved Ceresan 1/2 oz. per bushel to aid in giving the grain a good start against soil organisms, which, at times, add to the red-leaf symptoms.

2. In the fall or late winter, sow Support oats, or, if not available, the standard winter variety Gray Winter (Winter Turf). Support appears to be more tolerant to the high acidity of the soil in wet winter weather than other varieties. Avoid seeding oats on ground that will be under water later in the winter, as red leaf prevails under these conditions.

3. In the spring, sow Victory oats in the Willamette Valley. On cold bottom lands, Eclipse is less subject to root rots and red leaf symptoms. In the coast region, Schoolman (a strain of Green Russian) is a rust resistant variety

that is recommended. While it yields well in grain, the straw is shorter than is desired for hay. Trials conducted during the past eight years indicate that certain oats such as Minrus, Rusota, or Rainbow (the last two selections from the Green Russian oat) out-yield recommended varieties for hay and are better adapted to resist root rots and red leaf conditions. However, these varieties have not been tested to any extent by growers. Their behavior in experimental trials is indicative that they warrant wider testing.

4. For the proper oats to grow in eastern Oregon where red leaf is a factor, consult your nearest experiment station. Trials over long periods of time at Moro show some difference in resistance to root rots in the plots there.

5. In crop rotation, oats show less red leaf when they follow legumes particularly in the red soils of western Oregon. Soils deficient in phosphorous and nitrogen favor red leaf. Barley appears to be less desirable than wheat to precede oats but both are susceptible to fusarium root rot. Rotations should space cereal crops adequately where red leaf is common.

6. Experimental trials with powdered calcium cyanamid applied 100 pounds per acre in early spring reduced red leaf to an appreciable extent. This product costs approximately two cents per pound. No commercial tests have been made, however, in connection with red leaf.
