ASSESSMENT OF YIELD LOSSES FROM BARLEY YELLOW DWARF IN OATS[1]

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Yellow dwarf or red leaf of oats (*Avena sativa* L.) is caused by the aphid-transmitted barley yellow dwarf virus (BYDV) that also infects wheat, barley, and some grasses. The disease is common in Manitoba (2,3) but, with one exception (1), yield losses from the disease have not been estimated. One reason for this has been the lack of a method of estimating losses based on experimental data obtained under natural conditions in the field. In 1969 a severe epidemic of yellow dwarf in the Winnipeg area provided an opportunity to obtain data on the comparative yields of symptomless, apparently healthy plants, and of naturally infected plants showing symptoms of the disease; from these data a disease loss formula was developed.

Methods

Heavy, natural infections of BYDV appeared in stands of the oat cultivars Kelsey and Eagle planted for other purposes near Winnipeg. The oats were planted June 5th and symptoms of virus infection were evident by July 10th. Twenty-five stakes were placed at random in a 1-acre stand of each cultivar on August 5th, when the plants were in the soft dough stage of growth. The area around each stake constituted one replicate. In each plot, 10 main tillers each of healthy (no apparent symptoms), lightly infected (slight streaking on flag leaf), and moderately infected (definite reddening of flag leaf) plants were tagged. Severely infected, stunted plants were not considered because they produce no seed. The tagged panicles were harvested on Sept. 12th and threshed carefully. Germination tests were done in greenhouse soil beds with 50 seeds per replicate of each cultivar. All data presented are the means of 25 replicates.

Results and discussion

BYDV infection reduced yields from plants of both cultivars that had moderate infections and also from plants of 'Eagle' with light infections (Table 1). In 'Kelsey' the reduction appeared to be attributable mainly to reduced seed set, whereas in 'Eagle' seed set and weight were both reduced. Seed germination of both cultivars was also significantly affected by virus infection. Kelsey, which is grown on about 10% of the oat acreage in Manitoba, appears to have some tolerance to yellow dwarf.

These data could be used to estimate yield losses from BYDV in field surveys of oats by multiplying the percentage of lightly, moderately, and severely infected plants in each field by the average percentage yield reduction for each class (Table 1), e.g. light = 27.5%: moderate = 66%; severe = 100%, or for practical purposes 30, 65, and 100%, respectively. The loss in bu/acre for an area in which the average yield is known would be the difference between the potential average yield without disease and the average yield. The potential yield would be calculated by dividing the

Table 1. Effect of barley yellow dwarf on yield, seed set, seed weight, and germination in two oat cultivars

Cultivar and disease class	Yield (g/plot)	Seed set (no./tiller)	Seed weight (mg/seed)	Germination (%/plot)
Kelsey				
healthy	12.1	48.0	25.3	96.3
light	10.7 (12)†	42.1* (12)	25.3 (0)	96.3
moderate	4.5* (63)	19.5* (59)	23.2 (8)	89.6*
Eagle				
healthy	16.3	65.3	24.9	91.3
light	9.2* (43)	43.1* (44)	21.4 (14)	84.8*
moderate	5.0* (69)	25.2* (61)	20.0 (20)	79.3*

* Significantly different from the healthy (P = 0.01).
† Figures in brackets indicate % reduction from the healthy.

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average yield by 100 minus the average % loss in all fields. The accuracy of such a figure would depend on whether the number of fields surveyed was large enough to reflect the distribution of varieties differing in susceptibility, on the variable incidence of disease, and on the occurrence of late and early sown crops.

Literature cited

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