

THE EXPERIMENTAL APPROACH IN ASSESSING DISEASE LOSSES IN CEREALS: BARLEY YELLOW DWARF

C. C. Gill¹

The barley yellow dwarf virus (BYDV) causes diseases of wheat, oats, barley, and other members of the Gramineae. The virus is transmitted by several species of aphids that infest cereal crops.

Until recently, little was known about the reaction of varieties of wheat, oats, and barley grown on the Canadian prairies to BYDV, and no attempts had been made to assess losses from the disease in this area.

It was decided, therefore, to test the susceptibility of some of the more important varieties of cereals to this virus by controlled inoculations of plants grown in the greenhouse and in the field. Viruliferous aphids were placed on seedlings, allowed to feed for a few days, and then killed with insecticide. The yield from inoculated plants was then compared with the yield from uninoculated plants. This method allows one to:

Study symptom expression as an aid to diagnosis in the field:

Determine varietal reactions to the virus:

Make reasonable estimates of losses in the field from natural epidemics.

Results

Oats

All the more widely grown varieties that have been tested are very susceptible. The typical "red leaf" symptoms caused by the disease were clearly visible on these varieties. Yield losses from two separate trials are shown in Table 1.

In 1965 there was a high incidence of barley yellow dwarf in a 900 square mile area east of Riding Mountain in Manitoba. A survey indicated that losses to oats in this area amounted to 2¼ million bushels.

Wheat

Preliminary trials with nine varieties of common wheat and four varieties of durum wheat were made in the greenhouse. Despite mild symptom expression, losses in yield were heavy in all varieties (Table 2).

¹ Research Station, Canada Department of Agriculture, Winnipeg, Manitoba.

Table 1. Losses in oats from barley yellow dwarf

Variety	Yield loss (%)	
	Trial 1	Trial 2
Fulghum**	15	
Albion	52	
Albion x Clintland	62	
Coast Black		71
California Red	76	89
Rodney"	83	95
Russell*	85	91
Victory*	85	92
Clintland***	87	90
Garry*	95	96

* Varieties grown on the Canadian prairies.

** A variety with known tolerance.

*** A widely grown American variety regarded as very susceptible.

In 1966 a block of 'Manitou' wheat was sown at Glenlea, near Winnipeg. Eight-foot rows were inoculated with BYDV and yields were compared with those from similar but uninoculated rows. Losses of 64% and 40%, respectively, occurred when plots were inoculated 20 and 30 days after seeding. Symptom expression was slight, however, and it will be difficult to make accurate disease ratings in the field on this and other wheat varieties.

Barley

A block each of 'Parkland' and 'Conquest' barley was grown at Portage la Prairie in 1965, and eight-foot rows were inoculated at the 3-leaf stage. Yield losses were 80% in 'Parkland' and 67% in 'Conquest'. Yellowing of the leaves and stunting of the plants were obvious, but leaf symptoms may be easily confused with those from infection with aster yellows virus.

Table 2. Losses in varieties* of common and durum wheats from barley yellow dwarf

	Variety	Yield loss (%)
Common wheat	Thatcher	63
	Pembina	71
	Canthatch	73
	Selkirk	76
	Manitou	80
	Chinook	81
	Park	85
	Cypress	85
Durum wheat	Rescue	88
	Stewart 63	79
	Lakota	89
	Pelissier	95
	Ramsey	99

* All varieties except 'Lakota' are grown on the Canadian prairies.

DISCUSSION OF THE PAPER BY C. C. GILL

W. E. Sackston: An apparent correlation was mentioned between the susceptibility in barley to aster yellows infection and root rot. This is an interesting observation. Dr. Putt and I found a somewhat similar relationship between two diseases of sunflowers. We relied upon natural infections of sunflowers with aster yellows virus to determine varietal reactions. Then it was found that aster yellows susceptibility could be determined by checking the susceptibility of varieties to Verticillium, another root-infecting pathogen.

J. A. Hoes: I believe there has been a prior report that cereals infected with virus are more susceptible to root rots.

M. L. Kaufman: Some of the data would indicate a disparity between 'Thatcher' and 'Canthatch' wheats in their reaction to virus disease. Since 'Canthatch' was derived by a backcrossing program to 'Thatcher', one would expect smaller differences between these two than between either one of them and other varieties.

C. C. Gill: The varietal comparisons were made in the greenhouse in preliminary trials, and further work is necessary. Different figures have been obtained in the field. For example, in 'Manitou' wheat we recorded losses of 64% in the field and 80% in the greenhouse.

D. S. McBean: The suggested correlation between root rot and virus susceptibility in wheat is not strengthened by some of the data. 'Manitou' and 'Chinook', which are resistant and susceptible, respectively, to common root rot, showed similar losses from barley yellow dwarf. Are there other data for the correlation?

T. G. Atkinson: I noted that 'Thatcher', which is fairly resistant to root rot, incurred the least loss from BYD. The three sawfly-resistant wheats, which are all fairly susceptible to root rot, had high loss figures for BYD.