

## EFFECTS OF SOME CULTURAL PRACTICES ON ROOT ROT OF BARLEY IN CENTRAL ALBERTA

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### Abstract

In field plot experiments in naturally infested soil, root rot of barley was more severe on the varieties 'Olli' and 'Gateway' than on 'Galt' or 'Conquest'. When sown 4 inches deep 'Olli' had more root rot than when sown 2 inches deep. The addition of fertilizers containing nitrogen and phosphorus resulted in less root rot than on nonfertilized land. Urea added before seeding to both stubble and fallowed land reduced root rot, but ammonium nitrate increased root rot ratings. *Bipolaris sorokiniana* (*Helminthosporium sativum*) was isolated from the subcrown internodes of 40% of the plants tested from all treatments. *Fusarium* spp. from 20%.

In 1967 some observations on the incidence of root rot of barley (*Hordeum vulgare* L.) grown under various cultural practices were made at Lacombe, Alberta (3). These observations were continued in 1968 and 1969, and the amount of root rot was also determined in several additional experiments on these plots. Root rot was examined in relation to varietal reaction, seeding depth, fungicide treatment of the seed, the presence of ground barley in the seed bed, and date of seeding. The effect of various nitrogen containing compounds on root rot development was also tested in 1969.

### Methods

The area chosen for these trials has been under cultivation since 1911. Seed was sown 2 or 4 inches deep in rod rows and each treatment was replicated four times on both stubble and fallow land. Approximately 70 to 100 plants were examined for root rot in each treatment on each of the following dates: 2 July, 14 July, 14 August, and 4 September 1968. The data presented here were recorded on 4 September. The data obtained at the other dates was of the same relative order as that obtained in September, although there was less disease. The degree of root rot was indicated by the amount of tissue disintegration and discoloration on the subcrown internode at the soft dough stage. A rating of 5 indicated the maximum amount of root rot found, whereas a trace amount of infection was rated 1. The rating indicated the average value obtained by examining 70-100 subcrown internodes from each treatment. All the 'Olli' and 'Gateway' plants examined had root rot.

Fertilizer, when used, was applied to stubble at the rate of 50 lb/acre of 11-48-0 (monammonium phosphate) and 150 lb/acre of 33-0-0 (ammonium nitrate); and to fallow at 50 lb/acre of 11-48-0.

The treatments were sown on 3 June 1968 on land that had been fallowed or in barley in 1967, except one experiment, which was sown on 12 June.

Varietal reaction to root rot was rated on 'Gateway', 'Olli', 'Conquest' and 'Galt' barley. Ratings were also made on 'Gateway' plants grown from seed that had been treated with 2 oz/bushel of the fungicide Bay 33172 (50% 2-[2-furyl]-benzimidazole) supplied by Chemagro Co., Toronto, Ontario; on 'Olli' sown with 200 g of ground barley seed mixed with the seed; on 'Olli' sown 4- and 2 inches deep; and on late-sown 'Gateway' on fertilized and nonfertilized land.

Urea, ammonium nitrate, or anhydrous ammonia, providing 50 lb of nitrogen per acre, was worked into the soil one day before seeding with 'Gateway' barley. They were applied to the fertilized and non-fertilized stubble and fallow land, each treatment covering 2500 ft<sup>2</sup>.

### Results and discussion

The results of four of these experiments are illustrated in Figure 1. There was more visible root rot of barley when it was grown on summerfallow than on stubble land. This is in agreement with the results reported from this area in 1967 (3). 'Galt' and 'Conquest', which are both widely grown in central Alberta, appeared to have less root rot than 'Gateway' or 'Olli'. Hamilton et al. (2) in a greenhouse study comparing the reaction of barley varieties to root rot found 'Olli' to be among the most susceptible varieties.

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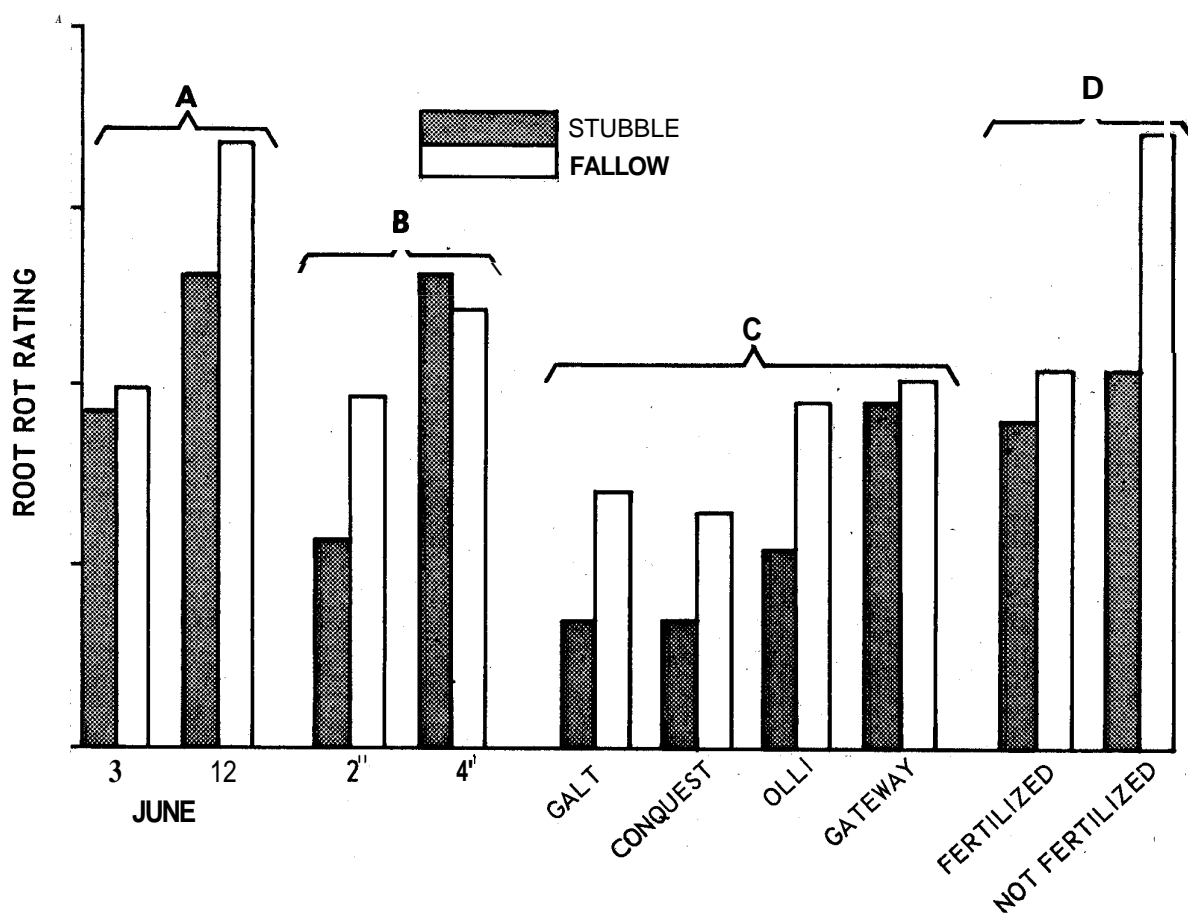


Figure 1. Root rot ratings on barley grown on stubble and fallow land. A) 'Gateway' seeded June 3 and June 12; B) 'Olli' seeded at 2- and

4-inch depths; C) Reaction of the barley cultivars 'Golt', 'Conquest', 'Olli', and 'Gateway'; D) 'Gateway' grown on fertilized and non-fertilized land.

The spring of 1968 was very dry in central Alberta and consequently many farmers seeded their grains deeper than usual. In our trials, seeding 'Olli' 4 inches deep resulted in more root rot, especially on fallow soil, than seeding at 2-inch depths.

With late-sown 'Gateway', root rot ratings were higher on plants grown in nonfertilized soil than on those grown in fertilized soil. Similar results were observed in 1967. It is possible that the effect of the fertilizers may increase host vigor and growth, so that the amount of diseased tissue compared to healthy tissue may be less. The work of Broadfoot and Tyner (1) indicated that a close relationship existed between host vigor and susceptibility to disease. In the 1969 experiment, urea

reduced root rot slightly on nonfertilized fallow and on stubble, but anhydrous ammonia reduced root rot only on fallow soil. Root rot was increased when ammonium nitrate was applied (Table 1).

'Gateway' barley sown on 12 June 1968 had more root rot than that sown 9 days earlier. Due to the dry conditions, the later-sown seed had less moisture to start germination and growth and this may have produced somewhat weaker plants that were more susceptible to attack by root rot organisms.

It was hoped that increased microbial activity in the areas immediately around the seeds amended with barley meal would have reduced the activity of the root rot

Table 1. Root rot ratings of 'Gateway' barley on fertilized and nonfertilized fallow and stubble land treated with three compounds supplying 50 lb nitrogen/acre

Condition of land	Control		Ammonium nitrate		Urea		Anhydrous ammonia	
	F*	NF**	F	NF	F	NF	F	NF
Stubble	1.25†	1.62	1.39	1.79	1.17	1.50	1.56	2.00
Fallow	2.26	2.71	2.64	3.05	2.27	2.61	2.00	2.22

\* F = fertilized: in addition to the treatment indicated, fertilized stubble received 50 lb/acre of 11-48-0 and 150 lb/acre of 33-0-0 (ammonium nitrate); and fertilized fallow received 50 lb/acre of 11-48-0.

\*\* NF = non-fertilized.

† Root rot ratings based on a scale of 0 (healthy) to 5 (maximum disease).

pathogens. However, barley meal placed with 'Olli' seed did not reduce root rot on fallow soil and increased it slightly on stubble soil. The type of organic matter in ground barley kernels differs from barley straw which has had 4 or 5 months to decompose. Dressing 'Gateway' seed with Bay 33172 increased root rot of both fallow and stubble land. The chemical had, however, the marked effect of increasing the height of plants. On stubble the mean height of Gateway plant!; from seed treated with Bay 22172 was 29.1 inches compared with 23 inches for plants from non-treated seed. On fallow the treated barley averaged 33 inches in height and the untreated plants, 30.9 inches. The results suggest that this chemical may have growth promoting effects.

After harvest, the root of the plants on both stubble and fallow soil were pulled up and the roots washed 24 hr in running tap water. The subcrown internodes were cut out and placed in 10% Chlorox for 1 min and rinsed in sterile water. These sections were placed on potato dextrose agar (PDA) in petri plates and the fungi that grew from them were identified. Several hundred roots were examined on three occasions. Forty percent of the plants from all treatments yielded Bipolaris sorokiniana (Sacc. in Sorok.) Shoem. (Helminthosporium sativum Pamm., King & Bakke), and 20% yielded Fusarium culmorum (W.G. Sm.) Sacc. Or Fusarium graminearum Schwabe. Tyner (4) also reported that H. sativum was isolated more frequently than F. culmorum from wheat stubble in central Alberta. In each assay, it was interesting

to note that large numbers of bacteria developed on PDA about the internode sections from plants grown on fallow land but not from those grown on stubble.

### Literature cited

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