DETECTION OF *GAEUMANNOMYCES GRAMINIS* VAR. *TRITICI* IN WHEAT STUBBLE

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Abstract

Two methods (visual assessment and a bioassay) of detecting the presence of *G. graminis* var. *tritici* in wheat stubble were compared. Of the stubble visually assessed as infected, only 4% was not confirmed as infected by the bioassay. On the other hand, the bioassay showed that 41% of the stubble visually assessed as free of infection was incorrectly assigned.

I. Introduction

Many authors have assessed the incidence of *Gaeumannomyces graminis* var. *tritici* Walker (hereafter referred to as *G. graminis*) in the field by the number, or percentage, of plants infected (White 1945; Chambers 1962; Chambers and Flentje 1968; Ebbels 1969; Etheridge 1969). Some assessments have been confirmed by isolation (Chambers 1962) or by production of perithecia (White 1945). As isolation of *G. graminis* from old wheat stubble is difficult (White 1945), and the production of perithecia takes considerable time (White 1945), assessments are generally made by visual examination of the root or foot region of the plant. Although symptoms of infection by *G. graminis* may be obvious on immature or recently mature plants, they are likely to be difficult to detect on old stubble. Visual examination of stubble also gives no indication of whether viable *G. graminis* is still present. To clarify the situation before commencing some studies on the incidence and survival of *G. graminis* (Mac Nish and Dodman 1973*a*, 1973*b*), a comparison was made between the detection of *G. graminis* in wheat stubble by visual assessment and by a bioassay based on a test by Garrett (1938) and similar to that used by Hornby (1969).

II. Experimental Methods

The mature wheat stubble that was to be assessed was collected from the field and adhering soil removed from each crown (which was taken to include attached roots). Each crown was examined macroscopically for symptoms of infection by *G. graminis*. Particular attention was paid to the subcrown internode; black discoloration of this region was recorded as positive infection. After examination, the crown was inserted (stem end first) into a polyvinyl chloride (PVC) tube (internal diam. 1 cm, length 4 cm) and the roots packed down against the base of the crown. Any stem straw extending beyond the bottom of the tube was removed. If the crown was so large that it was difficult to insert into the tube some tillers were broken off and discarded. If the crown was very small it was rolled into a ball and inserted into the tube. Two untreated wheat seeds were placed on top of the crown in the tube and covered with soil. Two seeds were used to obviate emergence failures. To

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minimize the possibility of cross-infection among the seedlings, each tube was placed in a small cylinder (rigid PVC conduit, internal diam. 2·25 cm and length 8 cm) filled with soil (Fig. 1). Large numbers of these cylinders could be packed into a box and they effectively prevented the spread of *G. graminis* from one tube to another.

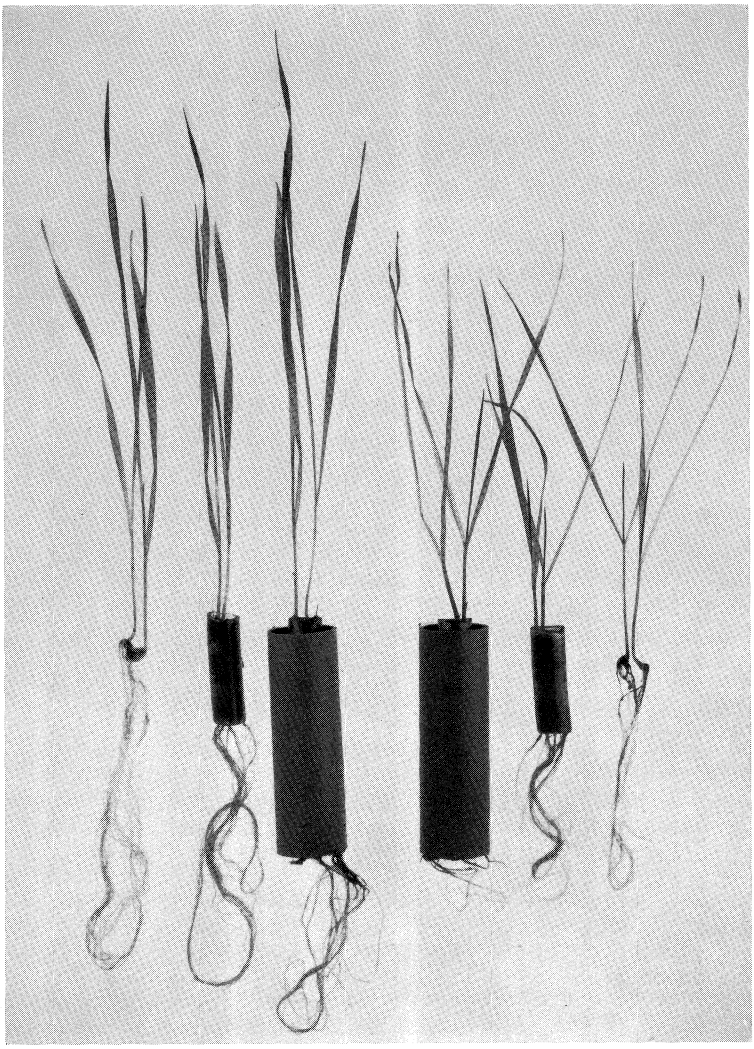

Fig. 1.—Method used to detect the presence of *G. graminis* in wheat stubble. Two wheat seedlings were grown on stubble (crown region) inserted in a PVC tube placed in soil in a PVC cylinder. Seedlings on left, disease-free; seedlings on right, infected from crowns containing viable *G. graminis*.

After watering, the box was covered with a plastic sheet and placed in a controlled environment (16 hr of fluorescent light, 17,200–18,300 lumen/m^2, and 15°C constant temperature). The plastic was removed as soon as seedlings started to emerge. The box was watered daily to saturation and allowed to drain freely. After 4 weeks the seedlings were removed and examined for infection by *G. graminis*. The number of tubes containing seedlings showing vascular discoloration of one or more roots was recorded.

III. Results and Discussion

The results of the visual assessment of infection with *G. graminis* are compared with those of the bioassay in Table 1. Less than 4% of the crowns recorded as infected by the visual assessment were incorrectly assigned, whereas 41% of those visually assessed as free of infection were in fact shown by the bioassay to be infected.

TABLE 1

COMPARISON OF VISUAL ASSESSMENT AND BIOASSAY FOR THE DETECTION OF *G. GRAMINIS* IN MATURE WHEAT STUBBLE

+ indicates infected; − indicates free of infection. Values in parentheses are numbers of crowns as percentage of those in visual categories

Visual assessment	Bioassay	Number of crowns	Visual assessment	Bioassay	Number of crowns
+	+	339 (96·6%)	−	−	168 (59·0%)
+	−	12 (3·4%)	−	+	117 (41·0%)

Discrepancies between visual assessment and bioassay of crowns considered to be uninfected by the former method could be due either to the inability to detect all lesions on the crowns or to the presence of *G. graminis* in a form difficult to detect macroscopically. For example, the fungus may be present on the stubble as runner hyphae which have not invaded the plant and have not produced detectable lesions (Warcup, personal communication). Whatever the reason for the discrepancies, these results demonstrate the inaccuracies that could result from basing an estimate of incidence of *G. graminis* on visual assessments alone.

The results from the bioassay reveal nothing about the type and location of propagules present. However, the studies envisaged were concerned with incidence and survival of the fungus, rather than detecting its location on the plant remains or debris. The bioassay also gives no indication of the amount of inoculum present. The intensity of infection in terms of effect on seedling growth was recorded in a preliminary experiment, but the assessment was too time-consuming to be employed in large-scale experiments.

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