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Cultural practices affecting the rate of fusarium damage in durum wheats

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SUMMARY – Under water stress conditions, "white head" appearance caused by *Fusarium* in durum wheat, was associated with nitrogen fertilization. In a dry season, all the agronomic practices leading to drought increase, such a high plant density or spring nitrogen fertilisation, produce an increase on the number of plants affected. Although all the tested entries were susceptible, differences in performance among them were detected.

Key words: Water stress, durum wheat, white head, *Fusarium.*

RESUME – *"Pratiques culturales affectant le taux de dommage par* Fusarium *chez les blés durs". En conditions de stress hydrique, l'apparition d'"épis blancs" dans le blé dur par l'attaque de la fusariose a été associée avec la fertilisation azotée. Dans une année sèche, toutes les pratiques agronomiques qui conduisent à une élévation de la sécheresse, telles qu'une haute densité ou la fertilisation azotée au printemps, produisent une plus forte incidence de la maladie. Bien que toutes les variétés que nous avons expérimentées ont été sensibles, il y a eu entre elles des différences de susceptibilité*.

Mots-clés : *Sécheresse, blé dur, épis blancs,* Fusarium.

Introduction

Durum wheat has become one of most important crops in some southern European regions. One of these regions is the central part of the Ebro Basin, in Northern Spain, where durum wheat is mainly cultivated under rainfall conditions.

Prior to 1990, durum wheat was cultivated in areas with good soil and relatively high annual precipitation. After this year, and as a consequence of EU subsides, the growing area was increased, moving to poor soils and dry conditions.

From 1990 to 1995, the growing seasons were extremely dry. Then, in the new cropping areas, spikes were small, poorly filled or even empty, leading in many cases to a crop failure. In these seasons, farmers began to report the appearance of "white spikes" in an unusual number. Nevertheless, it was in 1996 when problems arose. This season farmers were expecting a reasonable good yield, but on heading time, in many fields and in all the areas, a high percentage of spikes (up to 50% in some cases) were "white". Analysis sowed that in all the plants affected, *Fusarium* (*gramineum* or *culmorum*) was present. Such type of damage has been reported as a common durum wheat disease that increases its importance if water stress is present (Papendick and Cook, 1973; Cariddi and Catalano, 1990).

A rapid screening showed that damage was more evident on those plots having a high plant density, a high level of nitrogen fertilization, or a shallow soil. Experiments were performed to assess whether, as it seems, modification of agronomical practices could decrease fusarium damage. Similarly, and because literature indicated varietal differences in susceptibility, experiments aimed to find differences among the more common varieties used in this area were performed.

Materials and methods

Experiments were performed during the 96/97, 97/98 and 98/99 cropping seasons. Data from 97/98 will not be used because of bad emergence.

In 96/97 five durum varieties were sowed in Bujaraloz (Zaragoza) at three sowing densities (130, 170 and 210 kg/ha). The trial included the four modern varieties most sown in the region (Antón, Jabato, Regallo and Roqueño) and a very traditional one (Bidi 17). In another experiment performed in Fuendejalón (Zaragoza), 20 varieties were sown at 170 kg/ha. The design of both experiments was in blocks with three replications.

In 98/99 in Bujaraloz an experiment was performed including three varieties (Antón, Jabato and Regallo), three sowing densities (those used in 96/97) and three types of nitrogen fertilization: (i) no fertilization; (ii) urea; and (iii) nitrate. In both cases 33.5 units/ha were applied. Near Bujaraloz, in Pina, an experiment including 28 durum wheats was sown. Experiments were randomised with four replications. In all the cases, the number of "white spikes" on 0.25 m^2 was counted at the beginning of grain filling. Two measurements per plot were performed.

Results and discussion

We found that fusarium attacks increased as soon as the crop area moved to less favourable environments. Most probably, prior to 1996 the problem was present, but it was not detected because severe drought produces more damage than the disease.

Results of the 96/97 experiment did not show significative differences among varieties in the number of spikes affected by fusarium, even when large differences in the main values can be observed (Fig. 1). On the contrary, results from 98/99 show differences between varieties. Alacon, Bolenga and Borli were the more susceptible, whereas Favio, Soldur, Ifox and Claudio were the more resistant cultivars.

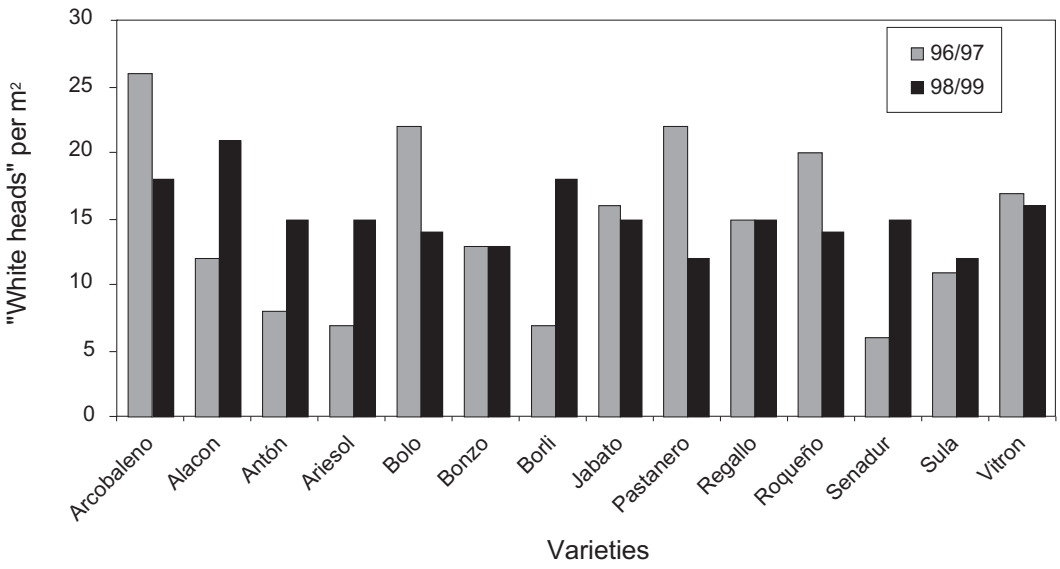

Fig. 1. Number of spikes/m^2 affected by fusarium. Only the results of common varieties tested in the two seasons are presented.

Durum wheat has been reported to be very susceptible to fusarium, (Lemmens *et al.,* 1993; Corazza *et al.,* 1998). In our experiments, although some entries seem to have a low susceptibility, there was not a relationship between the rank of resistance in the two studied seasons. This is probably related to differences in heading date and differences in the time when stress is present in each season. So, in some seasons early material will be an advantage and in other seasons earliness will be a disadvantage. On the other hand, no differences in fusarium susceptibility among varieties were found in any of the two experiments in which plant density or fertilization were tested. In each season, the performance of all varieties was always the same.

In 1997 (Table 1), the plant density did not affect the rate of fusarium infection. The number of "white spikes" was similar in the three treatments. This was probably because in this particular environment

drought was very mild, and then the fusarium attack was low as can be shown by the low average of white spikes/m^2 (6 spikes).

Table 1. Number of "white spikes"/m^2

	Level[†]	98/99	96/97
Plant Density	A	41.50 a	5.80 a
	B	33.84 a	7.46 a
	C	31.64 a	7.60 a
Type of fertilization	A	23.18 b	
	B	41.90 a	
	C	44.40 a	

[†]Density levels were: A = 130; B = 170; and C = 210 seed kg/ha, respectively.
[a,b]Values with the same letter do not differ significantly.

The results of 1999 (Table 1), indicated that those treatments with more density (although, not significatively) or that receiving nitrogen in cover were the most affected. Both treatments are known to increase largely the LAI, and as a consequence they will increase the evapotranspiration and the water stress. These results are similar to those reported by Papendick and Cook (1973) and by Cariddi and Catalano (1990), and indicate that we should probably decrease the showing density, and control water status at boot stage before deciding the rate of N fertilization.

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