Influence of Tillage on *Fusarium* spp. in Different Crop Rotation Systems

Siegrid Steinkellner*, Vitore Shala-Mayrhofer and Ingrid Langer

Institute of Plant Protection, University of Agricultural Sciences Vienna, Peter Jordan-Strasse 82, A-1190 Vienna

*, Corresponding Author

Abstract

In the present study the influence of different conventional and reduced tillage systems on *Fusarium* spp. and the production of the mycotoxin deoxynivalenol in winter wheat and maize in different crop rotation systems was investigated. Field trials were conducted in semihumid areas in Lower and Upper Austria and in the pannonian area in Eastern Austria. Generally, extremely dry and hot climatic conditions in all trial years resulted in low infestation levels. As a consequence, no significant effect of tillage system on the infestation with *Fusarium* spp. in winter wheat respectively maize and the contamination with deoxynivalenol was found.

Keywords: *Fusarium* spp., deoxynivalenol, mycotoxin, tillage, crop rotation

Introduction

During the last years, there has been an ongoing development by Austrian farmers away from conventional tillage involving inversion of the soil towards conservation tillage characterised by reduced or no tillage. In spite of many advantages (e.g. reduction of soil erosion, improvement of soil structure) this change profoundly affects the microenvironment where the crop is grown. Consequently, changes in plant pathogen incidence have to be considered. In the last years particular interest was directed towards an increased risk of *Fusarium*-infection and the production of the associated mycotoxin deoxynivalenol in wheat [1, 2, 6,7] and maize [1, 3].

The objective of this study was to determine the influence of crop rotation and different conventional and conservation tillage systems on the development of *Fusarium* spp. in winter wheat and maize and the deoxynivalenol contamination of grain in Austrian semihumid and pannonian climatic regions.
Materials and Methods

Field-plot trials were carried out from 1999 to 2001 in central Upper Austria and in the eastern and central Lower Austria. Each of these locations represented at least 2 different conventional and conservation tillage systems within the last several years. Ansfelden (central Upper Austria) and Pyhra (central Lower Austria) represented the semihumid climate area with about 800 mm annual rainfall. Groß Enzersdorf and Fuchsenbigl in the eastern Lower Austria were characterised by pannonian climate and about 550 mm annual rainfall. At Ansfelden the rotation sequence maize, winter wheat and sugar beet was investigated in a long plot design with four replicates since 1980. Tillage factors were moldboard plough (30 cm, 24 cm and 17 cm), chisel plough (30 cm, 24 cm and 17 cm), rotary tiller and rotary tiller alternating with moldboard plough. At Pyhra already in the beginning of the nineties a long-term trial has been started. Eight tillage factors (moldboard plough, 7 chisel plough factors containing different cover crops) were assessed in a row design with three replicates. Maize and winter wheat were grown alternately. At Groß Enzersdorf two crop rotation systems and five tillage factors (mouldboard plough, no till, chisel plough, stubble mulch cultivator, chisel plough alternating with mouldboard plough) were investigated in a split-plot design with four replicated plots. The rotation sequence A (1996 – 1999) comprised barley, sugar beet, winter wheat and rape, rotation sequence B comprised barley, maize, winter wheat and sunflower. At Fuchsenbigl three tillage systems, moldboard plough, chisel plough and rotary tiller, were investigated in a disordered block design. Previously grown crops since 1996 were winter wheat, maize, durum and barley.

Ear infection of the test crops was studied from random samples of 100 ears per plot at stage BBCH 85-87. Data on disease incidence (%) and disease severity (%) were collected. Final-harvest samples from each test crop were taken for assessment of grain infections under laboratory conditions. 400 grains per plot were incubated on agar plates and the identification of the Fusarium species was done by direct microscopic observation on Fusarium-specific media [1, 2]. Deoxynivalenol content of each sample was analysed by IFA Tulln, Center for Analytic, Tulln. The basic material of 250 g winter wheat or maize from final harvest, respectively, were ground and investigated by gas chromatography with electron-capture detection.

Results and Discussion

Generally, the unusually warm and dry weather in all trial years led to low ear infestation levels with Fusarium spp. In the semihumid climate area disease ratings of Fusarium head blight on winter wheat differed among Ansfelden and Pyhra. A significantly higher disease incidence occured on ears in chisel ploughed plots at Ansfelden in 2000 (Table 1). Results on grain infections did not confirm the field observations. Furthermore, no consistent effects on DON-contamination were observed.