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DIPARTIMENTO DI SCIENZE AGRARIE

Con il patrocinio di
LE UNIVERSITÀ PER EXPO 2015
COMITATO SCIENTIFICO DEL COMUNE DI MILANO

XLIV
Convegno Nazionale SOCIETÀ ITALIANA DI AGRONOMIA
L'Agronomia per la gestione dei sistemi produttivi agrari
Bologna, 14-16 settembre 2015
Dipartimento di Scienze Agrarie, Scuola di Agraria e Medicina Veterinaria, Alma Mater Studiorum Università di Bologna

EFFECT OF METEOROLOGICAL AND AGRONOMIC FACTORS ON MAIZE GRAIN CONTAMINATION BY FUMONISIN

Research founded by ERSA-FVG

Francesco Savian[1*], Fabrizio Ginaldi[1], Davide Bianco[2], Mauro De Paoli[2], Piera De Pauli[2], Markus Daniele Castelluccio[2], Giorgio Barbiani[2], Francesco Danuso[1].

[1] University of Udine, Department of Agricultural and Environmental Sciences, Via delle Scienze 206, 33100 Udine, Italy.

[2] ERSA - Regional Agency for Rural Development of Friuli Venezia Giulia, Via Sabbatini 5, 33050 Pozzuolo del Friuli, Italy.

**corresponding author*: francesco.savian@uniud.it

Introduction

Fumonisins are toxic secondary metabolites mostly produced by *Fusarium* species of *Liseola* section. In Friuli Venezia Giulia (FVG, NE Italy) these fungi are widespread all over the territory and may seriously compromise maize healthy. Our study aims at understanding the effect of environmental and agronomic factors on fumonisins production, in order to predict toxin concentrations and help farmer in developing control strategies.

Data and Method

Fumonisins concentrations were sample from 14 drying plants in FVG for 10 years, from 1998 to 2013. Three harvest time were analysed: early (before 6th Oct), average (from7th to 31th Oct) and late (after 1st Nov).

Data were then analysed by full factorial ANOVA considering the factors "year", "harvest time" and "location of drying plant" (STATA software).

Meteorological data, obtained from the regional weather watch center (OSMER) for each drying plant, have been used to calculate environmental indexes, evaluated every 15 days, from 1st April to 31th November. A multiple regression approach was performed by SEMoLa software, correlating fumonisins concentration with those indexes.

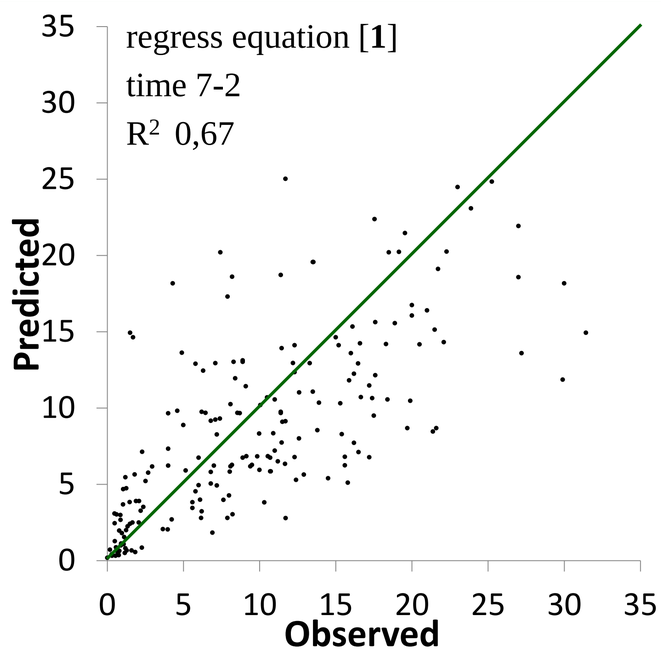

Fig. 3. Predicted vs observed values (ppm)

Results

The ANOVA test pointed out a significant effect on fumonisins concentration of factors "year" and "harvest time" ($p<0.01$) while "location" and all interactions were not significant (**Fig. 1**).

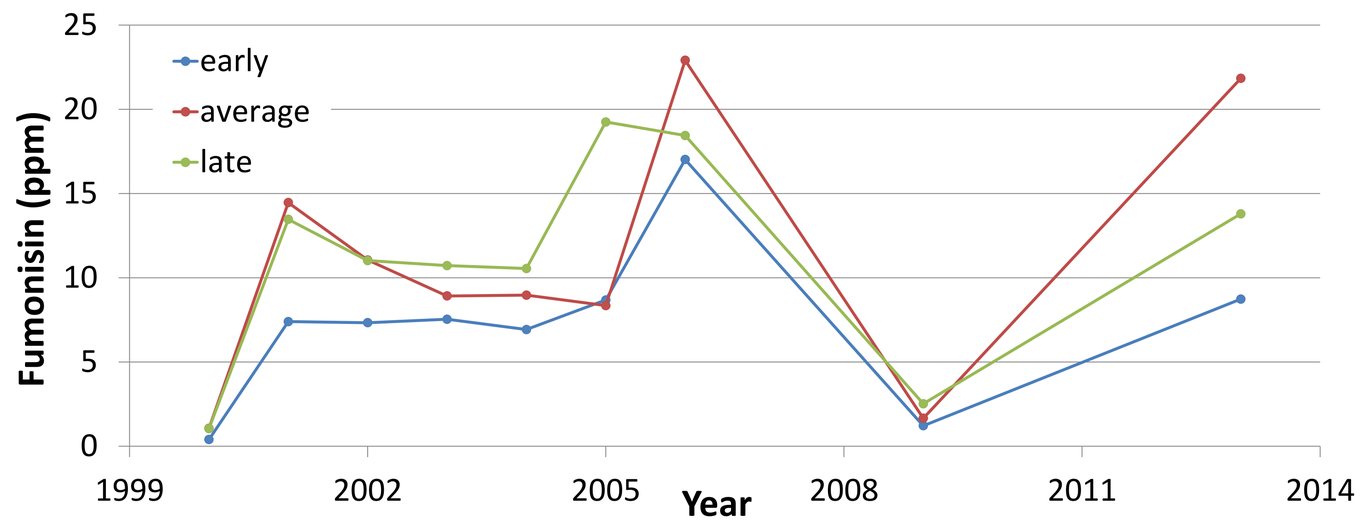

Fig. 1. Fumonisin level for the different year and harvest time

The multiple regression approach showed a good correlation between fumonisins concentration and meteorological conditions when using data of second half of July, Time=7-2 (**Fig. 2** and **Fig. 3).**

$$fumo = e^{[b_1\Delta T + b_2 Tmin + b_3 RH + b_4 Rain + b_5 Rainlimit + b_6 Tminlimit + b_7 R1 + b_8 R2 + b_0]} \quad [1]$$

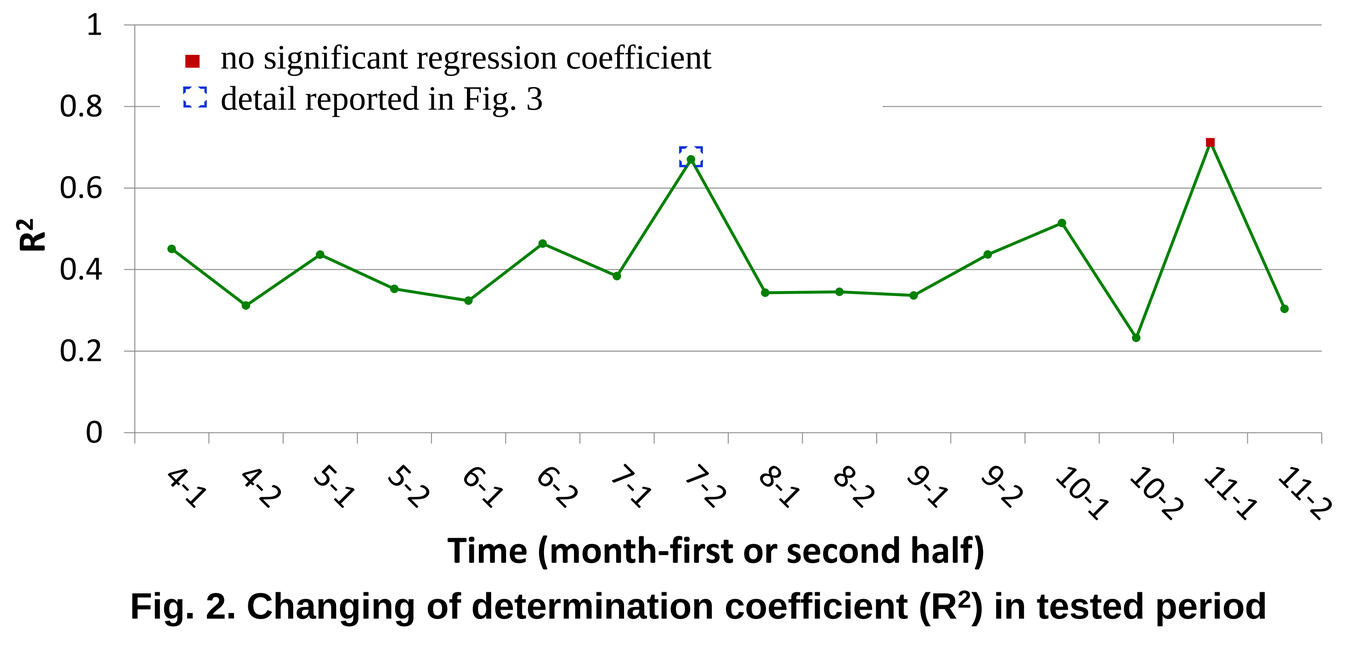

Fig. 2. Changing of determination coefficient (R^2) in tested period

Fumonisins concentration (**fumo**) was positively correlated with the mean of thermal excursion (**ΔT**), minimum temperature (**Tmin**), relative humidity (**RH**), total rainfall (**Rain**), number of rainfall days (**RainLimit**) and number of days with daily minimum temperature higher than 10°C (**TminLimit**). Otherwise, constant and dummy variables **R1** and **R2**, used to represent the 3 different harvest times, were negatively correlated.

Conclusion

Year to year fluctuations of fumonisins concentrations, resulted by ANOVA test, may be linked to environmental conditions. The same test also reveals early harvest as less susceptible to fumonisins contaminations if compared to average or late ones.

The multiple regression approach point out that meteorological conditions from 15th to 31th July may be used to evaluate a risk index for fumonisins contamination in early development stage of maize cultivation.

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