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

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Introduction

Fumonisin is a toxic secondary metabolite 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 fumonisin production, in order to predict toxin concentrations and help farmer in developing control strategies.

Data and Method

Fumonisin concentrations were sampled from 14 drying plants in FVG for 10 years, from 1998 to 2013. Three harvest times were analysed: early (before 6th Oct), average (from 7th 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 31st November. A multiple regression approach was performed by SEMoLa software, correlating fumonisin concentration with those indexes.

Results

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

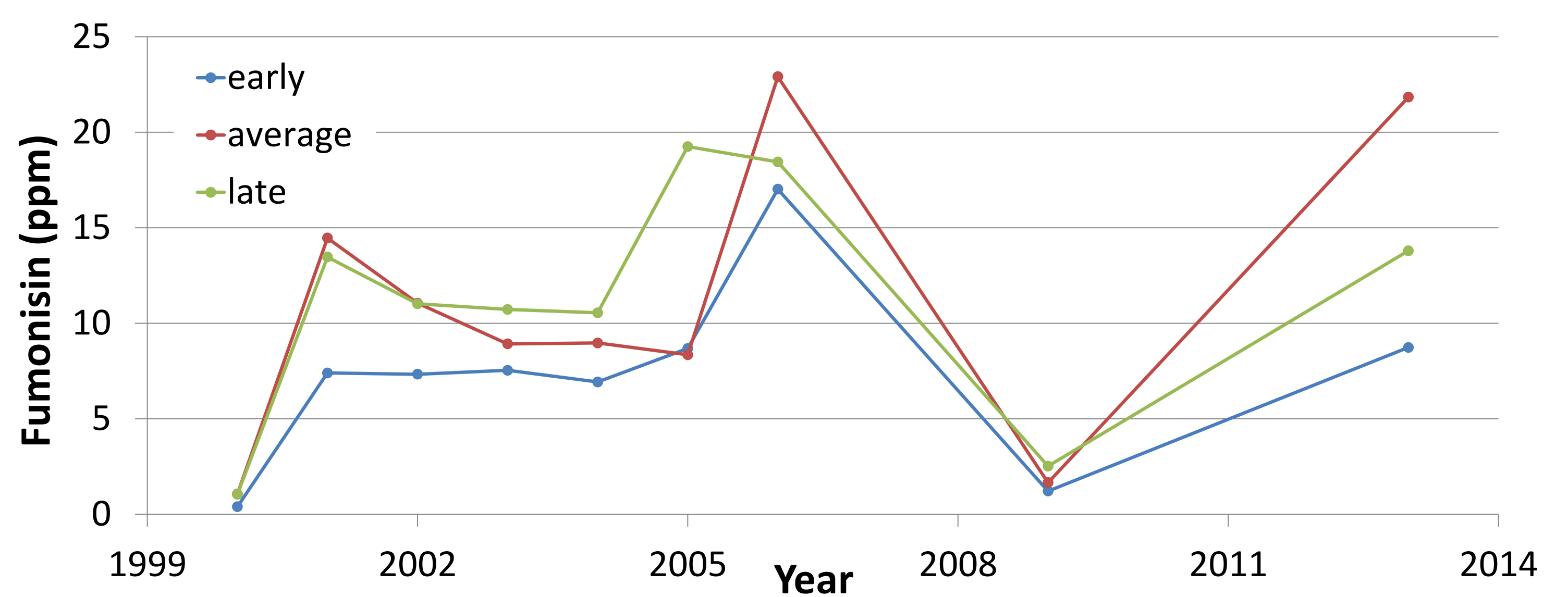


Fig. 1. Fumonisin level for the different year and harvest time

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

$$fumo = e^{[b_1\Delta T + b_2T_{min} + b_3RH + b_4Rain + b_5Rain_{limit} + b_6T_{min_{limit}} + b_7R1 + b_8R2 + b_0]} \quad [1]$$

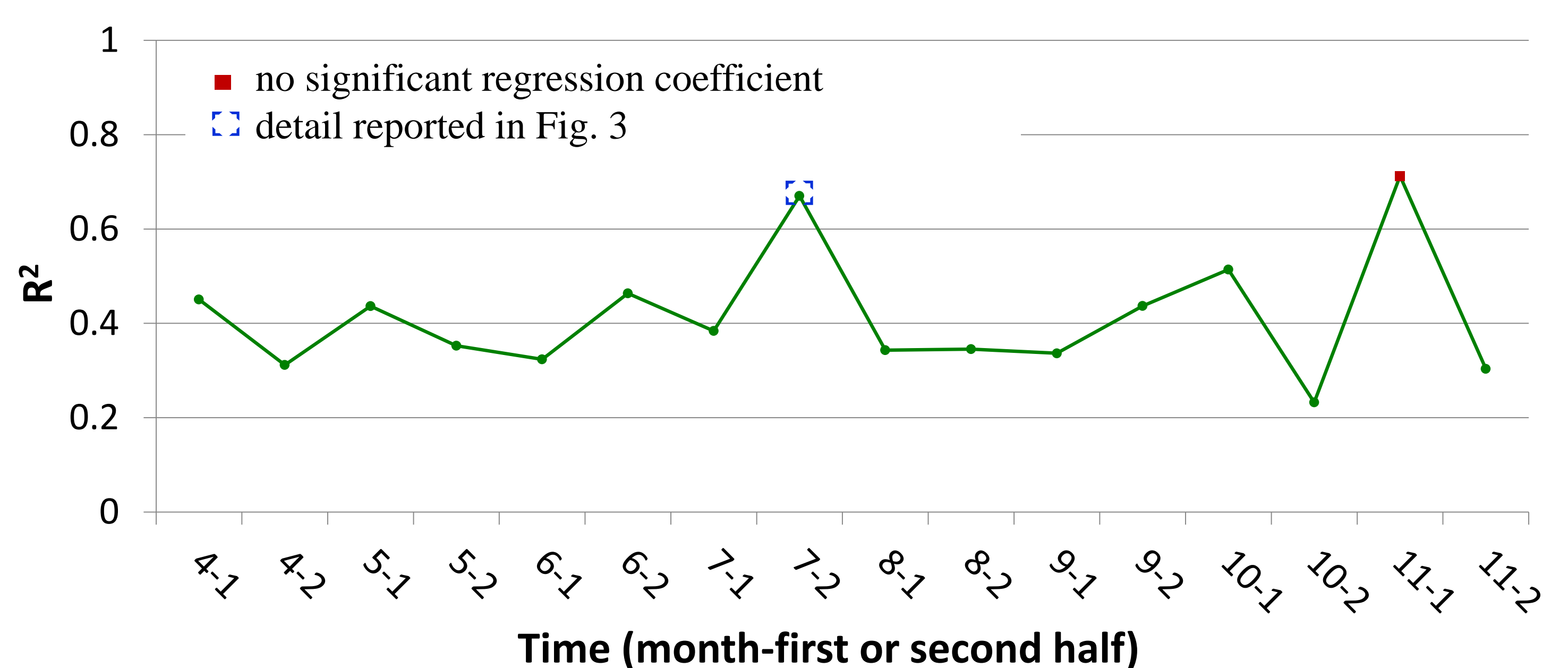


Fig. 2. Changing of determination coefficient (R²) in tested period

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

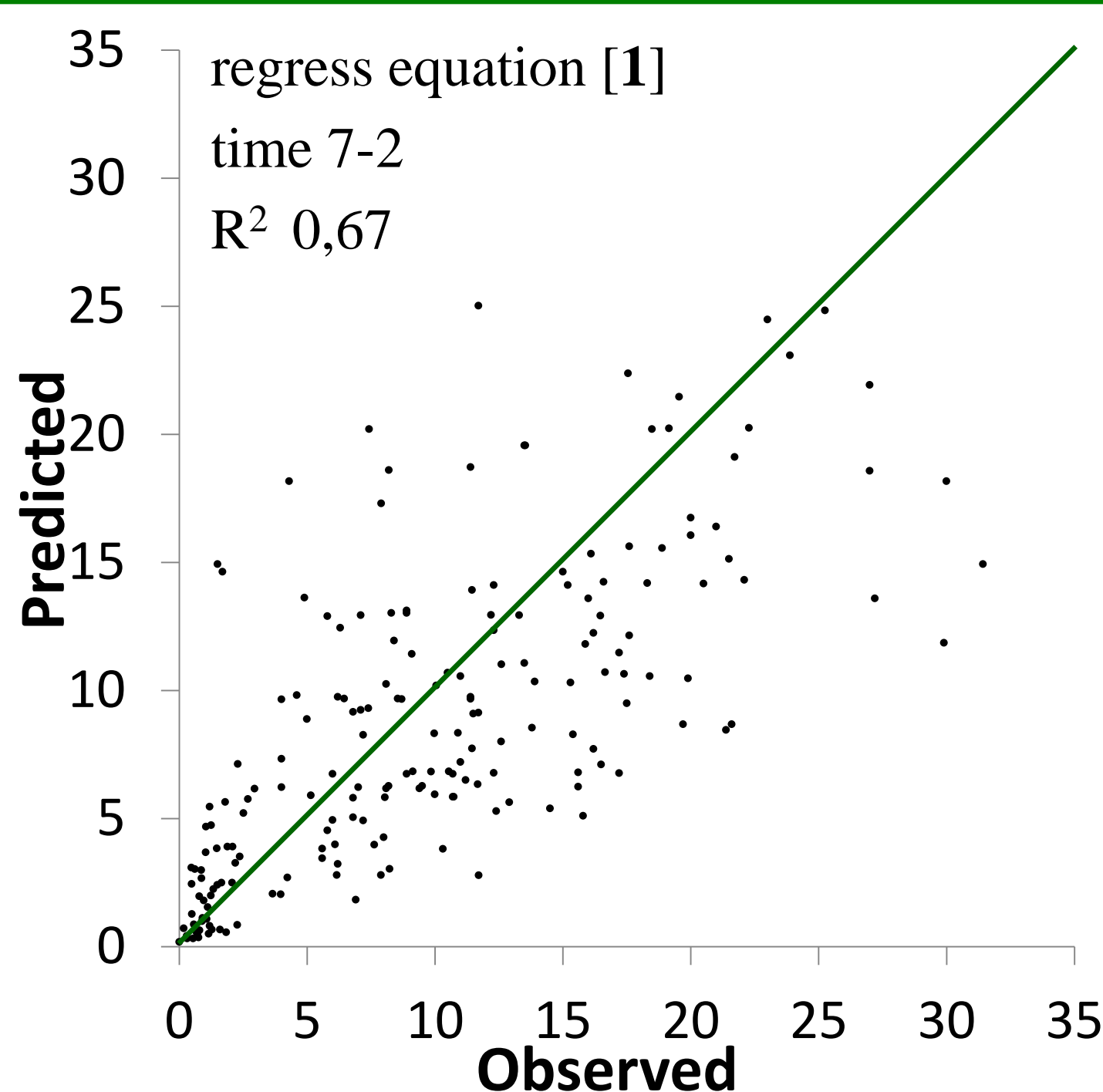


Fig. 3. Predicted vs observed values (ppm)

Conclusion

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

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

References

- Maiorano, A., Reyneri, A., Sacco, D., Magni, A., & Ramponi, C. (2009). A dynamic risk assessment model (FUMAgain) of fumonisin synthesis by *Fusarium verticillioides* in maize grain in Italy. *Crop Protection*, 28(3), 243–256.
- Picot, A. et al. (2010). Factors of the *Fusarium verticillioides*-maize environment modulating fumonisin production. *Critical Reviews in Microbiology*, 36(3), 221–231.
- Rossi, V., Scandolara, A., & Battilani, P. (2009). Effect of environmental conditions on spore production by *F. verticillioides*, the causal agent of maize ear rot. *European J. Plant Pathology*, 123(2), 159–169.
- Danuso F., Rocca A., 2014. SEMoLa: a simple and easy modelling language. *Ecological Modelling*, 285C (2014), pp. 54-77. DOI: 10.1016/j.ecolmodel.2014.04.012