INTRODUCTION

For many years, the IGV Institute of Cereal Processing, Ltd. has been concerned with the analysis of wheat and rye samples of integrated and organic cultivation as regards the components used, dough rheology, and milling and baking properties. During the years 2000 to 2013, the samples were analyzed additionally for Fusarium toxins in order to collect data on the contamination situation of the federal state Brandenburg over a period of several years. Since 2012 only wheat samples were analyzed for Fusarium toxins whereas rye samples were analyzed for ergot alkaloids. The analyses had the further aim to confirm differences between samples of organic and integrated cultivation with regard to the contamination by mycotoxins.

MATERIAL AND METHODS

During this period, approx. 60 wheat and 60 rye samples were analyzed in each year, these were collected from farmers of all the agricultural districts of the federal state, with special consideration of organic cultivation. The Fusarium toxins DON, zearalenone, nivalenol, T-2 and HT-2 toxins, 3-Ac-DON, 15-Ac-DON, DON-3-glucoside, DAS and fusic acid were analyzed by means of LC-MS/MS (2000-2008: HPLC). The detection threshold was 0.5 μg/kg. The samples were analyzed by the following methods: DON/Nivalenol/DON-3-glucoside/FUS-X: 15 μg/kg, zearalenone: 3 μg/kg. The maximum content of the samples was monitored in the years 2000-2013. The amount of the samples of organic cultivation harvested in the years 2000-2013 was determined by the harvest yield, the mean value of all positive samples was 556 μg/kg. The maximum content of the samples was 1380 μg/kg.

Analysis by LC-MS/MS

The samples were extracted by shaking with acetone/water (84:16, v/v) for 1 h. An aliquot of the filtered extract was mixed with internal standards (¹³C-marked) and purified with the aid of Bond Elut Mycotoxin columns. The purified extract was concentrated to dryness by rotary evaporation at app. 50 °C, redissolved in HPLC mobile phase and purified by LC-MS/MS. The detection threshold was 5 μg/kg. The maximum content of the samples was monitored in the years 2000-2013. The amount of the samples of organic cultivation harvested in the years 2000-2013 was determined by the harvest yield, the mean value of all positive samples was 556 μg/kg. The maximum content of the samples was 1380 μg/kg.

RESULTS

Fusarium toxins:

DON was detected in wheat for almost all years of the investigation (except 2010). Over the years the measured contents of DON varied widely (see Fig. 1 and Tab. 1). In 2002, 2007 and 2012 were years with very high DON contaminations. In the other years the DON contamination was significantly lower. DON was detected in 26 % of the wheat samples. The maximum content was 2477 μg/kg, the mean value of all positive samples was 556 μg/kg (median: 237 μg/kg). The maximum content was 1380 μg/kg. The mean value of all positive samples was 556 μg/kg (median: 237 μg/kg). The maximum content of the samples was monitored in the years 2000-2013. The amount of the samples of organic cultivation harvested in the years 2000-2013 was determined by the harvest yield, the mean value of all positive samples was 556 μg/kg. The maximum content of the samples was 1380 μg/kg.

T-2/HT-2 toxins were rarely detected. T-2-/HT-2 toxins, DAS and FUS-X were detected in 4 to 12 ergot alkaloids were detected. Samples with very low content of ergot alkaloids were detected (mean value of the positive samples: 629 μg/kg, median value: 409 μg/kg).

Ergot alkaloids:

In rye samples DON was found over the years more rarely than in wheat samples. In rye samples DON was found over the years more rarely than in wheat samples.

In the contaminated samples from 2 to 12 ergot alkaloids were detectable (see Fig. 2). Highly contaminated samples contained from 10 to 12 ergot alkaloids (17 respectively 18 % of all analyzed samples). In the samples with medium content from 4 to 12 ergot alkaloids were detected. Samples with very low content contained from 2 to 8 ergot alkaloids.

CONCLUSION

2013 was a crop year of the Federal State of Brandenburg with moderate to high DON contamination in wheat samples and with a high contamination of ergot alkaloids in rye samples, respectively.

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REFERENCES


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Fusarium toxins and ergot alkaloids in wheat and rye of the Federal State of Brandenburg harvested 2013

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