Effects of the Botanical Composition and Weather Conditions on Mycotoxins in Winter Forage from Grassland

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Abstract

The paper focuses on possible effects of the botanical composition and weather conditions on the extend of zearalenone and ochratoxin A concentrations in various grass swards in winter pasture systems. Zearalenone is only detectable in pure stands of Lolium perenne or in Lolio-Cynosuretum plant communities, respectively. The occurrence of ochratoxin A is more frequent and less specific concerning the botanical composition. This mycotoxin was found in both, Lolium perenne and Festuca arundinacea in varying years. The incidence of ochratoxin A depends on year and is apparently related to the weather conditions in autumn and winter. There was no evidence that particular locations have a higher or a lower risk for high ochratoxin A or zearalenone concentrations than others. Peak values in individual swards are not intermittent over the years.

Keywords: winter pasture, botanical composition, ochratoxin A, zearalenone

Introduction

In Central European grassland mycotoxins are usually not detectable in herbage of spring and summer growth, but in the course of the growth period it is more likely that toxins like zearalenone and ochratoxin A occur (Opitz v. Boberfeld et al. 2000). Regarding animal health, this could pose a problem for low-input grassland systems, where the extension of the grazing period or year-round outdoor-keeping could improve productivity by reducing costs for conserves and stables (Opitz v. Boberfeld & Sterzenbach 1999, Opitz v. Boberfeld, W. 2000). Quality aspects like energy concentration and crude protein of winter pasture herbage apparently fulfil the requirements for suckler cows at least until December, assuming an adequate management (Opitz v. Boberfeld & Wolf 2002, Opitz v. Boberfeld & Wöhler 2002). This paper focuses on the problem of forage spoilage by fungal contamination in different grass swards used in winter pasture systems.
Materials and Methods

Two experiments were established to investigate the possible effects of the botanical composition and weather conditions on the extend of mycotoxin concentrations in various grass swards in autumn and winter. Pure stands of Festuca arundinacea and Lolium perenne were observed under standardized conditions in experiment 1, experiment 2 was focused on mixed swards considering the plant communities Lolio-Cynosuretum and Festuco-Cynosuretum in ten different locations in altitudes from 320 to 475 m above sea level. In both experiments, samples of three successive years were analysed to compare the effects of different courses of weather. The samples were taken mid of December. There was not any harvest between mid of June and this date to obtain sufficient winter yield. The concentrations of zearalenone and ochratoxin A were determined by HPLC using a immuno-affinity column at a flourescence detector (Anonymus 1993). The ergosterol concentration in herbage was measured by HPLC at an UV detector after saponification in petrolether (Schwadorf & Müller 1989, Anonymus 1993). Ergosterol is a substance that mainly occurs in fungi used to estimate the extend of fungal infections.

Results and Discussion

In comparison of the pure stands of the two grass species the extend of fungi infection (see figure 1) – estimated by the concentration of ergosterol – was higher for Lolium perenne than for Festuca arundinacea. Apparently, structural differences influence the extend of fungal infections. The more erect growth type of Festuca arundinacea in combination with its solid fibre component with silicate inclusions reduces the penetration in tissue by fungi, whereas flattened Lolium perenne leaves in ground level lay themselves more open to attack and generate a suitable micro climate for fungi.

![Figure 1: Comparison of ergosterol concentrations with concentrations of ochratoxin A (a) and zearalenone (b)](image)