Possibilities to control Fusarium infection on oats with fungicide applications

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Fusarium infections on oats

- *Fusarium* species are prevalent in oat grain
- Infections during grain development
- The first *Fusarium* species can infect kernels at panicle emergence
- The main risk period at anthesis
- Infections mainly in humid conditions
- Reduce grain weight, germination and quality
- Soil-borne infections cause foot and root rot
- Can produce mycotoxins during the whole grain development
- Production can continue in harvested, moist grain
Fusarium species and mycotoxins

- Fusarium infections are important, reduce market value of grain
- Regulation for mycotoxin contamination in grain for food in EU
- Maximum contents in EU legislation: DON (deoxynivalenol) 1750µg/kg for oats; ZON (zearalenone) 100µg/kg; proposed maximum for T-2+HT-2 1000 µg/kg
- Problems with DON on oats, also increasing contaminations of T-2/HT-2
- The main mycotoxins and their producers in nordic conditions:
  - DON (zearalenone): *F. graminearum, F. culmorum*
  - T-2/HT-2 toxins: *F. langsethiae, F. sporotrichioides*
  - Nivalenol: *F. poae*
Weather conditions important

- Weather conditions have strong influence on Fusarium infection and mycotoxin contents in grain
- DON-producers important in humid and warm conditions
- T2/HT-2 producers not so dependent on humidity
- *F. langsethiae* can infect in dry conditions and warm and dry weather enhance its growth
- In cool and humid conditions *F. avenaceum* most common: no trichothecene toxins
- *F. poae* prevalent in dry and warm conditions
Possible management tools

- Healthy seed, seed treatment with fungicides
- Crop rotation reduces infection from crop debris
- Tillage: no-till can reduce DON producers but increase T-2/HT-2
- Resistant cultivars: not available and tolerance varies
- Fungicide treatment during growing season
- Rapid drying of the harvested grain
- Circulation in drying machinery and sorting can reduce infection and mycotoxins
- Dehulling
Chemical control with seed treatment

- Seed treatment has not been popular on oats
- Can increase germination and improve early plant development
- In studies 2010-12 seed treatment with fludioxodonil
- Observations of seedling infection 3-4 weeks from sowing, Fusarium infections in developing and harvested grain
Effect of seed dressing

- Can clean the seed of contamination on the surface
- No protection against infections from crop debris
- No effect on Fusarium infection under grain development or harvested grain
Fungicide application during growing season

- Fungicide treatments on oats have increased recently
- Different recommendations for applications: divided doses at different development stages, at heading, at anthesis
- *Fusarium* species can infect early, at heading: *F. langsethiae*
- The main risk period at anthesis: *F. graminearum*
- Trials with applications at flag leaf stage, heading and anthesis
Application at flag leaf stage

- Trial in 2004-2006 on four oat cultivars
- Different weather conditions: effect on DON producers
- Results varied
- Cultivar has more effect than fungicide application
- Too early treatment – more than two weeks before anthesis
Application at heading

- Trials in 2010-2012 at Jokioinen, southern Finland
- Several cultivars, fungicide Delaro325SC
- Cultivar more important than treatment
- Different weather conditions: effect on *Fusarium* flora
Application at heading

- Trials at Ylistaro, western Finland 2013-2014 on three oat cultivars
- Fungicides Delaro 325SC and Proline 250EC
- Generally no significant effect on Fusarium infections
- In 2013 effect on *F. culmorum* with Proline
- Differences between years and cultivars

![Fungicide application at heading](image)
Application at heading - mycotoxins

- Fungicide application reduced DON contaminations
- Contaminations not high
- No significant effect on T-2/HT-2 contaminations
Application at anthesis

- Trial in 2014 in Ylistaro, western Finland
- No effect on Fusarium contamination
- The main DON producer *F. culmorum*
- Mycotoxin contaminations not high
- Some effects on DON, none on T-2/HT-2
Effect on *Fusarium* inoculum

- Fungicide application also meets the straw and stubble
- Observations in 2010-2012
- Infections dependent on weather conditions and cultivar
- *F. culmorum* most common
- Minor effects on *F. graminearum*
Conclusions

• Seed treatment could not protect plant against *Fusarium* infections from crop debris
• No clear effects with fungicide applications on *Fusarium* contamination or mycotoxin contents
• Results varied on oat cultivars and between years
• Cultivar important
• No clear effect on *Fusarium* inoculum surviving in plant residue
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