



EFFECT OF SOIL TILLAGE, VARIETIES AND FUNGICIDE TREATMENT ON THE DEOXYNIVALENOL CONTAMINATION IN SOFT WHEAT. M. Blandino¹, M. Corbellini², D. Scudellari³ and F. Vanara¹. ¹Dipartimento di Agronomia, Selvicoltura e Gestione del Territorio, Università degli Studi di Torino, Via L. Da Vinci 44, 10095 Grugliasco, TO, Italy. ²CRA, Istituto Sperimentale per la Cerealicoltura, Sezione di S. Angelo Lodigiano, Italy. ³CRPV-Filiera Grandi Colture e Sementi, Imola, Italy. E-mail: massimo.blandino@unito.it

The new European Union regulations, that defined maximum levels for *Fusarium*-toxins in food, require the evaluation of the methods of direct and indirect control of the *Fusarium* head blight (FHB) in soft wheat. The data reported are part of interregional project MICOCER, which has the aim to evaluate the effect of combined agronomic techniques and the environmental effect on mycotoxin contamination in cereal grains. During 2005-2007, two varieties with different susceptibility were compared in 4 sites. In each place these treatments were compared: 2 cultivar (Serio, susceptible and Bologna, medium-resistant), 2 soil tillages (ploughing and direct sowing), 3 fungicide treatments at heading (Prochloraz, Azoxystrobin, Metconazole). A clear productive advantage (+5,3%) was evidenced with ploughing compared to direct sowing and an advantage was also evidenced with the use of fungicide compared to untreated control not treated (+8,8%). Direct sowing, with the presence of previous crop residue on soil, and the susceptible cultivar showed significantly higher FHB severity compared respectively to ploughing and medium-resistant cultivars. Only in the year-sites with the highest level of infection, the fungicide treatment had significantly reduced the FHB compared to control (by 41%), while no significant differences were observed between the different fungicides. The deoxynivalenol (DON) contamination was clearly correlated with the FHB severity. The careful agricultural practices (resistant variety, ploughing and fungicide treatment at heading) showed a 98% lower DON contamination than the hazardous productive practices (susceptible variety, direct sowing and no treated).

EFFECT OF INSECTICIDE APPLICATIONS AGAINST THE EUROPEAN CORN BORER (*OSTRINIA NUBILALIS*) ON *FUSARIUM VERTICILLIOIDES* CONTROL AND ON FUMONISIN CONTAMINATION. M. Blandino¹, A. Reyneri¹, M. Saladini² and F. Vanara¹. ¹Dipartimento di Agronomia, Selvicoltura e Gestione del Territorio, Università degli Studi di Torino, Via L. Da Vinci 44, 10095 Grugliasco, TO, Italy. ²Dipartimento di Valorizzazione e Protezione delle Risorse Agroforestali, Sezione di Entomologia, Università degli Studi di Torino, 10095 Grugliasco, TO, Italy. E-mail: massimo.blandino@unito.it

Ostrinia nubilalis (Hübner) (ECB) is the main maize pest in Central and South Europe and it promotes the *Fusarium verticillioides* infection on maize grains, which is able to produce fumonisins. The objective of this study was to determine the effect of the insecticide treatments on ECB damage, *F. verticillioides* infection and fumonisin contamination. The field experiments were performed during 2006 and 2007 in two locations in North West Italy. Seven time of insecticide application were compared, from maize flowering to approximately 15 days after the ECB flight peak. At harvest, ears were rated for the incidence and severity of ECB damage and *Fusarium* ear rot symptoms, moreover the harvested kernels were analyzed for fumonisins B₁ + B₂. In all the years/sites, the treatments applied 7-15 days before the ECB adults flight peak showed the best efficacy to control the insect damage on ears. *Fusarium* ear rot and fumonisin contamination were clearly affected by ECB control. Fumonisin contamination

was generally 10 times higher in ears damaged by *O. nubilalis*, and was positively related to the number of cavities on ears. The occurrence of this mycotoxin in plots treated was significantly reduced, on average, by 68%, compared to control. Furthermore, early insecticide treatment showed significantly lower *Fusarium* infection and fumonisin contamination than treatment applied after the ECB flight peak. This research indicates that the production of kernels with low fumonisin content may be enhanced by a correct insecticide treatment against the 2nd ECB generation.

RESISTANCE TO FUSARIUM HEAD BLIGHT IN NEW ZEALAND WHEAT CULTIVARS. M.G. Cromey, S.C. Shorter, W.B. Griffin, C.A. Munro, D.R. Lauren. *New Zealand Institute for Crop and Food Research Ltd, Private Bag 4704, Christchurch, New Zealand.* E-mail: cromeym@crop.cri.nz

The occurrence of *Fusarium* head blight (FHB) in New Zealand wheat crops is affected by cultivar susceptibility, previous crop, and the climate during and after flowering. FHB is caused by a complex of *Fusarium* spp., with *F. graminearum* most common in North Island crops, and *F. avenaceum* and *F. culmorum* most common in South Island crops. Most New Zealand cultivars are moderately susceptible or moderately resistant to FHB, while a few are highly susceptible, and a few have adequate resistance even under conditions conducive to disease development. The aim of this study was to examine the inheritance of resistance to FHB in doubled haploid progeny of a cross between a highly susceptible and a moderately resistant cultivar. A total of 141 lines were assessed over a two year period in inoculated field trials. Measurements were made of FHB, visibly affected grains, *Fusarium* infection, and mycotoxins. There were moderate to good correlations between most components of FHB, except that the proportions of visibly infected grains were poorly correlated with other components. The parents differed strongly in the incidence of FHB (1% ears infected compared with 18%). Most doubled haploid lines had less than 7% ears infected, but few were as low as the resistant parent. Several lines had more FHB than the susceptible parent. There was less difference between parents in grain infection with *Fusarium*, but most of the progeny had lower levels than either parent. There was a close relationship between the percentage of infected grains and mycotoxin concentrations.

OCCURRENCE OF FUSARIUM EAR ROT AND FUMONISIN CONTAMINATION OF MAIZE IN MOLISE AND EFFECTS OF SYNTHETIC FUNGICIDES. F. De Curtis¹, M. Haidukowsky², A. Moretti², R. Castoria¹, G. Lima¹ and M. Pascale². ¹Dipartimento di Scienze Animali, Vegetali e dell'Ambiente, Università del Molise, Via De Sanctis, 86100 Campobasso, Italy. ²Istituto di Scienze delle Produzioni Alimentari del CNR, Via Amendola, 122/O, 70126 Bari, Italy. E-mail: decurtis@unimol.it

Fusarium ear rot of maize is a worldwide disease, which is most frequently caused by *Gibberella moniliformis* and *G. intermedia*, belonging to the *G. fujikuroi* species complex. Both species produce carcinogenic fumonisins, in particular fumonisin B₁ (FB₁), B₂ (FB₂) and B₃ (FB₃) that accumulate in maize kernels. Occurrence of fumonisins in maize in Italy has been documented, but little information is available on the effects of synthetic fungicides on *Fusarium* ear rot and fumonisin contamination. The aim of this work was to assess (i) the diffusion and severity of *Fusarium* ear rot and fumonisin occurrence in an area of maize cultivation (Molise Region, central Italy) and (ii) the effectiveness of some synthetic fungicides in reducing disease and contamination with these myco-



toxins. In preliminary epidemiological investigations, disease incidence and fumonisin occurrence were determined in 18 sites, where representative samples (100 ears) were collected at the dent stage. In 2005 and 2006, field trials were carried out with some synthetic fungicides applied by a drip irrigation system at silk emission and milky-waxy ripening stage. Incidence of disease, identification of fungi and levels of contamination with FB₁, FB₂ and FB₃ were determined. Preliminary epidemiological investigations showed that both disease incidence (up to 100% of kernels contaminated by *Fusarium* species) and fumonisin contamination (up to 50 µg/g) in Molise were quite severe, being *F. proliferatum* and *F. verticillioides* the main *Fusarium* species. Field trials showed that some fungicides resulted in a significant reduction of *Fusarium* ear rot and fumonisin contamination.

IMPACT OF CROP AGRONOMY ON THE HT2 AND T2 CONTENT OF OATS IN THE UK. S.G. Edwards. *Crop and Environment Research Centre, Harper Adams University College, Newport, Shropshire, TF10 8NB, UK. E-mail: sedwards@harper-adams.ac.uk*

During a study of trichothecenes in UK harvested cereal grains from 2001-2005 it was determined that wheat had a high incidence of deoxynivalenol (DON), barley had a low incidence of all trichothecenes and oats had a high incidence of HT2 and T2 toxins. The average combined HT2 and T2 content (HT2+T2) of oats was 570 ppb. The DON content of wheat and the HT2+T2 content of oats were modelled against the agronomy for each sample. The model for DON was similar to those determined for DON in wheat in other countries with large regional and seasonal differences, and significant effects of previous crop, cultivation, variety and fungicide use. There was no difference between organic and conventional wheat samples. The model for HT2 and T2 in oats was different; for example there were smaller differences between region and year. High HT2+T2 concentrations were detected in all regions and years. Organic samples had a significantly ($P < 0.001$) lower HT2+T2 content compared to conventional samples. Due to the multicollinearity within the dataset (ie organic and conventional growers tended to use distinctly different agronomy) the model could not accurately determine the relative importance of various agronomic factors, although the model did identify previous crop, cultivation and variety had some impact. Results indicate that the impact of agronomy on mycotoxin content of cereals can differ between mycotoxins and consequently the advice to cereal growers in the form of "Good Agricultural Practice" to reduce *Fusarium* mycotoxins must be crop/mycotoxin specific.

EFFECT OF FUNGICIDE TREATMENT IN FIELD TRIALS ON DIFFERENT FUSARIUM spp. AND MYCOTOXINS. O. Elen¹, I.S. Hofgaard¹, G. Brodal¹, H.U. Aamot¹, M. Jestoi² and S. Klemsdal¹. ¹Bioforsk-Norwegian Institute for Agricultural and Environmental Research, Plant Health and Plant Protection Division, Aas, Norway. ²Finnish Food Safety Authority, Evira, Chemistry and Toxicology Unit, Helsinki, Finland. E-mail: oleif.elen@bioforsk.no

Naturally infected field trials with oats and wheat were treated with the fungicides Amistar Duo (azoxystrobin+ propiconazole) and Proline (prothioconazole) in 2006 and 2007. The grain was analyzed for mycotoxins and the amounts of DNA of *Fusarium langsethiae/sporotrichioides*, *F. avenaceum*, *F. poae*, *F. culmorum*, *F. graminearum* and the *tri5* gene were quantified by real time

PCR analyses. So far we have results for the first year only. In oats, the toxins deoxynivalenol (DON), T-2, HT-2, moniliformin (MON), enniatin B (ENN B) and antibiotic Y (ANT Y) were found above detectable level, while the toxins found in wheat were zearalenone (ZEN), DON, 3-AcDON, ENN B and ENN B1. No statistical significant effect of fungicide treatments on mycotoxin levels was registered due to great variation between trials. However, DON was on average reduced by about 70% and a similar reduction was recorded in the amount of DNA of both *F. graminearum* and *tri5* in plots of wheat treated with Proline. In oats a similar effect of Proline on DON level was registered. Relatively high levels of T-2 and HT-2 were measured in some oat fields, but no reduction in mycotoxin content or DNA of *F. langsethiae/ sporotrichioides* was recorded in Proline-treated plots from these fields. In conclusion, Proline reduced the DON levels in both oats and wheat, whereas no reduction in T-2 and HT-2 was recorded in Proline-treated plots from these same fields.

EFFECT OF MANAGEMENT PRACTICES ON FUSARIUM ROOT INFECTION OF PEA CROPS GROWN IN ROTATION WITH SPRING WHEAT IN THE SEMI-ARID CANADIAN PRAIRIES. M.R. Fernandez¹, R.P. Zentner¹, E.N. Johnson², H.R. Kutcher³, B.G. McConkey¹ and R.J. Kremer⁴. ¹Semiarid Prairie Agricultural Research Centre, Agriculture and Agri-Food Canada, P.O. Box 1030, Swift Current, Saskatchewan S9H 3X2, Canada. ²Scott Research Farm, Agriculture and Agri-Food Canada, P.O. Box 10, Scott, Saskatchewan S0K 4A0, Canada. ³Melfort Research Farm, Agriculture and Agri-Food Canada, P.O. Box 1240, Melfort, Saskatchewan S0E 1A0, Canada. ⁴USDA ARS, 302 ABNR Bldg, University of Missouri, Columbia, MO 65211, USA. E-mail: fernandezm@agr.gc.ca

Fusarium avenaceum (Fr.:Fr.) Sacc. is the most important *Fusarium* head blight (FHB) pathogen in Saskatchewan, Canada. A few years ago, extensive surveys conducted in the eastern region of the province revealed that *F. avenaceum* was present at higher levels in cereal crops, especially barley, when grown after a pulse than after a cereal crop. Previous applications of glyphosate formulations (mostly pre-seeding) were associated with increased *Fusarium* infection of spikes and roots of crops grown under reduced tillage. However, because of the nature of these previous studies, the impact of tillage could not be completely separated from glyphosate use. A replicated experiment was established recently in southwestern Saskatchewan to separate effects of tillage method from glyphosate use on *Fusarium* root populations. Tillage treatments consisted of one spring tillage (minimum-till) or no tillage (zero-till), with or without glyphosate application. The glyphosate treatment was one pre-seeding application at the recommended rate. In 2007, *Fusarium* root rot levels were significantly higher in field pea roots in glyphosate treatments compared with glyphosate-free treatments, regardless of tillage. Pea root lengths also decreased significantly in the glyphosate treatments compared with glyphosate-free treatments. Similarly, root colonization by *Fusarium* spp. in glyphosate-resistant soybean increased after glyphosate relative to non-glyphosate treatments in 2006-07 Missouri field studies. Results help explain increased FHB and root rot caused by *F. avenaceum* in cereal crops grown in diversified cropping sequences that rely on glyphosate for weed control, and the apparent enhancement of *Fusarium* spp. on leguminous crops by glyphosate.

BREEDING FOR TOP QUALITY DURUM WHEAT RESISTANCE TO FUSARIUM HEAD BLIGHT AND LOW DON

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Fusarium head blight (FHB) is a wheat disease causing serious damages to durum wheat. Food industries are deeply concerned about contamination of wheat due to fungal mycotoxins. The disease is caused by different *Fusarium* species and it develops from heading stage under wet and warm weather conditions. Release of new varieties, which are resistant to FHB, is the most efficient way to contrast the disease with advantages both for environment and consumers health. In the breeding program carried out by PSB Ning 7840 a Chinese resistant cultivar was used in crosses with our Durum elite variety and the resulted lines were screened for FHB tolerance and DON content under controlled environment. Plants were screened with microsatellite markers for the presence of QTLs located on the chromosome arms 3BS and 5AS. We used a mixture of highly virulent and toxigenic strains of *F. culmorum* and *F. graminearum* as artificial inoculum by spray inoculation. The disease was recorded by visual scoring. For each plant we recorded seed weight, % of infected kernels and DON content. Selected lines showed a lower percentage of all the values compared to commercial varieties. These lines were assessed for yield potential in replicated trials in fields. Again the agronomic traits were recorded and the artificial infection was enhanced by watering the plants with sprinklers. In field we also recorded infection, production, test weight and DON content. Selected lines showed a significant difference in resistance compared to the test cultivars commercial lines.

ASYMPTOMATIC COLONIZATION OF SOYBEAN (*GLYCINE MAX*) BY *FUSARIUM VERTICILLIOIDES*. D.F. Kendra and M. Busman. *Mycotoxin Research Unit, National Center for Agricultural Utilization Research, Agricultural Research Service, United States Department of Agriculture, Peoria, Illinois, USA. E-mail: david.kendra@ars.usda.gov*

Crop rotation is an integral component in field crop production systems and is highly associated with improved yields and reduced weeds, disease and insect pests. In the U.S. Corn Belt, the most common crop rotation combination involves maize (*Zea mays*) and soybean (*Glycine max*). *Fusarium verticillioides* is often found in maize seeds which constitute an important source of inoculum in the field. In maize plants, the fungus may exist as an endophyte or as a primary causal agent of disease or as a secondary invader vectored by insects and under stress conditions produce a variety of mycotoxins, including fumonisins. At harvest infected debris is littered on the soil surface and incorporated into the soil which serves as an inoculum source for the next season crop. Since there is little information available regarding the interaction of *F. verticillioides* and soybean we used RT-PCR to quantify fungal colonization in healthy field produced plants. We also developed a greenhouse bioassay using a green fluorescent protein-expressing isolate of *F. verticillioides* to measure the asymptomatic colonization of soybean plants. Fungal infection and colonization did not affect plant growth and was not influenced by Roundup® treatment. The implication of an asymptomatic *F. verticillioides* – soybean interaction will be discussed in relation to the ecological usefulness of corn – soybean crop rotation.

***FUSARIUM GRAMINEARUM* ON MAIZE CROWNS AND ROOTS IN SOUTH AFRICA.** S.C. Lamprecht¹, M.P.W. Farina², G.R. Thibaud³, M. Marais⁴, J.H. Habig⁴, J.F. Bloem⁴ and A.

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The incidence of *Fusarium graminearum* on maize crowns and roots was recorded in a trial conducted in KwaZulu-Natal (KZN), South Africa, to determine the effects of alternative winter crops and soil treatments on no-till maize yields, soilborne diseases and microbial diversity and activity in soil. The maize cultivar PHI 32D96B was used and the trial consisted of fifteen treatments, which included the winter crops canola (CAN), crambe (CR), black oats (BO), wheat without tillage (C), wheat with tillage (T), soybean-wheat (SW), fallow (maize fallow = MF and soybean fallow = SF), soil treatments with anhydrous ammonia (AN) and methyl bromide (MB), a nematicide (N), and the biocontrol products Fungimax+Organoboost (OB), Spin+Web-starter (S), Eco-T (ECO) and Extrasol (EXT). Parameters were evaluated at 21, 70 and 100 days after planting. Incidence of *F. graminearum* increased from the beginning to the end of the season and was lowest in roots of plants subjected to the AN, CAN, CR, MB, MF, SF and T treatments. The highest mean incidence on roots and crowns was 30.6 (C) and 6.7% (EXT), and the lowest 11.1(T) and 0.0% (CAN), respectively. There were significant positive correlations between the incidence of *F. graminearum* and crown and root rot severity, especially at the third sampling time. The importance of this fungus as a crown and root rot pathogen of maize in KZN will be further investigated in future.

POPULATION DYNAMICS OF *FUSARIUM OXYSPORUM* f. sp. *CICERIS* ASSOCIATED WITH MONOCULTURE OF RESISTANT CHICKPEA CULTIVARS. B.B. Landa¹, R.M. Jiménez-Díaz^{1,2} and M.M. Jiménez-Gasco³. ¹Departamento de Protección de Cultivos, Instituto de Agricultura Sostenible, Consejo Superior de Investigaciones Científicas, P.O. Box 4084, 14080 Córdoba, Spain. ²Departamento de Agronomía, Universidad de Córdoba, Edificio C4 "Celestino Mutis", Campus Rabanales, Carretera de Madrid Km 396, Córdoba, Spain. ³Department of Plant Pathology, The Pennsylvania State University, University Park, PA 16802, USA. E-mail: jimenez-gasco@psu.edu

Fusarium wilt of chickpea, caused by the soilborne fungus *Fusarium oxysporum* f. sp. *ciceris* (Foc), is managed mainly by resistant cultivars. The efficiency of this management strategy can be limited by the occurrence of significant variation (two pathotypes, yellowing and wilting; and eight pathogenic races) in populations of the pathogen. Over the past ten years we have followed shifts in the population structure of Foc in an artificially infested field plot in Córdoba, southern Spain. This field had no previous history of chickpea cultivation, was infested with a single wilt-inducing Foc-race 5 genotype in 1992 and since then has been continuously used for screening of chickpea germplasm resistant to race 5. Five years after continuous chickpea monoculture, disease (yellowing syndrome) developed in the race 5-resistant cv. PV1 which is susceptible to Foc races 0, 1A, 1B/C, and 6. We have analyzed over 600 *F. oxysporum* isolates obtained in 1998, 2001, 2002, 2004 and 2005 from stems of different chickpea cultivars, and typed them into *forma specialis ciceris* and Foc races by means of specific-PCR assays and DNA fingerprinting analyses. Results indicate that additional Foc races have developed in the field plot that was initially infested exclusively with a Foc-race 5 genotype, as a result of continuous chickpea monoculture. Those

Foc races are 0, 6, or other unidentified races. Several lines of evidence suggest that chickpea monoculture in the infested soil may have induced changes in the virulence and/or pathogenicity structure in Foc and/or *F. oxysporum* populations that initially inhabited the soil.

FUSARIUM HEAD BLIGHT IN KENYA AND POSSIBLE MANAGEMENT STRATEGIES. J.W. Muthomi, G.M. Riungu, J.K. Ndung'u, R.D. Narla and J.K. Gathumbi. *Department of Plant Science and Crop Protection, University of Nairobi, P.O. Box 30197, 00100 GPO Nairobi, Kenya. E-mail: james_wanjohi@yahoo.com*

A survey was carried out to determine occurrence of FHB of wheat during the 2004 and 2006 growing seasons. FHB incidence was determined as the number of blighted ears per 10 m² while severity was determined as the proportion of spikelets bleached. Isolation of the causal fungus was done from ears and grain samples. Mycotoxin content in the grain was determined by competitive ELISA. Effect antagonistic microorganisms on FHB severity and mycotoxin content was tested by co-inoculating *F. graminearum* together with antagonistic microorganisms. FHB was found to be highly prevalent, with an incidence of 7% and severity of 24%. The major causal *Fusarium* species were *F. poae*, *F. graminearum*, *F. chlamyosporum*, *F. equiseti*, *F. oxysporum*, *F. verticillioides* and *F. avenaceum*. Higher fungal contamination was found in ears (34.6%) and grain (53%) during the 2006 season. The same was observed for deoxynivalenol (DON) in grain. Other mycotoxins detected in the grain samples were zearalenone (3.8 µg/kg), T-2 toxin (22.7 µg/kg) and aflatoxin (1.7 µg/kg). *Trichoderma* sp. reduced FHB severity but resulted in increased DON content. Folicur and copper oxychloride reduced FHB severity by 48.7% and 32%, respectively and reduced DON by 93%. The results indicated that integration of biological and chemical control could be used to manage FHB. Constant surveillance for the presence of FHB and DON is necessary. More studies are needed to explore other biological control agents effective against FHB.

IDENTIFICATION OF BREAD WHEAT RESISTANCE AGAINST DRYLAND CROWN ROT (*FUSARIUM CULMORUM*) UNDER INOCULATED FIELD AND CONTROLLED GREENHOUSE CONDITIONS IN TURKEY. J.M. Nicol¹, A. Bagci², N. Bolat³, G. Erginbas¹, E. Sahin¹, A.F. Yildirim³, F. Ozdemir², A. Yorgancilar³, A.T. Kilinc³, R.T. Trethowan⁴ and Y. Manes⁴. ¹CIMMYT (International Maize and Wheat Improvement Centre), P.O. Box 39, Emek, 06511 Ankara, Turkey. ²Babri Dagdas International Agricultural Research Institute, Konya, Turkey. ³Anatolian Agricultural Research Institute, Eskisehir, Turkey. ⁴CIMMYT Mexico, El Batan, Mexico. E-mail: j.nicol@cgiar.org

Crown rot (CR) caused by *Fusarium* is a major biotic constraint in many rainfed wheat cropping systems of the world. *F. culmorum* is the dominant causal species in Turkey and has been found to cause yield losses of up to 43% on winter wheats. Since 2002 Turkey in collaboration with CIMMYT International has established screening methods under field and greenhouse conditions to screen wheat germplasm to identify resistance against CR. Over the past 5 years more than 8000 germplasm from National and International sources have been screened and to date 19 sources have been repeatedly confirmed in two or more field and greenhouse tests providing resistance equivalent or better than the best known published resistant sources 2-49 and Sunco. All of

these sources are in advanced high yielding backgrounds and some released Turkish cultivars. Of these 19 sources 14 are winter wheat with 7 originating from the joint TURKEY-CIMMYT-ICARDA International Winter Wheat Improvement Program and similarly 7 from the Turkish National Program. Five are spring wheat, 4 coming from CIMMYT Mexico wheat breeding program (two are synthetic derivatives) and one is an advanced line from Australian breeding program (with three sisters). Significant progress has been made to identify resistance which is now being actively incorporated into both National and International Breeding programs and being distributed to interested collaborators.

SOURCES OF BREAD WHEAT RESISTANCE COMBINED WITH DRYLAND CROWN ROT (*FUSARIUM CULMORUM*) FROM TURKEY AND FUSARIUM HEAD SCAB (*F. GRAMINEARUM* AND *F. CULMORUM*) IN AUSTRIA AND MEXICO UNDER INOCULATED FIELD CONDITIONS. J.M. Nicol¹, J. Lewis², H. Buerstamyr³, E. Duveiller² and F. Ozdemir⁴. ¹CIMMYT (International Maize and Wheat Improvement Centre) P.O. Box 39, Emek, 06511 Ankara, Turkey. ²CIMMYT Mexico, El Batan, Mexico. ³University of Natural Resources and Applied Life Sciences Department for Agrobiotechnology (IFA-Tulln) Institute for Plant Production Biotechnology, Tulln, Austria. ⁴Babri Dagdas International Agricultural Research Institute, Konya, Turkey. E-mail: j.nicol@cgiar.org

Crown rot (CR) and Fusarium head scab (FHS) caused by various species of *Fusarium* are major biotic constraints on wheat production systems. It is commonly accepted that CR is a problem in many rainfed wheat cropping systems of the world, whilst FHS occurs in more optimal irrigated/high rainfall wheat cropping systems. Recent literature has clearly indicated that the 2 species *F. culmorum* and *F. graminearum* can cause both CR and FHS depending on the environmental conditions. In light of this information and some of the forecasted predictions in climate change preliminary work has been undertaken to investigate if multiple sources of resistance could be found. A nursery of 121 diverse spring and winter lines with resistant and susceptible checks for FHS and CR were screened under inoculated field conditions in Turkey for CR (*F. culmorum*), and in Mexico and Austria under irrigated field conditions for FHS (*F. graminearum* and *F. culmorum*) using well published screening methods. Preliminary one year data has clearly indicated that around 15% of the germplasm screened offered resistance to both FHS in Mexico and Austria and CR in Turkey. Of these 15 lines, 6 were as resistant (R) as the widely accepted check lines for FHS and CR, 3 were R-MR (moderately resistance) and 6 MR compared with checks. Ten of these lines were spring and 5 winter type. One third of these lines were of Chinese origin. Work is underway to confirm these findings and possibly explore the genetic control of the resistance with both pathogens.

PLURIANNUAL EXPERIENCES IN CONTROLLING FUSARIUM HEAD BLIGHT AND THE CONTENT OF DON IN INFECTED KERNELS WITH DE METHYLATION INHIBITORS (DMI) FUNGICIDES. D. Pancaldi¹, P. Nipoti², A. Pisi², A. Prodi², S. Tonti², C. Oliver² and I. Alberti³. ¹Dipartimento di Protezione e Valorizzazione Agroalimentare, Università degli Studi, Viale Fanin 46, 40127 Bologna, Italy. ²Dipartimento di Scienze e Tecnologie Agroambientali, Università degli Studi, Viale Fanin 44, 40127 Bologna, Italy. ³Ente Nazionale delle Sementi Elette, Via Ca' Nova Zampieri 37, 37057 San Giovanni Lupatoto, Verona, Italy. E-mail: davide.pancaldi@unibo.it

Fusarium head blight (FHB) is the main worldwide wheat disease. In Emilia-Romagna (Northern Italy), the most frequent species responsible of FHB on *durum* wheat were *Fusarium graminearum* and *F. culmorum* since 1995. FHB can cause losses in production (0.6-2.7 t/ha) and seed quality, due to kernel infection and micotoxin accumulation. From 2000 to 2006, some DMI commercial fungicides were evaluated for their efficacy in controlling FHB incidence and severity, percentage of infected kernels and deoxynivalenol (DON) content in kernels. DMI were applied at anthesis stage (GS 60-61), in several cultivars of *durum* wheat, inoculated artificially with a mixture of *F. graminearum* and *F. culmorum* toxigenic isolates. Trials, on fourteen cultivars with bromuconazole, prochloraz and tebuconazole were performed from 2000 to 2002 and on four cultivars with epoxiconazole + prochloraz, cyproconazole + prochloraz, metconazole (not yet registered in Italy) from 2005 to 2006. These fungicides significantly reduced incidence and severity of FHB compared with the untreated control. The results showed an average efficacy in reducing the tested parameters of 53% and 68% respectively in the first experiment, 64% and 59% in the second. From 2000 to 2002 on six *durum* wheat cultivars, bromuconazole, prochloraz and tebuconazole significantly reduced the percentage of *F. graminearum* and *F. culmorum* infected kernels by averagely 63% and DON content of 66%, when compared with the untreated control. The knowledge of DMI efficacy in reducing FHB incidence and severity, infected kernels and DON content is very important for setting up disease control strategies.

FUSARIUM INFECTION AND MYCOTOXIN CONTENTS OF OATS UNDER DIFFERENT TILLAGE TREATMENTS. P. Parikka¹, V. Hietaniemi², S. Rämö² and H. Jalli¹. ¹MTT Agrifood Research Finland, Plant Production Research, 31600 Jokioinen, Finland. ²MTT Agrifood Research Finland, Laboratories, 31600 Jokioinen, Finland. E-mail: paivi.parikka@mtt.fi

Fusarium infection and mycotoxin contents of oat cvs Belinda, Freja, Roope and Veli were studied in a field trial in 2004-2006 under autumn ploughing and direct drilling. The infection of developing kernels was investigated from panicle emergence until harvested grain. Trichothecene mycotoxins on grain were analysed 2-3 weeks before harvest and at harvest. The weather in 2004 was very rainy and cool, in 2005 warm and less rainy, while 2006 was warm and dry. Fusarium infection was detected immediately after panicle emergence on all cultivars. The first species identified was a T-2/HT-2- producing species *F. langsethiae*, but also *F. poae* was found in the early stages of kernel development. The deoxynivalenol- producing species *F. culmorum* and *F. graminearum* colonized the kernels later. In 2005 and 2006, *F. poae* was most abundant in autumn-ploughed plots. Direct drilling increased the infection of *F. avenaceum* and reduced *F. culmorum*. Tillage did not have much effect on the *F. graminearum* and *F. sporotrichioides* infections of oats. However, it increased the *F. langsethiae* infection. Direct drilling decreased DON and NIV contents in grain, but seemed to increase T-2/HT-2 contents of oats. The amounts of DON detected were not high, the highest contents being below 800 µg/kg on cv Roope. T-2/HT-2 toxins were detected on all the cultivars, the amounts being highest in cv. Belinda (about 1000 µg/kg in 2006). The nivalenol contents were high in 2005 due to heavy *F. poae* infection.

PROTHIOCONAZOLE: A NEW ACTIVE SUBSTANCE AGAINST FUSARIUM HEAD BLIGHT AND DEOXYNIVALENOL ACCUMULATION IN WHEAT KERNELS. M. Pascale¹, M. Haidukowski¹, G. Perrone¹, A. Visconti¹, D. Pancaldi², C. Risi³ and P. Sidoti³. ¹Istituto di Scienze delle Produzioni Alimentari del CNR, Via Amendola 122/O, 70126 Bari, Italy. ²Dipartimento di Protezione e Valorizzazione Agroalimentare, Università degli Studi, Viale Fanin 46, 40127 Bologna, Italy. ³Bayer CropScience, Viale Certosa 130, 20156 Milano, Italy. E-mail: michelangelo.pascale@ispa.cnr.it

Prothioconazole is a new broad spectrum fungicide belonging to the new chemical class of triazolothiones. It exhibits ideal systemic properties providing protective, curative and long lasting activity. Prothioconazole has been showed to provide an outstanding control of the major fungal diseases in cereals, mainly those caused by *Fusarium* species. Fusarium head blight (FHB) is a worldwide disease of wheat caused by various fungi including *Microdochium nivale* and different *Fusarium* species (mainly *F. graminearum* and *F. culmorum*). It has been shown that the most common contaminant associated with FHB infected grains is deoxynivalenol (DON), a trichothecene mycotoxin primarily produced by *F. graminearum* and *F. culmorum*. During the 2004-05, 2005-06 and 2006-07 growing seasons, we carried out several field experiments in the North of Italy in order to evaluate the effect of Prothioconazole as a foliar application on FHB development, grain yields and DON accumulation in different cultivars of soft and durum wheat after artificial inoculation with a mixture of *F. graminearum* and *F. culmorum*. Treatments at the beginning of anthesis (BBCH 61) significantly reduced both FHB disease severity (up to 70%) and DON content (up to 90%) in the grain as compared to the inoculated control. Yields (tons/ha) were higher in plots subjected to Prothioconazole treatments. Our findings show that the application of fungicides containing Prothioconazole provides a strong reduction of FHB disease caused by *F. graminearum* and *F. culmorum*, allowing an increase in grain yields and a considerable reduction of DON content in wheat kernels.

MANAGEMENT OF POTATO SEED-PIECE DECAY AND TUBER DRY ROT CAUSED BY FUSARIUM SPP. IN ATLANTIC CANADA. R.D. Peters¹ and K.A. Seifert². ¹Agriculture and Agri-Food Canada, Crops and Livestock Research Centre, 440 University Avenue Charlottetown, PE C1A 4N6, Canada. ²Agriculture and Agri-Food Canada, Eastern Cereal and Oilseed Research Centre, Central Experimental Farm, KW Neatby Bldg., 960 Carling Avenue, Ottawa, Ontario K1A 0C6, Canada. E-mail: petersr@agr.gc.ca

Potato diseases caused by *Fusarium* spp. annually reduce crop yield and tuber quality in Atlantic Canada. Infected seed potatoes can rot after planting (seed-piece decay) resulting in poor stands. After harvest, *Fusarium* spp. cause a dry rot in storage which reduces crop quality. Studies undertaken from 2000-2007 have identified *Fusarium sambucinum*, *F. coeruleum* and *F. avenaceum* as the predominant species causing potato seed-piece decay and tuber dry rot in the region, although other minor species, including *F. crookwellense*, *F. sporotrichioides* and *F. oxysporum*, were also recovered. As well, inoculation trials revealed that isolates of *Fusarium* spp. from cereal (*F. sporotrichioides* and *F. graminearum*) and forage (*F. avenaceum* and *F. oxysporum*) crops could also be pathogenic to potato tubers. The amount of rot in potato seed, although an important determinant of stand establishment, was not correlated with the severity of rot in storage, due to the requirement of tuber wounds generated during harvest and handling operations as a prerequisite for storage disease. However, the pathogen

species that predominated in a particular seedlot was usually the major pathogen of concern in subsequent storage of daughter tubers, confirming the importance of seed-borne inoculum for initiation of post-harvest disease. Resistance to chemical seed and post-harvest treatments was documented in various *Fusarium* isolates, underscoring the continuing need for cultural control measures in the management of potato seed-piece decay and tuber dry rot.

THE GENUS *FUSARIUM* ON TRANSGENIC AND NON-TRANSGENIC HYBRIDS OF MAIZE. L. Slezakova¹, A. Kubatova² and F. Kocourek¹. ¹Crop Research Institute, Drnovska 507, 16106 Praha 6, Ruzyně, Czech Republic. ²Charles University, Faculty of Science, Benatska 2, 12801, Prague 2, Czech Republic. E-mail: Slezakova@seznam.cz

The potentially toxigenic species of the genus *Fusarium* are widespread and important maize pathogens causing stalk and ear rot. *Fusarium* diseases cause significant yield losses and in addition many of these species are potentially producers of mycotoxins which are harmful to humans and animals. The most frequent and known mycotoxins from maize samples are deoxynivalenol, fumonisins, zearalenon, HT-2 and T-2 toxin. The *Fusarium* species enter into maize through different routes. The very often route is damage of plants created by insects, especially by European corn borer (ECB) which is the major pest of maize in the Czech Republic. This damage of plants and their ears is often the initial infection site for toxigenic species. Bt-maize, expressing insecticidal crystal protein from soil bacterium *Bacillus thuringiensis*, is one of the dominant transgenic crops and can reduce the occurrence of toxigenic species with minimizing the risk of mycotoxins contamination in maize. This toxic protein Cry 1Ab expresses in green plants tissues and protects the plants against the pest. During the period 2002-2007 different samples of corn (preharvest and postharvest) from different localities of the Czech Republic were collected. The main aim of this study was to analyse the spectrum of toxigenic species occurring in different samples of maize. The most frequent species were *F. subglutinans*, *F. verticillioides*, *F. proliferatum*, *F. sporotrichioides* and *F. graminearum*. The effect of Bt-maize was confirmed in lower occurrence of potentially toxigenic species.

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PINEAPPLE FUSARIOSIS RESEARCH IN BRAZIL: PROGRESS UPDATE. J.A. Ventura¹, H. Costa¹ M.P. Culik¹ and P. Machado Bueno Fernandes². ¹INCAPER, Rua Afonso Sarlo 160, Bento Ferreira, 29052-010, Vitória-ES, Brazil. ²UFES, Núcleo de Biotecnologia, Vitória-ES, Brazil. E-mail: ventura@incaper.es.gov.br

Among the problems that limit pineapple (*Ananas comosus* var. *comosus*) yield in Brazil, fusariosis caused by the fungus *F. guttiforme* (Syn.: *Fusarium subglutinans* f. sp. *ananas*) is the most serious one, with losses commonly estimated to be 30 to 40% in marketable fruits, and 20% for propagative material (slips and suckers). Significant progress has been made in understanding the pathogen biology, with the phylogenetic analysis of the fungal populations from different Brazilian regions, and epidemiology of fusariosis. Control of this disease is based on the integration of cultural practices and the use of fungicides from the early stages of inflorescence development until the flowers close. However, in the long run, pathogen populations resistant to the conventional fungicides may arise. Use of disease-resistant pineapple varieties, besides being an alternative of economic and more efficient control is also an environmentally safe approach. Promising resistant pineapple genotypes (hybrids) having good horticultural characteristics and fruit quality, were identified in the Brazilian breeding program and evaluated under field conditions. Pineapple cultivars were further evaluated to determine their resistance to plant and fruit fusariosis in seedling tests in the greenhouse. In adult field tests, natural and artificially inoculated plants and inflorescences (flowers) were rated on their resistance, to identify and obtain resistant hybrids with desirable horticultural characteristics, and good yield and fruit quality. Cultivar Vitória presents resistance to fusariosis, with better quality of the fruits and agronomic characteristics similar or superior to the prevalent commercial cultivars. This new resistant cultivar was released to growers in November of 2006 in Espírito Santo, Brazil, and eliminates the use of fungicides, reducing the production costs per hectare and risks of negative environmental impact.

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