MYCOTOXINS, FOOD SECURITY AND CLIMATE CHANGE

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Food security issues have become important as prices of staple grains have increased in the last few years. Climate change is expected to increase pressure on food supply/quality/sustainability worldwide. It has also been suggested that pests and pathogens may be moving from the equator to the poles at a systematic rate and that increased damage to staple food grains will occur. This may exacerbate impacts on mycotoxin contamination and on yields. Thus, changes in rainfall patterns, drought, temperature and CO_2 all impact on staple food production systems. It has been suggested that there will be "hotspots" in different regions of the world where the temperature may increase by +2-4^{o}C, where rainfall patters and drought events may increase, resulting in more rapid desertification and significantly impacting on staple food crop yields. Thus for staple cereals a doubling or tripling of CO_2 (350-400 to 800-1200 µl/l) and an increase in temperature will have a penalty on yield and nutritional quality while for rice this could increase crop biomass although effects on yield and quality are less clear. Plant stress inevitably leads to increased susceptibility to fungal infection, pre- and post-harvest, and potential for increased contamination by mycotoxins (Magan et al., 2011; Wu et al., 2011; Median et al., 2014; 2015). There has been significant interest in the impact that climate change environmental factors have on the ecology of mycotoxigenic moulds pre- and post-harvest in staple cereals. Using a mycotoxin microarray with sub-arrays for trichothecene B, aflatoxin and fumonisins we have examined the interaction between toxin gene clusters, growth and toxin production under different climate change environmental factors (water availability, temperature, CO_2) using strains of *Fusarium graminearum*, *Aspergillus flavus* and *Fusarium verticillioides* respectively. These data sets have been integrated for the first time using a mixed growth model and linking this to expression of key biosynthetic structural and regulatory genes in the biosynthetic pathways for mycotoxin production (6 *TRI*, 10 Afl and 9 FUM genes) to develop predictive models. This approach also allows the relationship between different key genes in to be determined and the importance of individual genes under different environmental conditions to be evaluated. The models can also be used to predict the relative risk of production of these mycotoxins under different climate change scenarios. We have now got data which shows that different spoilage and mycotoxigenic fungi respond differently to climate change scenarios with some responding by producing more mycotoxins, while other producing less mycotoxin. Growth is either unaffected or stimulated by elevated temperature + CO_2 and drought stress. These results are discussed in relation to food spoilage and the food security agenda.

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