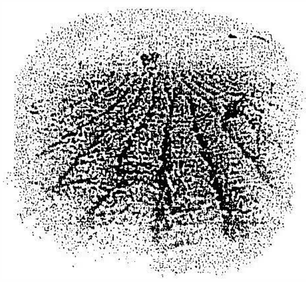
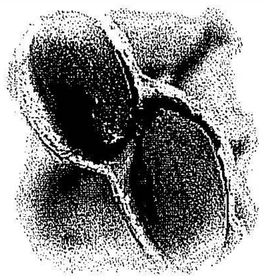
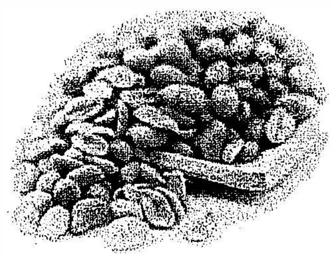
SUMMARY
International Peanut Conference 2005

Prospects and Emerging Opportunities for Peanut Quality and Utilization Technology

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Management of Aflatoxins in Groundnut in Southern India

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Aflatoxin contamination of groundnut is one of the most important quality constraints in the semi-arid tropics. The economic implications of aflatoxin problem and its' potential health threat to human/animals have clearly created a need to eliminate or at least control or minimize aflatoxin contamination of food and feed. The aflatoxins producing fungi *Aspergillus flavus* and *A. parasiticus* invade groundnut seed in the field before harvest, during post harvest drying and in storage. Semi-arid tropical environment is conducive to pre-harvest contamination when the crop experience drought before harvest, whereas in wet and humid areas, post-harvest contamination is more prevalent. Preventive methods such as host-plant resistance, cultural practices, biological control and integrated management strategies are helpful to reduce aflatoxin contamination.

Diagnostic tools

Aflatoxin determination in groundnuts and many other crops can be done by various physicochemical and immunological methods. Research at ICRISAT focused on developing simple, quick and cost effective immunological tools for aflatoxins estimation in groundnut as well other food products. We produced high titered polyclonal as well as monoclonal antibodies for aflatoxin B_1-BSA conjugate. The selected monoclonal antibodies showed specificities, recognizing B_1 alone or B_1 and G_1 or B_1, B_2, and G_1. Using these antibodies, we developed direct and indirect ELISA protocols for estimation of aflatoxins as low as 5 μg/kg. The results obtained by ELISA were comparable to that of HPLC analysis. We also produced polyclonal antibodies to aflatoxin M_1 and developed the protocols for estimation of aflatoxin M_1 in milk. It was observed that aflatoxin M_1 was more prevalent in peri-urban than rural milk samples (Waliyar *et al.* 2003).

Host-plant resistance

Genetic resistance to *A. flavus* invasion and aflatoxin production is considered as one of the cheapest mechanisms that can contribute to combat the aflatoxin contamination. During the 1980s we focused on identifying sources of resistance to *A. flavus/A. parasiticus* infection and aflatoxin contamination at Patancheru and in West Africa. More than 25 genotypes have been identified as resistant to *A. flavus* infectionand aflatoxin and some accessions (J11, 55-437, U 4-47-7, AH 7223, UF 71513 and ICGV 87107) have shown consistent resistant reaction to seed infection in India, Senegal and Niger (Mehan *et al.* 1991 and Waliyar *et al.* 1994). Later in 1990s the *A. flavus* resistant germplasm sources were utilized extensively in breeding programs. All the breeding lines were screened in the sick plot under artificial inoculated and stimulated end-season drought conditions. Promising lines were screened under rainout shelters. We have identified several lines resistant/tolerant to *A. flavus* infection and aflatoxin contamination with drought tolerance and high yield potential. In the new millennium, 14 high yielding and aflatoxins resistant/tolerant groundnut breeding lines are being tested in farmers' fields using participatory technology development (PTD) processes in Anantapur, Chittoor and Mahabubnagar districts of Andhra Pradesh. In this participatory varietal selection process, the farmers, traders and oil-millers were involved in selection of the varieties. The performance and farmer preference of the varieties varied with district. In Anantapur, ICGV 94434 and ICGV 94379 and in Chittoor, ICGV 94434 and ICGV 91284 produced 25-45% higher pod yield with very little or no aflatoxin contamination. Two lines ICGV 88145, ICGV 89104 have been registered as improved germplasm with tolerance to *A. flavus* infection in the field (Rao *et al.* 1995).

Biological control

Several bio-control agents such as non-toxigenic strains of *A. flavus*, *Trichoderma, Bacillus, Pseudomonas*, have been reported to control aflatoxins in groundnut. In *in vitro* studies at ICRISAT, we have identified *Trichoderma viride* and *T. harzianum*, as potential biocontrol agents for control of aflatoxins contamination in groundnut. The *Trichoderma viride* biocontrol agent was tested in on-farm trials in Anantapur and Chittoor . An average *A. flavus* infection was reduced from 32% to 8% and aflatoxin contamination from 92 μg/kg to 26 μg/kg.

Integrated Management of Aflatoxins

The problem of aflatoxin contamination in groundnut is endemic in rain-fed crop facing end of season drought. It is well established that there is a good correlation between drought at the end of the season and aflatoxin contamination. Any crop management practice that can improve water retention at the end of the season is likely to reduce the aflatoxin contamination. Keeping this in mind, we started a field experiment comprising 15 treatments (compost containing antifungal bacteria, gypsum, *Trichoderma viride* biocontrol agent, cereal crop residue and their combinations) with two varieties (susceptible JL 24 and resistant J11) laid-out in a split-split plot design. The highest reduction in aflatoxins contamination (>97%) in cultivar JL 24 was observed with bio-control agent (*Trichoderma viride)* (from 1067 μg/kg to 23 μg/kg) and gypsum + bio-control agent (*Trichoderma viride)* + compost (from 1811 μg/kg to 49 μg/kg) treatment application. Six other treatment (cereal residue, gypsum, compost + cereal residue, compost + gypsum, gypsum + bio-control agent (*Trichoderma viride)* and compost + cereal residue + bio-control agent (*Trichoderma viride*) applications in JL 24 also showed 64-96% reduction in aflatoxins contamination. In J 11, gypsum + bio-control agent *Trichoderma viride* + compost treatment application reduced >99% (from 3381 μg/kg to 6 μg/kg) aflatoxins contamination. Eight other treatment (compost, cereal residue, gypsum, cereal residue + gypsum, cereal residue + bio-control agent *Trichoderma viride*, gypsum + bio-control agent *Trichoderma viride*, compost + cereal residue and cereal residue + bio-control agent *Trichoderma viride* + gypsum) applications in J 11 also showed 65-96% reduction in aflatoxins contamination. Further trials are in progress to confirm the results.

Cultural practices

Several research reports indicate that cultural practices such as application of farm yard manure, gypsum, crop residues, adjusting planting period to avoid end of season drought, plant protection measures, removing the dead plants before harvest, avoiding the glean collections, harvesting at right maturity, quick wind-row drying and early stripping or threshing help in reducing aflatoxin contamination. Based on this information we tested a package of improved practices designed to increase yield to see if they reduce aflatoxin contamination as well. The package of improved practices comprises seed treatment (Mancozeb @ 3g/kg and chlorophyriphos), fertilizer application based on soil test, application of gypsum (500 kg/ha) and management of pest and foliar diseases. The improved practices in comparison to farmer practices were tested thru PTD process in on-farm trials in Anantapur and Chittoor. In general improved practices increased yield and reduced aflatoxins contamination. Although aflatoxin contamination was reduced (from 796 μg/kg to 176 μg/kg, on average), these levels are not low enough to meet the international standards.

For more information visit www.aflatoxins.info

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