Breeding Resistant Varieties: A Component for Aflatoxin Management in Groundnut

H.D. Upadhyaya, S.N. Nigam, V.K. Mehan, D. McDonald, and D.H. Smith[1]

The contamination of groundnut (*Arachis hypogaea* L.) by aflatoxins is a serious problem in most groundnut producing countries. The aflatoxin producing fungi, *Aspergillus flavus* and *A. parasiticus*, can invade groundnut seed in the field before harvest, during drying and curing after harvest, and in storage. The semi-arid tropics are conducive to preharvest aflatoxin contamination when crops experience drought before harvest. In wet and humid areas, postharvest contamination is more important. Breeding resistant varieties should provide an important component for the integrated management of aflatoxin.

Types of Resistance. The resistance to aflatoxin producing fungi operate at three sites: the pod, the testa, and the cotyledons. Sources of resistance to pod infection, seed colonization, seed infection, and aflatoxin production have been identified.

Breeding for Resistance. Breeding high-yielding groundnut varieties resistant to seed infection and colonization by *A. flavus* and *A. parasiticus* and/or to aflatoxin production is a major objective at ICRISAT. We have used sources of resistance to seed infection/colonization, and two sources of resistance to aflatoxin production in an effort to combine multi-site resistances with high yield.

---

1. Groundnut Breeder; Principal Groundnut Breeder; Groundnut Pathologist; Program Director (Legumes); and Principal Legumes Pathologist, ICRISAT Center, Patancheru P.O., Andhra Pradesh 502 324, India.

Wallyar, F., Ntare, B.R., and Williams, J.H. (eds.) 1993. Summary Proceedings of the Third ICRISAT Regional Groundnut Meeting for West Africa, 14-17 Sep 1992, Ouagadougou, Burkina Faso (In En., Fr.) Patancheru, A.P. 502 324, India: International Crops Research Institute for the Semi-arid Tropics.

Selection. We have modified our breeding scheme to the single seed descent method for generation advance and delay selection until the F_4 generation. In the F_5 generation, selected single plants are evaluated in progeny rows for reactions to diseases and insect pests, and yield potential. Phenotypically uniform progenies are evaluated for resistance to preharvest seed infection in imposed drought conditions. Lines are then evaluated for yield in replicated trials, and for resistance to seed colonization in the laboratory. Selected advanced breeding lines are evaluated for aflatoxin contamination. Next, breeding lines with resistance to aflatoxin contamination and high yield potential are evaluated in international trials. Resistant material reaches farmers through our cooperators in the national programs.

Progress in Breeding for Resistance. Several hundred breeding lines have been evaluated for resistance to seed colonization in laboratory tests. We evaluated 119 lines for resistance to natural seed infection and yield. Some lines have consistently shown resistance to seed infection and colonization and have given high yields: ICGVs 88135,88145, 89063, 89106, 89112, and 89115. The short-duration variety, ICGV 86168, yielded 18% more than the resistant control variety J 11 (1.74 t ha^{-1}) in 12 evaluations and showed equal or more resistance to seed colonization and infection. Three ICRISAT breeding lines (ICGVs 87094, 87107, and 87110) have shown resistance at three locations in Niger. The limitations of resistant sources makes the breeding of varieties completely free from aflatoxin contamination very difficult.

Future Plans. As we need to know the allelic relationship between the genes for resistance in different sources, we initiated genetic studies on the inheritance of resistance to seed colonization and aflatoxin production. We started the second cycle of breeding and selection, with the newly developed seed infection/colonization resistant varieties as parents. We shall evaluate selected varieties for resistance to seed infection and colonization by aflatoxin producing fungi in multilocational trials.