Groundnuts that are allowed to dry well immediately after harvesting tend to develop negligible levels of contamination, where as groundnuts left out but covered with haulms and leaves tend to develop alarming levels of aflatoxin contamination (Table 4). The most effective control was achieved through immediate removal of pods from the harvested plants, but this has labour constraints at the time when other farm activities are at their peak. There is a need to explore cheap dryers that can be used by farmers during the harvest period.

Table 4. Effect of method of harvesting and drying on aflatoxin contamination (susceptible variety,47-10) Kayes, average of 7 farmers (2004).

Farmer	Traditional	Improved	Reduction percentage (%)
Madou	71.31	20.02	72
Savadogo	60.08	18.01	70
Yaya	58.01	21.53	63
Mamadou	79.52	28.31	64
Coumba	59.62	15.73	74
Djènèba	74.48	27.01	64
Kandé	44.86	14.28	68
SE ±	2.999		
CV (%)	43		

Conclusions

Correct handling of groundnut during and after harvest will reduce fungal growth and aflatoxin contamination thereby increasing the marketability of groundnuts and increasing sales and income by groundnut farmers.

There is a need for increased awareness for aflatoxin contamination and health hazards.

The role of resistant varieties is striking and they are the most practical means to reduce aflatoxin contamination in groundnut.

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On-farm management of aflatoxin contamination of groundnut in West Africa

Aflatoxin is a toxic substance produced by mould fungi (*Aspergillus flavus* and *A. parasiticus*) that can grow on poorly managed agricultural crops, particularly groundnuts. If eaten in sufficient quantities, aflatoxin can cause serious sicknesses that can lead to liver and several other cancers. Groundnuts for sale and export should be free from aflatoxin. Therefore appropriate crop management is essential at pre-and post harvest times.

Moldy groundnuts

ICRISAT and partners have developed several technologies that can contribute to reducing risks to aflatoxin contamination. These include genetic resistance, integrated crop management practices, agronomic practices, biological control, and biotechnological interventions.

A number of these technologies have been tested on-farm with farmers in Mali. ICRISAT has also developed inexpensive quantitative methods for the detection of aflatoxin in groundnut-based products and feed. The ELISA based diagnostic test is reliable, cost effective and easy to carry out. This can help NARS, NGOs, traders and exporters to undertake large scale testing of groundnut-based foods and feed for aflatoxin.

Selected technologies

Resistant/tolerant varieties

Past research has identified and developed groundnut varieties that are tolerant to *Aspergillus flavus* invasion and subsequent aflatoxin contamination. The first action was to expose these varieties to groundnut farmers through participatory on farm trials/ demonstrations. In such trials in the district of Kolokani and Kayes, the main groundnut producing regions in Mali, low levels of aflatoxin contamination were recorded(Table 1). Similar trials/demonstrations have been extended to Niger, Nigeria and Senegal.

Table 1. Rages and means of aflatoxin content (ppb) in tolerant varieties evaluated by 10 farmers in Kolokani, 2004.

Variety	Range (ppb)	Mean (ppb)	Pod Yield (t/ha)	Haulm Yield (t/ha)
ICG 6101	0.22-1.46	0.86	0.82	1.15
ICG 7	0.02-0.96	0.36	0.92	0.89
ICG 6222	0.51-4.27	1.86	0.82	1.13
ICGV 88274	1.64-11.29	5.87	0.72	1.07
ICGV 92093	2.17-12.45	6.71	0.86	1.07
Res. check: 55-437	0.06-2.45	1.02	0.93	1.07
Susc. check: Fleur 11	70.89-118.18	92.49	0.94	0.93
SE ±	1.920		0.064	0.066
CV (%)	39		23	20

Integrated management practices

Infection of groundnut pod/kernel by the mold fungi occurs both in pre-and post-harvest conditions. In the pre-harvest conditions, end-of-season drought is a major predisposing factor. Technologies to mitigate effect of drought have been developed. These have been tested in two major groundnut regions of Mali (Kolokani and Kayes). The technologies are the application of lime, crop residues and farmyard manure and their combination. These treatments were applied to a resistant (55-437) and a susceptible (JL 24) variety with farmer participation. Results averaged over two cropping seasons are presented in Tables 2 and 3. All treatments significantly reduced aflatoxin contamination, especially in the susceptible variety. The application of lime reduced aflatoxin contamination by 84%.

Table 2. Aflatoxin contamination (ppb) under various agronomic practices in Kolokani (averaged over 5 farmers in 2003 and 2004 crop seasons).

Treatment	Variety		Pod Yield (t/ha)	
	55-437	JL24	55-437	JL24
Lime 50DAP	1.90	52.34	1.16	1.06
2.5 t/ha FYM	2.07	64.07	1.27	1.09
2.5 t/ha residue	3.28	126.59	1.14	1.03
Lime + residue	2.76	79.53	1.24	0.96
FYM + residue	4.20	90.64	1.39	1.18
Check	6.21	190.84	1.00	1.07
SE ±	1.22		0.087	

Table 3. Aflatoxin contamination (ppb) under various agronomic practices in Kayes (averaged over 5 farmers in 2003 and 2004 crop seasons).

Treatment	Variety		Pod Yield (t/ha)	
	55-437	JL 24	55-437	JL 24
Lime 50DAP	0.12	4.20	2.208	2.204
2.5 t/ha FYM	0.26	6.76	2.460	2.468
2.5 t/ha residue	0.79	36.71	1.952	2.080
Lime + residue	0.36	7.36	2.004	2.081
FYM + residue	0.94	12.10	2.576	2.460
Check	2.83	82.32	2.83	82.32
SE ±	1.564		0.082	

Best-bet harvesting and drying technique

Groundnuts need to be harvested at the correct time. Delay in harvesting results in over maturity leading to mould infections and subsequent aflatoxin contamination.

Poorly dried groundnuts enhance fungal growth and aflatoxin contamination. Good storage with kernel moisture of <10% does not permit mold growth and aflatoxin contamination. Poor curing can induce fungal growth (aflatoxin contamination) and reduce seed quality for consumption, marketing and germination.

Traditional drying method vs. improved