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Findings from On-Farm Acquisition of Maize Contaminated with Aflatoxin

AflaSTOP: Storage and Drying for Aflatoxin Prevention

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Implemented by:

Meridian Institute

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Partnership for Aflatoxin Control in Africa

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Introduction

From March–June 2014, the AflaSTOP project sought to acquire 53 tons of grain contaminated with aflatoxin. This grain was sourced from smallholder farmers in Meru and Makeuni districts of Kenya and provided the raw materials for AflaSTOP's testing of the effectiveness of a variety of storage devices in stopping the growth of aflatoxin in maize. Contaminated grain was swapped for "clean" grain.

This report summarizes findings from that acquisition process, including the experience identifying and interacting with farmers, the process used to test bags "on-site," and data on amounts sourced, contamination levels, and prevalence of contamination in bags tested. Results from the storage testing phase will be available in early 2015.

Mobilization for Swapping Maize

To source contaminated grain from individual smallholder farmers as outlined in the implementation approach, the project worked with the Ministry of Agriculture and a consultant to identify 200 farmers in Makueni and 200 farmers in Meru. These areas were previously identified as having high levels of aflatoxin. The identified farmers were asked to have about 10 bags of untreated, shelled maize ready for testing. The teams visited each smallholder farmer, discussed the aflatoxin problem, asked the farmers if they were willing to have their maize checked, and informed them that their contaminated maize bags would be swapped with "clean" tested bags of maize. AflaSTOP also informed the farmers that due to Government of Kenya regulations, the project was required to remove any maize with aflatoxin levels above 10 parts per billion (ppb) from the farm after testing.

In order to meet the capacity of our storage devices, the project needed to acquire around 26,000 kg of maize for each region. This volume is a little more if the maize is wetter than expected and a little less if it is dryer. Based on the average farmer producing around 10 bags per acre with immediate sales post-harvest taken into consideration, we expected most smallholder farmers would store or have on-hand around 10 90-kg bags (around 50% of their harvest). The AflaCONTROL project surveyed aflatoxin levels as maize came off the field and found that in both Meru and Makueni the levels were around 43%; based on this, the project estimated it would need to visit around 72 farmers to source 289 bags of maize.

As there are no accurate field tests available for aflatoxin, the project used Neogen scanners to test in front of the farmer. The test requires that the maize is the consistency of instant coffee, so the maize was ground using small mobile maize mills. To run the Neogen scanners, which are not battery operated, we used an inverter off one of the two trucks that visits each farmer.

The sample was analyzed based on the Neogen protocol, and the bag from which the sample was taken was marked contaminated or not. Once all bags had been marked, non-contaminated bags were set aside, while each contaminated bag was weighed and swapped for "clean" maize. The contaminated bags were loaded onto the waiting truck designated for contaminated maize.

Vital to the success of this activity was the continued support from the Ministry of Agriculture in Meru and Makueni, which provided agricultural extension officers to accompany AflaSTOP teams on the visits to famers.

The project would like to highlight the valuable assistance of Mr. Kaburu (County Director of Agriculture) and Mr. Murage (Agricultural Extension Officer) in Meru and Ms. Elizabeth Ndinda Muia (Agricultural Extension Officer) in Makueni.

Summary of Findings

In **Meru**, it was relatively easy to identify farmers with larger volumes of grain. The level of knowledge of aflatoxin in the Meru area was considerably lower than that of Makueni; however, the Meru farmers were more worried and willing to have their maize tested.

In **Makueni,** it was more difficult to acquire grain, as farmers often concealed the true number of bags they had, whether they had shelled or not, or whether they had fumigated or not and they were resistant to Kenyans from outside of the region to visiting their farms. In discussing the aflatoxin issue with farmers, they talked about how they had lived there all their lives, had always eaten maize, and were fine—as such, they did not believe there were problems.

In **Meru**, based on testing the first bag at each farm, **75% of farmers had grain above 10ppb**, and **61% of the bags tested were above 150ppb**.

In Makueni, based on testing the first bag at each farm, **74% of farmers had grain above 10ppb**, and **35% of the bags tested were above 150ppb**.

Table 1: Summary of findings from grain acquisition process[1]

	Meru	**Makueni**
Total metric tons acquired	26.5	26.602
Total bags tested	300	366
Areas where bags were tested	Giaka, Gachua, Kiburine and Mbririkene	Ikani, Kalama, Kee, Kilala, Kivani, Kola, Kukia, Kyambalaji, Mukuyuni, Miimandu, Okia and Wote
Total farmers visited	12	67 and 1 school
Average bags per farmer	28*	5.6
Based on the first bag tested, percent of farmers with contaminated grain	75	74
Percentage of bags above 150ppb	61	35
Average and medial aflatoxin levels**	114 150	77 55
Percentage of maize which looked good and the team would have eaten (the balance looked moldy or very moldy)	56%	97%
Percentage of farmers who sun dried cobs	83%	97%
Number of days farmers with “clean” maize sun dried cobs	14	12
Number of days farmers with contaminated maize sun dried cobs	7	6
Average moisture	18.01%	13.95%
Moisture range	15.4 - 21.4%	11.8 - 17.7%

***** *One farmer had 90 bags and another had 200 bags; these were not included in the average. Both these farmers had several farms. For one of them, the first bag was below 10ppb, and we did not test the remaining bags; the other farmer's first bag was above 150ppb.*

*****This is not a true average since AflaSTOP did not go back to verify the exact aflatoxin level having established it was above 10ppb; results over 150ppb require a second testing to establish exact aflatoxin level.*

[1] Findings from the maize acquisition process in Meru and Makueni have been shared with the County Directors of both regions.

Table 2 provides a summary of the range of aflatoxin levels found in the tested bags.

Table 2: Range of aflatoxin levels found in tested bags

	Below 10ppb	10–49ppb	50–99ppb	100–149ppb	Above 150ppb
Meru	4%	16%	11%	8%	61%
Makueni	21%	26%	9%	8%	35%

The results above appear to indicate a correlation between drying time and likelihood of having aflatoxin. However, we think this is coincidental. To reduce cost and potentially increase speed, AlfaSTOP first tested only one bag; if that bag was below 10ppb, we moved on to the next farmer. Just because the first bag was below 10ppb did not mean the rest of the maize was the same. Looking at the data, there was a one in five chance of finding aflatoxin in the first bag.

Table 3 illustrates the range of aflatoxin levels for farmers with five or more bags, where *all* bags were tested.

Table 3: Range of aflatoxin levels (as percentage of whole) for farmers with five or more bags, where all bags were tested

Below 10ppb	10–49ppb	50–99ppb	100–149ppb	Above 150ppb
19%	25%	10%	10%	32%

To understand better whether there is a causation link between drying times and lower aflatoxin levels, we would have to test all the bags of every farmer for a larger sample size. In a couple of cases, someone with a low contamination rate in their first bag still had all their other bags tested. The scenarios below illustrate several examples of this:

- Farmer Ben: Even though Ben's first bag was below 10 ppb, we tested his other 11 bags: 42% were below 10ppb, 50% between 10–49 ppb, and 7% between 50–99 ppb. Ben dried his cobs for three days.
- Farmer Boris: Boris's first bag was contaminated, from all his bags 25% were below 10ppb, 50% between 10–49 ppb, 16% between 50–99 ppb, and 8% between 100–149 ppb. Boris dried his 11 bags for 14 days

Maize acquired from a local boarding school

We visited one school in the area that grows its own maize to feed its pupils (and reduce the fees). The school had recently harvested 55 bags of maize, and every bag was contaminated and was swapped with our “clean” maize; the range of contamination is provided in Table 4.

Table 4: Range of aflatoxin levels found in tested bags from local boarding school

School aflatoxin results	Below 10ppb	10–49ppb	50–99ppb	100–149ppb	Above 150ppb
	0%	29%	9%	9%	53%

The headmaster reported that the previous term he had had around 20 students in the hospital for “stomach” problems. Both he and AflaSTOP’s field agent Lizbancy talked about their lack of options. The headmaster needs maize to feed the students. Maize is now a stable food—it provides four times the calories that cassava does. Even if they stopped growing maize, the maize in their market comes from their neighbors who have an equal problem. Interestingly, when we discussed the value of the other crops Lizbancy could plant, it was clear that she could plant a variety of pulses (with yields very similar if not better than maize), which have a higher value and could easily be sold. With the cash, she could buy maize and still have surplus cash. However, it is so ingrained in her thinking that she must grow the food the family is going to eat that it is not considered.

> An interesting anecdote concerning the “my grain isn’t contaminated” mindset prevalent in rural Kenya can be seen when AlfaSTOP's own local agent Lizbancy had her maize tested. She was shocked to discover her own six bags of maize were contaminated ranging from 25.5–150ppb—she assumed she’d be “safe” since she follows good agricultural practices.

In total, the project “swapped” just over 53 mt of maize; this represents the annual maize consumption of approximately 590 people, or the equivalent of approximately 215,000 portions of clean maize in the daily meals of the consumers.