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IMPACT OF AFLATOXIN CONTAMINATION ON GROUNDNUT EXPORTS IN MALAWI[1]

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ABSTRACT

Aflatoxin contamination is a serious quality problem at various stages of groundnut production, from crop growth to transportation. This paper presents an economic analysis of the impact of aflatoxin contamination on groundnut exports and trade balance in Malawi. Export losses due to aflatoxins ranged from MK 0.16 million (= US $ 0.057 million) in 1988/89 to MK 1.58 million (= US $ 0.845 million) in 1985/86 with a mean of MK 0.943 million (US $ 0.586 million). The export losses in groundnut as a percentage of the trade balance ranged from 0.01% in 1988/89 to 1.77% in 1981/82. Policy implications that would minimize aflatoxin contamination in groundnut are derived based on the results of the analysis.

***Key Words*: *Aspergillus flavus*, economic analysis, peanut, seed quality, trade balance.**

RÉSUMÉ

La contamination pour l'aflatoxine affecte sérieusement la qualité de la production arachidière à différents stades, depuis la croissance jusqu' au transport. Le présent article rapporte une analyse économique de l'impact de la contamination par l'aflatoxine sur les exportations de l'arachide et la balance commerciale au Malawi; les pertes d'exportation dues à l'aflatoxine ont varié de MK 0,16 million (US $ 0,057 million) en 1988/89 à MK 1, 59 million (US $ 0,845 million) en 1985/86 avec une moyenne de MK 0,945 (= US $ 0,586 million). Les pertes d'exportation de l'arachide exprimeés en pourcentage de la balance commerciale se sont situées entre 0.01% en 1988/89, et 1,77% en 1981/82.
Les résultats de cette analyse ont eu comme implications l'adoption d'une politique susceptible de minimiser la contamination de l'arachide par l'aflatoxine.

***Mots Clés*: *Aspergillus flavus*, analyse économoque, arachide, qualite de la remence, balance commerciale.**

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INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is the second most important crop after maize in smallholder agriculture in Malawi, providing approximately 25% of the agricultural cash income (Anon., 1987). More than 63% of the crop is produced in the Central region covered by the Lilongwe and Kasungu Agricultural Development Divisions. Pod yields are low, averaging 700 kg ha^{-1} (Babu *et al.*, 1994).

Prior to 1989, the Agricultural Development and Marketing Corporation (ADMARC), a parastatal of the Government of Malawi, was the sole purchaser of groundnut from farmers. Some groundnut is traded locally, and some is consumed domestically as food. Most of the groundnut purchased by ADMARC is exported. A portion of the produce is crushed for oil and some is sold to farmers as seed. Groundnut is procured as seed from different parts of the country and is transported to the Liwonde Groundnut Factory located in southern Malawi. The seed is then electronically graded to remove any foreign matter and mouldy seeds. A representative sample of groundnut from each bag is taken and analyzed for aflatoxins, the secondary toxic metabolites produced by fungi of the *Aspergillus flavus* Link ex Fries group. Aflatoxins are known to be hepatotoxic, carcinogenic, and teratogenic. The groundnut consignment is exported only when it has a very low level of aflatoxins (below 5 μg kg^{-1}). The graded seeds are then fumigated and sprayed with an insecticide before being exported (Anon., 1977; Kisyombe, 1989).

Aflatoxin contamination may occur at different stages of crop production, drying, and storage. To design appropriate control strategies, it is important to understand the stages during which the crop is vulnerable to aflatoxin contamination. Groundnut is exposed to *A. flavus* invasion and subsequent aflatoxin accumulation at the farm level before harvest (during pod development phase), during post-harvest drying, storage (Kisyombe, 1989; McDonald, 1966, 1969, 1989; McDonald and Harkness, 1967; Mehan and McDonald, 1984; Mehan *et al.*, 1986), and transportation to markets. This is particularly so when groundnut is transported and stored at market places without proper storage facilities. While it is possible to reduce contamination by aflatoxins at each of these stages, the control method at each stage should be different. For example, at the farm level, proper crop production, processing, and storage practices should be emphasized (Kisyombe, 1989). Price policies that differentiate groundnut quality may also provide incentives for preventing contamination by aflatoxins at the market level.

The objective of this paper is to provide information on the economic losses incurred in export earnings and trade balance due to aflatoxin contamination of groundnut in Malawi and to derive policy implications that would minimize this contamination.

DATA SOURCES

The data on area, production, and yield of groundnut for the past 11 years were taken from the Guide to Agricultural Production, published by the Ministry of Agriculture, Malawi. Data on groundnut prices, ADMARC purchases, and the volume and value of exports were taken from various economic reports published by the Office of the President and Cabinet. Data for 11 years on quantity of groundnut handled for export, number of samples analyzed for aflatoxins and quantity rejected were obtained from ADMARC. The data on contribution of groundnut to trade balance were taken from various issues of the Economic and Financial Review of the Reserve Bank of Malawi.

TRENDS IN GROUNDNUT PRODUCTION IN MALAWI

In analyzing the impact of losses in export earnings due to aflatoxin contamination on the general economy of the country, it is important to recognize the changes in crop production. Figure 1 presents the data on area, production, average seed yield, and value of groundnut in Malawi for 11 years (1980/81 to 1990/91). The area under groundnut is highly responsive to its price relative to the price of maize, the major staple food crop of Malawi. The total area under groundnut cultivation was stable in the first half of the 1980s, and started declining after 1988/89 with an average decline of about 5.2% per year (Fig. 1 A). The total

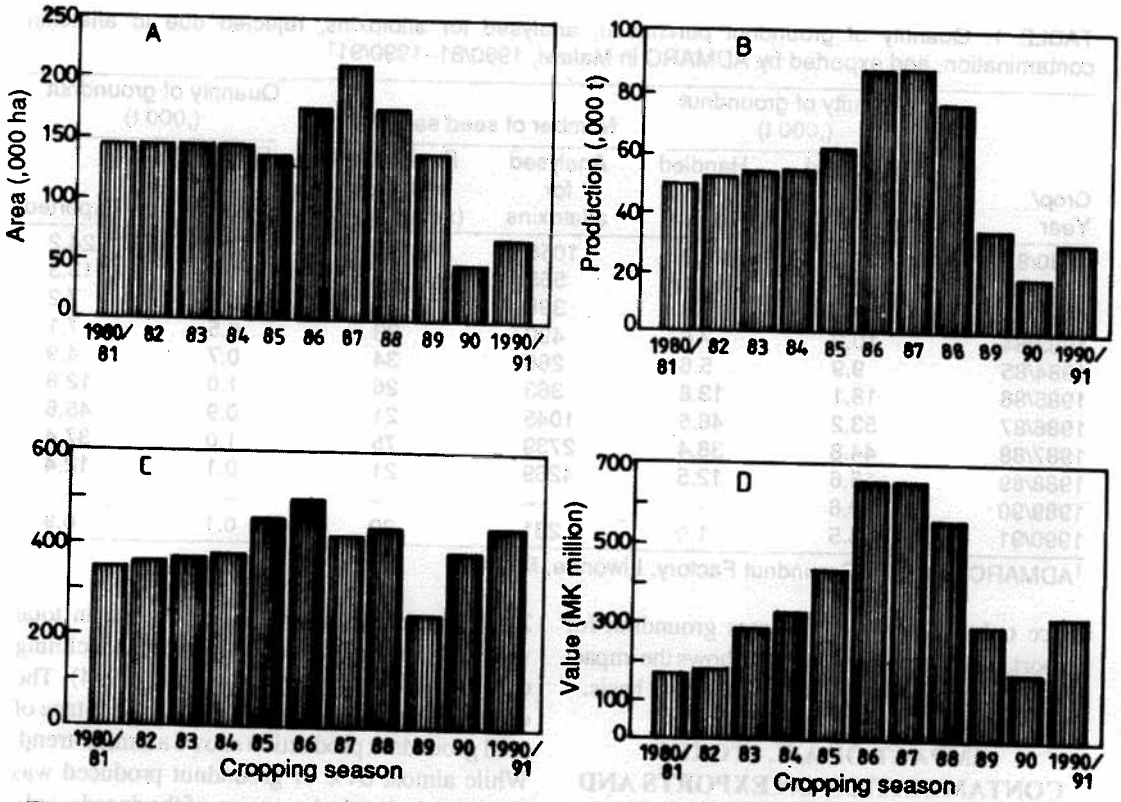

Figure 1. Area (A), production (B), average seed yield (C), and value (D) of groundnut in Malawi, 1981/82 to 1990/91. (Source: Guide of Agricultural Production, Ministry of Agriculture, Malawi).

production increased during the mid-1980s and has shown a decline since 1987/88 along with decrease in area (Fig. 1 B). The average decline in production from 1980/81 to 1990/91 is 4.7% per annum. The differences in growth rates between area and production could be attributed to the variation in the yield which is largely dependent on rainfall. The yields ranged from 249 kg ha^{-1} in 1988/89, which was a drought year, to 501 kg ha^{-1} in 1985/86, which had the highest rainfall during the 1980s. The total value of groundnut production showed a slight increase despite declining trends in the area and production due to increase in prices.

LOSSES IN GROUNDNUT EXPORT DUE TO AFLATOXIN CONTAMINATION

To understand the impact of losses in exports due to contamination by aflatoxins, it is important to investigate the marketing channels of groundnut from the producer to the export market. The extent to which the impact of aflatoxin contamination will be felt on the export earnings depends on the quantity of groundnut purchased by the ADMARC and on groundnut exports as a percentage of the total quantity purchased. Table 1 presents the quantity of groundnuts purchased and handled by ADMARC for export, number of samples analyzed for aflatoxins, number of samples with levels of aflatoxins exceeding 5 mg kg^{-1}, the quantity of groundnuts rejected for export, and the quantity exported during 1980/81–1990/91. The number of samples analyzed for aflatoxins roughly depended on the quantity of groundnuts handled for exports. In general, the quantity handled by ADMARC for export has shown a declining trend that agrees with production data given in Figure 1 A. Samples with levels of aflatoxins higher than 5 $\mu g\ kg^{-1}$ were rejected. For example, about 0.5% of the samples handled in 1988/89 and 12.9% in 1990/91 were rejected. The loss in groundnut value was mainly during export. Groundnuts used for local consumption or oil crushing do not go through the process of quality control. Thus, aflatoxin contamination reduces the quantity of groundnut exported. In Malawi,

TABLE 1. Quantity of groundnut purchased, analysed for aflotoxins, rejected due to aflatoxin contamination, and exported by ADMARC in Malawi, 1980/81–1990/91[1]

Crop/ Year	Quantity of groundnut (,000 t)		Number of seed samples		Quantity of groundnut (,000 t)	
	Purchased by ADMARC	Handled for export	Analysed for aflatoxins	Positive for aflatoxins (> 5 μg kg^{-1})	Rejected for export	Exported
1980/81	31.4	26.8	1056	101	2.6	24.2
1981/82	19.5	15.1	565	67	1.9	13.3
1982/83	10.6	7.8	398	31	0.6	7.2
1983/84	10.2	7.6	490	33	0.5	7.1
1984/85	9.9	5.6	266	34	0.7	4.9
1985/86	18.1	13.8	363	26	1.0	12.8
1986/87	53.2	46.5	1045	21	0.9	45.6
1987/88	44.8	38.4	2739	75	1.0	37.4
1988/89	15.6	12.5	4269	21	0.1	12.4
1989/90	0.6	–	–	–	–	–
1990/91	4.5	1.0	231	30	0.1	0.9

[1]ADMARC: Liwonde Groundnut Factory, Liwonde, Malawi.

since only ADMARC processes groundnut for export, data presented in Table 1 shows the impact of aflatoxin contamination on a national basis.

IMPACT OF AFLATOXIN CONTAMINATION ON EXPORTS AND TRADE BALANCE

The impact of losses due to aflatoxins on groundnut exports and on the trade balance of Malawi is presented in Table 2. The quantity of exports of groundnut shows a considerable decline over the ten- year period. The value of groundnut exports as a percentage of total value of exports ranged from 0.3% in 1984/85 to 7.4% in 1980/81 (Table 2). The percentage share of groundnut in total value of Malawi's exports has been declining over the past ten years (Babu *et al.*, 1994). The quantity of groundnut exported as a percentage of total groundnut production shows a similar trend. While almost 64% of groundnut produced was exported during the beginning of the decade, only 0.2% was exported in 1989/90. The decline in the volume of exports could be attributed to quantity produced, volume of groundnut purchased by ADMARC from farmers, world market prices, quantity of loss in storage, and quality control-regulations of importing countries. However, to quantify the value loss in export of groundnut due to aflatoxins, it is essential to relate the actual

TABLE 2. Impact of aflatoxin contamination on export loss and trade balance in Malawi, 1980/80–1990/91[1]

Crop year	Export price (MK kg^{-1})	Value loss (x 1000)		Trade balance (MK million)	Value loss as % of trade balance
		MK	US $		
1980/81	0.31	806	720	129.3	0.55
1981/82	0.72	1368	1303	-69.5	-1.77
1982/83	1.09	654	559	-69.9	-0.81
1983/84	1.27	635	432	-93.1	-0.47
1984/85	1.49	1043	614	64.7	0.98
1985/86	1.56	1580	845	-72.9	-1.14
1986/87	1.61	1449	659	-79.7	-0.85
1987/88	1.54	1540	602	-38.6	-1.62
1988/89	1.56	156	57	-328.5	-0.01
1989/90	1.96	0	0	-675.1	0.0
1990/91	1.96	196	69	-434.4	-0.02

[1]Economic and Financial Review, Reserve Bank of Malawi.

exports to potential exports when the levels of aflatoxins are effectively minimized to a level acceptable to importing countries.

The value of groundnut export loss due to aflatoxins as a percentage of the total value of groundnut exports is given in Table 2. The losses in exports due to aflatoxins ranged from MK 0.16 million (= US $ 0.057 million) in 1988/89 to MK 1.58 million (= US $ 0.845 million) in 1985/86 with a mean of MK 0.943 million (US $ 0.586 million) based on the quantity loss estimates presented in Table 1. The extent of these losses as a percentage of the trade balance provides a better indication of the impact of such losses because the gains from reducing levels of aflatoxins could have reduced the trade balance. The export losses in groundnut as a percentage of the trade balance ranged from 0.01% in 1988/89 to 1.77% in 1981/82 (Table 2). Since the trade balance is a component of the balance of payments, the latter is also affected by losses from contamination by aflatoxins.

POLICY INTERVENTIONS IN REDUCING AFLATOXIN CONTAMINATION

As a considerable amount of foreign exchange is lost due to aflatoxin contamination, some policy guidelines to improve groundnut quality are necessary. Several approaches have successfully been adopted in some countries to minimize contamination by aflatoxins (Ahmed *et al*., 1989; Cole *et al*., 1989; Ghewande *et al*., 1989; McDonald, 1966, 1969, 1989; McDonald and Harkness, 1967; Mehan, 1989; Mehan and McDonald, 1984; Mehan *et al*., 1986; Pettit *et al*., 1989; Pitt, 1989; Pollet *et al*, 1989). However, these approaches differ depending on the stage when control measures are implemented.

In Malawi, crop rotation has been reported to be beneficial to reduce *A. flavus* infection and possible aflatoxin contamination. Sowing groundnut with the first rains will be useful to optimize the use of available moisture and preventing drought stress at the pod-filling stage. Groundnut should be harvested at optimum maturity and should be dried rapidly and stored under damp-proof conditions. Removal of damaged or mouldy pods and seed would reduce levels of aflatoxins in the produce. Efforts should be made to educate farmers through formal extension systems on good storage practices at the farm level and on the harmful effects of aflatoxin contamination of groundnut (Kisyombe, 1989).

The storage methods at the procurement stations and at the export points should be improved to reduce the risk of aflatoxin contamination. There is also a need for improving handling of the produce during storage and transportation.

Breeding for resistance to *A. flavus* invasion and/or aflatoxin accumulation is probably the most effective method (Mehan and McDonald, 1984; Mehan, 1989) and is best suited to smallholder farmers in Malawi. Research efforts should be strengthened to investigate the possibilities of genetic resistance in the hope of developing cultivars with seeds which *A. flavus* cannot invade or which, if invaded, do not support aflatoxin production. Combination of genetic resistance and recommended cultural practices should be beneficial in reducing the risk of aflatoxin contamination in groundnut. Pricing policies that differentiate the quality of the produce may provide incentive to farmers for preventing aflatoxin contamination.

CONCLUSIONS

The information presented in this paper provides a first step in understanding the gains from reducing the levels of aflatoxins below the world trade acceptable limits. It also points to the need for allocating necessary resources for research on aflatoxins and extension in setting research priorities. The benefits accruing from reducing contamination by aflatoxins will also depend on the safety levels set by the importing countries. As more information becomes available on the health risks from aflatoxins, the safety levels for export will be made more stringent. The importance of research on aflatoxins and extension to meet these standards for developing countries to compete effectively in the world markets cannot be overemphasized.

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