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Farmers Knowledge and Adoption of Aflatoxin Management Practices in Groundnut Farming

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ABSTRACT

The groundnut (*Arachis hypogaea* L.) is a major oilseed crop of India. It has great potential for diversification for use as supplement food crop. The major impediment for diversification of groundnut is aflatoxin contamination. Aflatoxins are the toxic substances produced by the fungi *Aspergillus flavus* and *A. parasiticus*. The adoption of Aflatoxin Management Practices of Groundnut (AMPG) is very important for reducing aflatoxin contamination. In this study an *ex post facto* research design was used to understand the knowledge and adoption of aflatoxin management practices at farm level, identify the constraints faced by farmers in adoption of AMPG and seek the suggestions of farmers for improving the adoption of AMPG. The results revealed that most of the groundnut farmers does not possess adequate knowledge on AMPG and had not adopted the sowing, post sowing and post harvest AMPG. The most important constraint for adoption of AMPG was lack of premium price for aflatoxin free groundnut.

Groundnut (*Arachis hypogaea* L.) is the most important oilseed crop in Gujarat and occupies an area of 1.9 million hectares with a production of 1.5 million tonnes (Damodaram and Hedge 2007). Eighty per cent of groundnut production is utilized for oil extraction and 10 per cent is used for direct human consumption in the state. There is great potential for direct consumption of groundnut and groundnut-based products due to its high nutritive value and suitability as 'cheap fast food' both in the natural state and after processing. The major challenge to diversify groundnut from oil extraction to supplemental food uses is checking of aflatoxin contamination. Aflatoxins are the toxic substances produced by fungi, *Aspergillus flavus* and *A. parasiticus*. Groundnut can be contaminated with aflatoxin at various stages before harvest, during field drying, curing and in storage (Freeman et al. 1999). Aflatoxin contamination of groundnut is a major problem of rainfed agriculture in the semi-arid tropic environment (Kumar et al. 2008). Afaltoxins are the major toxins affecting the quality of groundnut meant for human consumption. As the future of groundnut lies in its use as a food crop by itself and in a variety of food products that are widely consumed, widens the health risks of aflatoxin contamination.

Groundnut is a major crop of Junagadh district, Gujarat, grown mostly under rainfed conditions in an area of 0.43 million hectares with a production of 0.59 million tonnes and productivity of 1370 kg/ha (Damodaram and Hedge 2007). The major portion of the produce is used for oil extraction and the rural and urban families use a small portion for direct consumption. A wide range of groundnut confectionary products is utilized in the daily diets of people of the district. There is every chance that people may consume the contaminated produce, as there are no quality checks in domestic trade and groundnut meant for local consumption. Hence, it becomes more important to check the aflatoxin contamination in groundnut meant for local consumption.

Several national and international institutes have carried out research on aflatoxins and developed technologies, which can significantly reduce contamination (Kumar et al. 2001, Kaaya and Harris 2003), but the farmers' knowledge and adoption of the same is not well

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documented. Hence, the present study was conducted to understand the knowledge and adoption of Aflatoxin Management Practices of Groundnut (AMPG) at farm level and identify the constraints faced by farmers in adoption of AMPG and seek the suggestions of farmers for improving the adoption of AMPG.

METHODOLOGY

The study was conducted in Gujarat following an *ex-post facto* research design. The sample constituted of 180 farmers selected by multi-stage random sampling technique. Twenty farmers each were selected from nine-village *viz*., Vadhavi, Vadal, Chokli, Agatrai, Ajab, Bamnasa, Nandharki, Umatwada and Koyli of three *taluka* of Junagadh district. The knowledge and adoption of AMPG was measured by developing suitable scales. The scales consisted of statements pertaining to pre-sowing, sowing, post-sowing, harvest and post harvest practices of aflatoxin management. The experts from Junagadh Agricultural University, Directorate of Groundnut Research and Gujarat State Agriculture Department ascertained the relevancy of the statements of the scales. The final knowledge test consisted of 32 statement and adoption scale consisted of 22 statement. The responses were recorded as correct/incorrect or yes/no against each statement. A unit score was given to correct/yes answer, and zero to incorrect/no answer. The scores of knowledge test ranged from 0 to 32 and that of adoption scale ranged from 0 to 22. The sum of scores on all the statements obtained by the respondents formed his knowledge/adoption score. Based on knowledge and adoption scores, the respondents were classified into three categories *viz*., low (below mean - standard deviation), medium (mean $\pm$ standard deviation) and high (above mean + standard deviation). The constraints faced by farmers in adoption of AMPG and the suggestions perceived by farmers for improving the adoption of AMPG were recorded by asking open-ended questions.

The data were collected with the help of pre-tested schedule by personal interview of the respondents. As the data were mostly qualitative in nature, descriptive statistics such as frequency, percentages, mean, standard deviation and coefficient of variation were used to analyze the data.

RESULTS AND DISCUSSION

Level of knowledge and extent of adoption of AMPG

The mean knowledge and adoption scores of the respondents were 11.5 and 10.2, respectively (Table 1), which were 50 per cent lower than the maximum possible scores of 32 and 22 for knowledge and adoption, respectively.

Table 1. Distribution of respondents based on level of knowledge and extent of adoption of AMPG

Category	Knowledge	Adoption
Low	23 (12.78)	27 (15.00)
Medium	122 (67.78)	123 (68.33)
High	35 (19.44)	30 (19.44)
Mean score	11.5	10.2
Standard Deviation	7.9	4.0
C.V. %	68.5	39.1

*Figures in parenthesis are % of farmers

The low knowledge and low adoption scores indicated that farmers possessed low level of knowledge of different components of aflatoxin management, which resulted in lower adoption of AMPG. The majority of farmers (68 per cent each) were in medium category with regard to knowledge and adoption of AMPG respectively. More than 19 per cent and 12.8 per cent were in high and low knowledge categories, respectively, whereas, 16.7 per cent and 15 per cent of farmers were in high and low adoption categories, respectively.

Knowledge and adoption of pre-sowing aflatoxin management practices

Many of the sampled farmers do not possessed knowledge on soil management practices like deep ploughing and application of castor cake / neem cake, but 81 per cent of sampled farmers (Table 2) had knowledge on manual weed control and 87 per cent adopted the same (Table 3).

Knowledge and adoption of harvest and post harvest aflatoxin management practices

Only 29 per cent of farmers possessed knowledge on the importance of harvesting at right maturity but 86 per cent of farmers harvested the crop at optimum maturity. This was mainly by observing the neighboring farmers. Many of the farmers (74 per cent) had knowledge on the optimum drying of groundnut pods and adopted the same.

Many of the farmers did not possess knowledge on prevention of damage to pods during harvesting, avoiding mixing of healthy and immature pods, precautions to be taken during storage of pods, and importance of fumigation and did not adopt these practices. Majority of farmers did not possess knowledge on pre-sowing, harvest

and post harvest aflatoxin management practices, which are very critical for control of aflatoxin contamination of groundnut.

Constraints in adoption of AMPG as perceived by the farmers

The most important constraint in adoption of AMPG perceived by majority of farmers (90.55 per cent)

Table 2. Item-response analysis of knowledge of aflatoxin management practices

Sl. No.	Item	*f*	%	Rank
Pre-sowing aflatoxin management				
1.	Removal of stubbles of previous crop	40	22.22	XXIV
2.	Deep ploughing during summer	31	17.22	XXVIII
3.	Weed control	46	25.56	XX
4.	Number and time of weedings	146	81.11	I
5.	Name of weedicide	100	55.56	VII
6.	Application of FYM	98	54.44	VIII
7.	Time and dosage	30	16.67	XXIX
8.	Application of plant cakes	51	28.33	XV
9.	Time and dosage	34	18.89	XXVI
Sowing & post-sowing aflatoxin management				
10.	Short duration groundnut variety	42	23.33	XXIII
11.	Name of suitable variety	121	67.22	IV
12.	Pre-monsoon sowing	29	16.11	XXX
13.	Time of pre-monsoon sowing	66	36.67	XI
14.	Selection of healthy seed for sowing	49	27.22	XVII
15.	Seed treatment	125	69.44	III
16.	Name of seed treatment chemical	55	30.56	XII
17.	Name of bio-control agent for seed treatment	48	26.67	XVIII
18.	Gypsum application	51	28.33	XXV
19.	Plant protection measures	117	65.00	V
20.	Supplemental irrigation	28	15.56	XXXI
Harvest and post-harvest aflatoxin management				
21.	Timely harvesting of the crop	52	28.89	XXIV
22.	Insect-pests and diseases	53	29.44	XXIII
23.	Patches of field with diseases, stress harvested separately	32	17.78	XXVII
24.	Avoiding mechanical damage to pods during harvesting	48	26.67	XVIII
25.	Optimum drying of harvested plants	117	65.00	V
26.	Avoiding mixing immature and mature pods	23	12.78	XXXII
27.	Optimum drying of pods	46	25.56	XX
28.	Identifying well dried pods	133	73.89	II
29.	Storage of groundnut	88	48.89	IX
30.	Precautions during storage	87	48.33	X
31.	Fumigation	39	21.67	XXV
32.	Name & dosage of fumigating chemical	43	23.89	XXII

Table 3. Item response analysis of adoption of aflatoxin management practices

Sl. No.	Item	*f*	%	Rank
Pre-sowing aflatoxin management				
1.	Removal of stubbles of previous crop	154	85.56	III
2.	Weed control	157	87.22	II
3.	Deep ploughing	36	20.00	XVI
4.	Application of neem cake	34	18.89	XVIII
5.	Application of FYM	69	38.33	XI
6.	Selection of short duration variety	105	58.33	IX
Sowing & post-sowing aflatoxin management				
7.	Pre-monsoon sowing	33	18.33	IXX
8.	Selection of healthy seed	169	93.89	I
9.	Chemical seed treatment	124	68.89	VII
10.	Biological seed treatment	32	17.78	XX
11.	Application of gypsum	54	30.00	IVX
12.	Supplemental irrigation	27	15.00	XXI
13.	Harvesting at right maturity	154	85.56	III
14.	Plant protection measures	129	71.76	VI
15.	Avoiding mechanical damage to pods	112	62.22	VIII
Harvest and post-harvest aflatoxin management				
16.	Proper drying of harvested pods	83	46.11	X
17.	Separation of damaged pods	35	19.44	XVII
18.	Thorough drying of pods	136	75.56	VV
19.	Use of polythene lined bags for storage	52	28.89	XV
20.	Storage at well aerated and well covered space	57	31.67	XIII
21.	Storage place free from seepage or leakage water	63	35.00	XII
22.	Fumigation of storage room	26	14.44	XXII

was lack of premium price for aflatoxin free groundnuts (Table 4), followed by lack of awareness on ill effects of consumption of aflatoxin-contaminated groundnut to human and cattle (89.45 per cent), non-availability of sufficient quantity of quality seed for sowing (87.78 per cent), lack of awareness on aflatoxin contamination (86.12 per cent), inadequate knowledge on the use of biological control methods (83.89 per cent), delay/irregularity of rains affecting time of sowing (82.78 per cent), inability of farmers to identify aflatoxin contamination (76.67 per cent), lack of knowledge on grading (75.56 per cent), inadequate knowledge on proper drying and stacking of plants (73.89 per cent).

Table 4. Constraints in adoption of AMPG as perceived by the farmers

Sl. no.	Item	*f*	%	Rank
1.	Lack of premium price for aflatoxin free groundnuts	163	90.55	I
2.	Lack of awareness on the ill-effects of consumption of aflatoxin contaminated produce to human and cattle	161	89.45	II
3.	Non-availability of sufficient quantity of quality seed at seed agencies (*Beej nigam*)	158	87.78	III

4.	Lack of sufficient irrigation facilities for providing supplemental irrigation/pre-monsoon sowing	157	87.23	IV
5.	Lack of awareness regarding aflatoxin contamination of groundnut	155	86.12	V
6.	Inadequate knowledge on the use of biological pest control methods	151	83.89	VI
7.	Delay/irregularity of first monsoon showers affecting timely sowing	149	82.78	VII
8.	Difficulty in identifying the symptoms of aflatoxin contamination	138	76.67	VIII
9.	Lack of knowledge on grading	136	75.56	IX
10.	Inadequate knowledge on drying and stacking of plants	133	73.89	X
11.	Non availability of adequate quantity of castor cake and neem cake for soil application	121	67.23	XI
12.	Shortage of labour during critical operations specially at harvest and post harvest stages	118	65.56	XII
13.	High cost of adoption of plant protection measures	110	61.12	XIII
14.	Lack of adequate knowledge on fumigation technique	101	56.12	XIV
15.	Lack of efficient storage facilities	98	54.45	XV
16.	Non-availability of required quantity of FYM	98	54.45	XV
17.	Lack of adequate knowledge on gypsum application	96	53.34	XVII
18.	Lack of knowledge on storage methods	96	53.34	XVII
19.	Lack of adequate knowledge on plant protection for aflatoxin management	90	50.00	IXX
20.	High cost of FYM	88	48.89	XX
21.	Lack of adequate institutional support to small farmers for credit	85	47.22	XXI
22.	Damage to pods due to mechanical threshing	35	19.45	XXII

Farmers felt that the market has neither rejected contaminated produce nor provided incentives to contamination free groundnuts. There was no hindrance for the sale of contaminated groundnut in the local markets, as there was no resistance from the ultimate consumers of groundnut.

Suggestions for improving the adoption of AMPG as perceived by the farmers

The most important suggestion offered by 94 per cent of sampled farmers was provision of sufficient quantity of quality seed in time (Table 5) followed by premium price for groundnut (93.34 per cent), provision of aflatoxin free groundnut (93.34 per cent), education of farmers regarding the ill-effects of consumption of aflatoxin contaminated groundnut (90 per cent), creating awareness on aflatoxin problem (88.34 per cent), provision of timely and adequate credit (80.56 per cent), promoting construction of efficient storage facilities/structures (77.78 per cent), making timely availability of required inputs (72.22 per cent), strengthening existing water bodies and providing additional irrigation facilities (69.44 per cent), imparting training on biological control methods (66.67 per cent), education on water conservation practices (58.33 per cent), imparting training on plant protection methods (49.44 per cent), storage methods (45.00 per cent), grading (40.00 per cent), use of herbicides (33.33 per cent), and conducting demonstrations (32.20 per cent).

Table 5. Suggestions to improve the adoption of AMPG as perceived by the farmers

Sl. No.	Item	*f*	%	Rank
1.	Providing sufficient quantity of improved groundnut seed in time	169	98.89	I
2.	Provision of premium price for aflatoxin free groundnut	168	93.34	II
3.	Educating farmers on the ill effects of consumption of aflatoxin contaminated groundnut	162	90.00	III
4.	Creating awareness on the problem of aflatoxin contamination of groundnut	159	88.34	IV

5.	Providing timely and adequate credit to farmer through financial institutions	145	80.56	V
6.	Promoting efficient storage facilities	140	77.78	VI
7.	Timely provision of required inputs to farmers through different agencies	130	72.22	VII
8.	Strengthening the existing water bodies like village ponds and providing additional irrigation facilities	126	69.44	VIII
9.	Conducting training programmes for farmers on the use of biological control methods for aflatoxin management	120	66.67	IX
10.	Educating farmers on water conservation practices	105	58.33	X
11.	Conducting training for the			
	i. Plant Protection methods	89	49.44	XI
	ii. Storage methods	81	45.00	XII
	iii. Grading	72	40.00	XIII
	iv. Herbiides	60	33.33	XIV
12.	Conducting large number of on-farm trials in farmer participatory mode	58	32.22	XV

CONCLUSION

Farmers needed the basic input seed in sufficient quantity and at an appropriate time through the seed agencies in order to avoid delay in sowing, using local varieties and spurious seed. An appropriate institutional mechanism had to be developed for providing required credit and necessary inputs, which will have considerable positive impact on the adoption of aflatoxin management practices. These efforts had to be backed by extensive training of farmers on important aspects of aflatoxin management viz., biological control methods, water conservation techniques, plant protection methods, storage and drying methods, grading of produce, use of herbicides and techniques of identification of aflatoxin contamination at field level. Mass awareness campaigns may be conducted to educate farmers and consumers of groundnut products on the ill effects of aflatoxin contamination. Providing premium price and building of consumer demands for aflatoxin free groundnuts will go a long way in reducing the aflatoxin contamination and making groundnut a safe supplemental food crop.

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