Aflatoxin

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Yearly estimates of the degree of aflatoxin contamination in Arizona and southern California cotton fields were made on the basis of analysis of samples from widely scattered plots.

Table I

Estimate of aflatoxin levels in Arizona and southern California cottonseed based on analysis of seed harvested from 1976, 1977 and 1978 research plots[1]

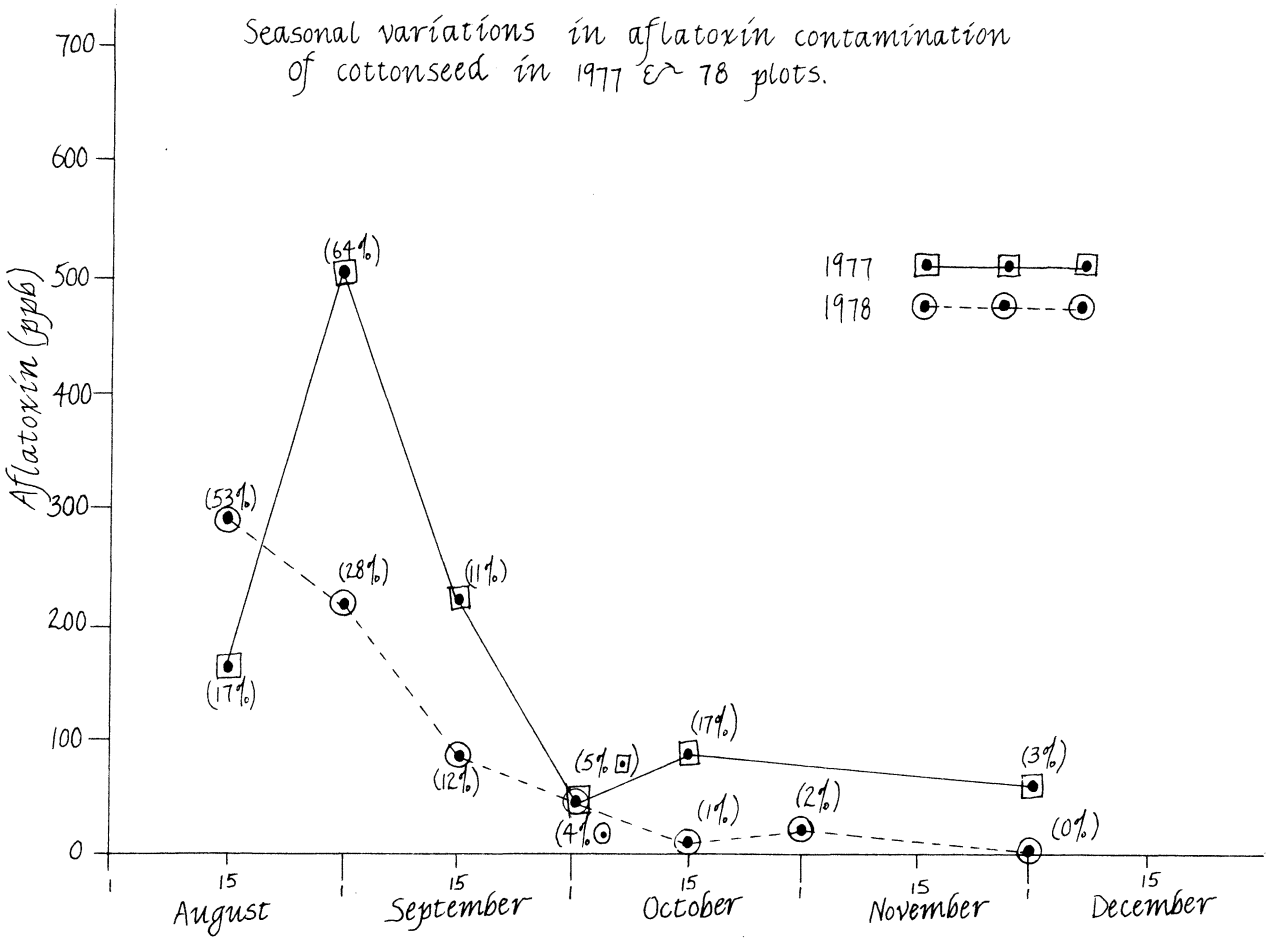
Fields Sampled #	Aflatoxin[2] ppb	Portion of Total %		
1976				
5	<0	18		
11(3)	<20	39	57%	20 ppb
9(3)	20-100	32	89%	100 ppb
2(1)	101-200	7	11%	101 ppb
1	>201			
28				
1977				
0	<0	0		
2	<20	18	18%	20 ppb
3(1)	20-100	27	45%	100 ppb
4(2)	101-200	36	55%	101 ppb
2	>201	19		
11				
1978				
0	<0	0		
11(2)	<20	33	33%	20 ppb
9(2)	20-100	27	60%	100 ppb
5	101-200	16	40%	101 ppb
8(2)	>201	24		
33				

[1]Data are calculated from the periodic analysis of samples from eight replications in each field. All fields located below 1800' elevation. The numbers in parathensis are the fields sampled in the Imperial Valley of California. All bolls having at least one fluffed locule were removed, the seed ginned, decorticated, ground and analyzed for aflatoxin by HPLC.

[2]Evaluations are based on a total of 2013, 2389 and 1671 analysis in 1976, 1977 and 1978, respectively.

Approximately 80% of the aflatoxin formed during the 1977 and 1978 season was produced prior to September 1 in about 65% of the seed. The quantity of irrigation water and rainfall occurring in late July and early August, PBW, plant stand density and plant height are all correlated with peak aflatoxin contamination (Figure 1).

Fig. 1



Seed from scrap or ground recovered cotton may contain 2-2000 times more aflatoxin than the first harvested spindle picked cotton. It is estimated from three years of data that a mean of 50 times more is a conservative estimated (Tables II and III). If it is assumed that scrap cotton constitutes 10% of the crop and it contains 50x more aflatoxin than 1st and 2nd spindle picked cotton (90%) then a theoritical projection can be made as to the mean level in all seed when scrap and spindled picked cotton are mixed at the gin. If the seed from spindle picked cotton contains 20 ppb then adding back in the ground recovered seed from the same field will result in a level of 118 ppb.

Table II

Comparison of aflatoxin levels found in 1st pick and ground (scrap) cottonseed from selected fields.

Field	$\bar{x}$ Aflatoxin (ng/g) 1st Pick	Ground (scrap)	
		1976	
A	9[a]	144	(16X)
B	25	52	(2X)
C	54	488	(9X)
D	14	26	(2X)
E	5	214	(43X)
		1977	
A	236	3,131	(13X)
	167	2,435	(15X)
B	235	8,159	(35X)
	128	6,408	(50X)
C	392	2,977	(8X)
	329	1,819	(6X)
		1978	
A	5	2,241	(448X)
B	5	1,104	(221X)

[a]Each $\bar{x}$ calculated from the analysis of 10-20 sub-samples selected from composite trailer samples.

Table III

Comparison of aflatoxin levels found in 1st pick and ground (scrap) cottonseed samples collected from gins.

Gin	$\bar{x}$ Aflatoxin (ng/g) 1st Pick	Ground (scrap)	
		1976	
A	9[a]	201	(22X)
		1977	
A	536	2,580	(5X)
	199	1,462	(7X)
	210	2,193	(10X)
B	958	1,445	(2X)
	650	610	--
	300	1,804	(6X)
	148	666	(5X)
C	2,546	113,868	(45X)
	4,600	102,353	(22X)
	6,048	97,980	(16X)

[a]Each $\bar{x}$ calculated from analysis of 10-20 sub-samples taken from a 100-200 lb. bulk samples.

When temperatures are optimum for seed invasion by A. flavus humidity and the pbw are the major parameters which control the degree of seed contamination by aflatoxin. High humidity delays carpel drying and ultimately the rate of boll opening. When boll opening is delayed, lint is prone to invasion by fungi such as A. flavus. When microbial deterioration of lint occurs prior to fluffing a "tight" loculed condition results.

The pbw exit hole provides a portal for the entry of A. flavus. Locules in pbw damaged bolls often remain tight.

In 1977, mature open bolls were divided into three categories: (1) all locules fully fluffed, (2) one or more tight locule but no pbw damage, and (3) one or more exit hole. Aflatoxin analysis revealed that 37% of the aflatoxin resided in seed from tight loculed bolls (14% of meal), and 33% in pbw damaged bolls (6% of meal). In total 70% of the aflatoxin resides in only 20% of the meal. Elimination of the conditions which lead to the tight loculed condition and the pbw would greatly reduce the aflatoxin problem. Seed from tight and pbw damaged bolls make up a large portion of scrap or ground pick cotton.

Table IV

Aflatoxin content of seed ginned from fully fluffed tight loculed and PBW damaged bolls[a]

	1977		
	Aflatoxin		Meal Wt
Seed Source[b]	$\bar{x}$ ppb	%[c]	%
Fluffed	268	30	80
Tight Loculed	1875	37	14
PBW Damaged	4365	33	6

[a]Based on 60,000 bolls from 11 commercial fields.
[b]Fluffed (no tight locules), tight loculed (1 or more and no pbw damage), PBW damaged (one or more exit holes).
[c]$\frac{\text{Nanograms detected for each seed source}}{\text{Total nanograms for 3 sources}}$