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AGRONOMIC AND PATHOLOGICAL FACTORS AFFECTING SOYBEAN SEED QUALITY AND HEALTH IN BENUE STATE, NIGERIA.

By

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ABSTRACT

Factors affecting soybean seed quality and health in Benue State were studied in the experimental research station and advanced pathology laboratory of the university of Agriculture, Makurdi in 1998 and 1999. Results showed that the time of planting, time of harvest of soybean, method of threshing, all affected the seed quality and health of soybean in Benue state. July 5 planting date produced soybean seeds with the best quality and it was observed that for every 2 weeks delay in planting, seed quality reduced significantly. Seeds from the July 5 planting also produced seeds that were more viable six months after storage. This trial has also shown that harvesting soybean in late December produced the highest good quality seeds but had the highest percentage infection. Breaking soybean pods with hand help to improve seed quality while the traditional threshing of soybeans with sticks reduced seed quality and increased percentage infection of seeds by 64.83% while storage in airtight containers improved the seed health. Seed quality and health were also lowered by the attack of micro-organisms especially those of the *Aspergillus spp* that was tested.

KEY WORD: soybean, seed quality, seed health, planting date, storage.

INTRODUCTION:

As the production of soybean, which has become the most important source of protein in the savanna is on the increase the seed quality and health is on the decrease (Sinclair and Backman 1989). The ability of the Nigerian government to set up official grain standard in the country has made both scientist and producers of soybean in the country to pay less attention to the seed quality and health. This neglect is responsible for the low viability of soybean seed in Nigeria. The viability of the seed has become a major concern in the development of soybean as a crop in the savanna (Delouche 1975). Chamberlain and Gray (1974) stated that any seed with germination below 70% and high incidence of seed borne organism is regarded as having low quality. The high percentage infection and damage to our soybean seeds is also dangerous to both man and animals and to the growers / producer, (Sinclair and Backman 1989). It does not only produce mycotoxins in some cases that may cause problems for animals consuming them, but also causes serious economic problems for both producers and processors. Athow (1976) reported that the immediate consequence of poor seed quality is a lower market grade and lower market price due to discounting. This study was undertaken in order to find out the important factors affecting, soybean seed quality and health in the state so that it will provide a clue to the methods of improving them.

MATERIAS AND METHODS

EFFECT OF TIME OF PLANTING:

Five planting dates were tried for 2 years namely June 5, June 20, July 5 (control), July 20 and august 4 planting dates. The soybean variety used was TGX 536-02D which was obtained from Benue Agricultural and Rural Development Authority (BNARDA) The treatments were replicated 3 times and arranged in randomized complete block design. The plot size was 6m x 4m and seeds were planted 5cm apart within row. All Agronomic practices were followed up to harvest and threshing. The yield of the various treatments were recorded at harvest. Other data taken were percentage germination, physical examination of seeds after harvest and examination of seeds health after 6 months of storage. Data were subjected to ANOVA and means separated using least significant difference.

EFFECT OF TIME OF HARVEST

This trial was undertaken to find out how the time of harvest of soybean can affect disease development in storage, and germination percentage of seeds. There were four harvest dates tried. They are November 12, November 26, December 10, December 24th. TGX 536 02D variety obtained from BNARDA was planted same time in each of the plots (July 5) in 1999. The treatments were arranged in factorial combinations in randomized complete block design and replicated three times. Data collected included, yield at harvest, seed damage after harvest, germination percentage, examination of seed mycoflora after 10 months of storage. Plot size was 6 m x 4 m and plant spacing was 75cm x 5cm x 1 plant. All agronomic practices were followed and plants were harvested in accordance with their fixed dates. Data collected were subjected to analysis of variance and means separated by least significant difference.

EFFECT OF METHOD OF THRESHING

Three methods of threshing were tried namely:- hand breaking, machine threshing and traditional beating with sticks in bags. Each of these methods constituted the treatments and were replicated 4 times and arranged in completely randomized design. The seeds were stored for 10 months. Data collected included, examination of seed mycoflora after 10 months of storage, physical damage after threshing, germination percentage at the end of the storage. Data were subjected to analysis of variance and the means separated using least significant difference.

EFFECT OF METHOD OF STORAGE

Four methods of storage of soybean were tried namely, storage in sacks, storage in polyethylene bags, storage in plastic air tight containers and traditional storage in Rhumbus. Each of these methods constituted a treatment, which was replicated four times and arranged in completely randomized design and stored for 6 months. Data collected included percentage germination of seeds, percentage infection and frequency of occurrence of organisms after examination of seed mycoflora. Data were subjected to analysis of variance and means separated using least significant difference.

EFFECT OF MICRO-ORGANISM ATTACK

Three organisms were isolated form soybean seeds and used to artificially inoculate 400 seeds of soybean, variety samsoy 2, obtained from BNARDA in four replications of 100 seeds per replicate by dusting the seeds with the spores of the organisms. The seeds were

sterilized using 5% sodium hypochlorite solution and air dried before inoculation. The organisms used were A. flavus, A. niger , and A. tamarii. The seeds were stored for 6 months before examination with the unaided eye. Each of the organisms constituted a treatment and seeds which were not inoculated as control. Treatments were replicated four times and arranged in completely randomized designed data collected were physical damage seeds, percentage germination and frequency of organisms isolated. Data were subjected to analysis of variance and means separated using least significant difference.

RESULTS

EFFECT OF TIME OF PLANTING

The result of the effect of time of planting on seed quality and health is shown in Tables 1 and 2. There were significant difference recorded on all parameters measured, at both 5% and 1% levels of probabilities among the various planting dates. On the percentage germination of seeds of the various planting dates, July 5 and July 20 planting dates performed best in both years with 93.33% and 81.11% germination for 1998, and 90.33% and 95.33% germination in 1999 respectively. August 4 planting date performed poorest in both years. On yield performance, the July 5 planting date out yielded the other dates in two years. The July 5 planting date also produced seeds with the best quality recording over 58.75% of seeds having no physical damage. Every 2 weeks delay in Planting significantly reduced the quality of seeds produced. The type of damage that had the highest frequency of occurrence was shriveled seeds and was highest on August 4 planting date treatment with a total of 81.83% frequency.

Table 2 shows the viability of seeds after 6 months of storage and the percentage infection and frequency of occurrence of each organism isolated. The first planting date (June 5) produced seeds with the highest infection percentage of 70% while the last planting date (August 4) produced seeds with the least infection percentage of 27.5%. July 5 planting date produced seeds with the highest percentage germination of 75%, followed by the June 20 and July 20 planting dates with 62% germination each.

EFFECT OF TIME OF HARVEST

There were significant difference recorded between the treatments in all the parameters taken as shown in Tables 3 and 4. On yield performance, November 12 date of harvest performed best with 508.85 kg/ha and 407.41 kg/ ha in 1998 and 1999 respectively as shown in table 3. December 24 harvest date recorded the highest frequency of good quality seeds of16.50% followed by the November 12 date of harvest with 12.50%.

Table 4 shows the percentage germination, percentage infection, organism isolated and their frequencies of occurrence 10 months after storage of the different harvest date treatments. December 24 harvest date recorded the highest percentage germination of 72.5% while November 12 date recorded the lowest of about 50%.

The percentage infections of all the treatments were very high with A. Flavus and Cercospora spp recording the highest frequency of occurrence in all the treatments. The December 24 harvest date was the most infected treatment.

EFFECT OF METHOD OF THRESHING

Table 5 shows the mean frequencies of damage seed categories after physical examination of 400 seeds from each method of threshing after 10 months of storage. Analysis of various showed that there were significant differences in all the damage categories considered except the purple stain and green stain damages. The hand broken seeds recorded the highest goods quality seeds of 71.33%, followed by machine threshed seeds with 46% frequency, while seeds threshed with sticks in bags recorded the lowest frequency of good quality seeds of 20%. Table 6 shows the germination percentage of seeds 10 months after storage and the level of seed health. The hand broken and machine threshed seeds recorded percentage germination (which were not significantly different) of 36.83% and 33.33% respectively. The highest percentage infection of 92.33% was recorded by seeds threshed with sticks in bags, while hand broken seeds had the lowest percentage infection of 27.5%. The highest frequency of occurrence of all the organisms isolated was recorded by the seed threshed with sticks in bags.

METHOD OF STORAGE

Table 7, shows the result of the effect of different methods of storage of soybean on viability of seeds, percentage infection and frequency of occurrence of organisms after six months of storage. There were significant differences recorded in all the parameters tested at both 5% and 1% levels of probabilities. Seeds stored with polyethylene bags had the highest percentage germination of 52-5% while the seeds stored in airtight containers had the lowest percentage infection. The control (traditional Rhumbus storage) was more infected than the airtight containers by about 18.75%. Aspergillus flavus was more frequently isolated from all the storage method than all the other organisms.

DISCUSSION

The quality of seeds obtained from the planting dates showed that the more, planting is delayed; the more the qualities of the seeds are adversely affected. This finding shows that when the quality of seeds are being taken into consideration, it is better to plant the crop early in the season at around June in Benue State. The Crop is likely to record the least damage to its seeds at this time. However, after 6 months of storage, it was discovered that the seeds from the June 5 planting recorded the highest infection rate in storage, which resulted in the low viability of their seed.

EFFECT OF MICRO-ORGANISM ATTACK

Result of the pathogenicity test on seeds are presented in Table 8. The physical damage observed on the inoculated seeds included brown stains, cracks on the seeds and shriveling of seeds.

The control however recorded more damage categories of seeds than all the other treatments.

A combination of good quality and health of seeds are important to increase viability of seeds. The best planting date in Benue State that can help produce relatively high good quality seeds, acceptable yields, low levels of seed infection and better viability of seeds after storage is the July 5 planting date. This confirms the recommended date of planting of soybean in Benue state by Kalu (1993). His recommendation was based on other agronomic and environmental factors. The implication of the result of the harvest date experiment is that, soybean harvest should not be done too early or too late in the season, in order to produce good quality matured seeds, which

will be viable after storage. Singh (1975) stated that a number of factors like seed quality, storability, planting time and method of planting, seed size etc, determine the viability of soybean seeds. This trial has also shown that the method of threshing of soybean used affects the seed quality, health and viability Singh (1975) stated that seed quality in terms of seed weathering, embryo damage during threshing and infection by certain fungi is one of the most important causes of poor germination. The traditional beating of soybean with sticks which caused more damage to the seeds recorded the lowest quality seeds, highest percentage infection and lowest percentage germination of seeds after storage. Farmers should be encouraged to thresh their soybean seeds with machines. This investigations has also confirmed that micro-organisms that are seed borne in soybean cause a lot of damage to seeds resulting in low quality and low viability of soybean seed after storage, Sinclair and Backman (1989).

Table 1: Percentage Germination, yield at harvest and physical damages observed on the seeds of various planting dates.

Treatments	Percentage germination		Yield at harvest (kg/ha)		Cracked	Brown	Purple	Shrivelled	Green	Good Quality
	2000	1999	1998	1999	Seeds	Stained	Stained	Seeds	Stain	Seeds
June 5	-	55.0	-	93.32	2.72	21.5	0.0	16.75	0.0	58.75
June 20	78.89	70.0	302	102.96	3.92	22.50	0.0	23.25	0.75	49.50
July 5	93.33	90.33	513.89	232.59	6.0	30.58	0.0	38.25	2.08	23.75
July 20	81.11	95.33	236.11	102.22	8.17	24.75	2.0	40.25	10.50	15.42
August 4	20.22	35.0	129.02	15.96	0.25	13.25	0.0	81.83	3.33	1.83
LSD 0.05	18.61**	14.85**	21.95**	40.4**	0.68**	1.29**	0.20**	2.69**	0.63**	3.63**

NS = Not significant at 5% level of probability.
** - Significant at both 5% and 1 levels of probabilities

Table 2: Organisms Isolated From Soybean Seeds Of Each Planting Date And Their Frequencies Of Occurrence Together With Their Levels Of Infection And Percentage Germination After 6 Months Of Storage.

NS = Not significant at 5% level of probability.

Planting Dates	Viability After 6 months	% Infection	FREQUENCY OF ORGANISMS ISOLATED (%)					
			Fusarium Spp	*Botryodiplodia Theobromae*	*Phomopsis sojae*	*Cercospora spp*	*Aspergillus flavus*	*Aspergillus Niger*
June 5	32.50	70.0	22.50	10.0	42.50	5.0	0.0	0.0
June 20	62.50	42.5	12.5	0.0	15.0	15.0	0.0	2.5
July 5	75.00	55.0	12.50	0.0	17.50	27.50	0.0	0.0
July 20	62.50	40.0	10.0	0.0	15.0	17.5	0.0	2.5
August 4	32.5	27.5	0.0	0.0	20.0	2.5	10	7.5
LSD 0.05	21.31**	15.80**	8.80**	5.5**	10.29**	8.02**	NS	0.95**

** = Significant at both 5% and 1% levels of probabilities.

Table 3: Mean Frequencies Of Damaged Seed Categories After Physical Examination Of 400 Seeds From Each Date Of Harvest, 10 Months After Storage, And Yield At Harvest.

Dates of Harvest	DAMAGE CATEGORIES (%)						Yield /ha	
	Shrivelld Seeds	Brown stain seeds	Green stained seeds	Cracked seeds	Purple stained seed	Good quality seeds	1999	2000
Nov.12	38.67	42.58	5.5	2.75	0.0	12.50	508.85	407.41
Nov.26	30.50	50.0	4.0	3.75	0.0	11.75	297.5	277.78
Dec.10	36.75	43.42	3.75	5.25	0.25	10.75	230.83	137.04
Dec.24	20.25	53.58	4.5	4.5	0.5	16.50	126.67	259.26
LSD0.05	1.92**	3.10**	NS	0.58**	0.04	0.74**	156.25**	123.54**

** = Significant both 5% and 1% level of probabilities: S=Not significant.

TABLE 4: PERCENTAGE GERMINATION, PERCENTAGE INFECTION, ORGANISMS ISOLATED AND THEIR FREQUENCIES OF OCCURRENCE IN 400 SEEDS FROM EACH DATE OF HARVEST, 10 MONTHS AFTER STORAGE.

Dates of Harvest	Percentage Germination	Percentage Infection	Frequencies of organism isolated (%)				
			Aspergillus Flavus	*Aspergillus niger*	*Cercospora spp*	*Fusarium Spp*	*Phomopsis sojae*
Nov. 12	50.0	95.0	64.39	23.51	39.67	5.26	2.71
Nov. 26	65.0	95.0	73.06	28.65	41.29	0.0	0.0
Dec. 10	52.5	90.0	52.83	8.01	44.98	13.89	11.37
Dec. 24	72.5	100.0	62.5	52.5	55.0	5.0	0.0
LSD0.05	5.77**	NS	4.54**	3.62**	2.12**	0.96**	0.57**

** = Significant both 5% and 1% level of probabilities
NS = Not significant.

TABLE 5: MEAN FREQUENCIES OF DAMAGED SEEDS FROM EACH METHOD OF THRESHING AFTER 10 MONTHS STORAGE.

METHODS OF THRESHIN	DAMAGE CATEGORIES (%)					
	Cracked Seed	Brown Stained Seed	Purple Stained Seed	Reduced Shrivelled	Green Stained Seed	Good Quality Seeds
Hand breaking	10.0	8.0	1.33	10.0	10.0	71.33
Beating with stick	30.0	80.0	8.0	50.0	14.66	20.0
Machine threshing	21.33	33.33	4.0	30.0	10.67	46.0
LSD 0.05	5.81**	14.36**	NS	13.65**	NS	12.06**

** = Significant at both 5% and 1% level of probabilities

NS = Not significant.

TABLE 6: PERCENTAGE GERMINATION, PERCENTAGE INFECTION, ORGANISM ISOLATED AND THEIR FREQUENCIES OF OCCURRENCE IN 400 SEEDS FROM EACH METHOD OF THRESHING AFTER 10 MONTHS OF STORAGE.

METHODS OF THRESHING	Percentage Germination	Percentage Infection	Frequencies of organism isolated (%)				
			Aspergillus Flavus	*Aspergillus niger*	*Cercospora spp*	*Fusarium Spp*	*Phomopsis sojae*
Hand breaking	36.83	27.5	5.45	9.70	0.0	0.0	11.33
Beating with stick	21.67	92.33	45.58	92.96	21.79	10.0	28.67
Machine threshing	33.33	70.0	6.72	48.89	41.67	3.0	3.75
LSD0.05	5.68**	11.88**	1.03**	8.05**	3.34**	1.63**	1.86**

** =Significant both 5% and 1% level of probabilities

TABLE 7: CUMULATIVE PERCENTAGE GERMINATION, PERCENTAGE INFECTION AND FREQUENCIES OF OCCURENCES OF EACH ORGANISM IN DIFFERENT STORAGE METHODS 6 MONTHS AFTER STORAGE.

Method Of Storage	Percentage Germination	Percentage Infection	FREQUENCY OF OCCURRENCE OF ORGANISM					
			Aspergillus Flavus	*Cercospora spp*	*Aspergillus tamarii*	*Fusarium spp*	*Aspergillus niger*	*Phomopsis spp*
Black	52.5	98.33	56.67	36.67	0.0	21.67	5.0	15.0
Leather		100.0	96.67	8.34	43.34	6.67	3.33	7.5
Sackcloth	36.25	80.0	76.67	8.33	18.33	0.0	2.5	2.5
Air-tight	25.0	98.75	65.0	17.5	5.0	25.0	42.5	10.0
Container	25.0							
Traditional Method								
LSD0.05	10.14**	5.17**	2.73**	1.37**	0.67**	1.5**	0.79**	1.74**

** =Significant both 5% and 1% level of probabilities

TABLE 8: MEAN FREQUENCIES OF PHYSICAL DAMAGE CATEGORIES OF SOYBEAN SEEDS INNOCULATED WITH 3 ORGANISMS AND STORED FOR 6 MONTHS.

Treatments	MEAN FREQUENCIES OF DAMAGE SEED CATEGORIES(%)				
	Brown Stain	Purple Stain	Cracked Seed	Green Stain	Reduced/ Shrivelled Seed
Aspergillus spp	0.00	0.00	5.00	0.00	0.00
Aspergillus flavus	2.50	0.00	27.50	0.00	12.5
Aspergillus tamarii	12.50	0.00	12.50	0.00	12.5
Control					
LSD 0.05	9.32*	NS	NS	NS	NS

NS = Significant; * = Significant at 5% level of probability.

REFERENCES

Athow K.L, 1976. Pathological factors affecting seed quality. In: world soybean research: a proceeding of the world Soybean research conference, held on August 3-8.1975, Ramada inn in Champaign Illinois, U.S.A.

Chamberlain, D.W and L.E Gray (1974). Germination seed treatment and micro-organism in soybean seed produced in Illinois. Plant disease, 58: 50-54.

Delouche, J.C (1975). Seed quality and storage of soybeans. Proceedings of a conference for scientists of African, middle east and south Asia. October 14-19 1974, Addis Ababa, Ethiopia.

Kalu, B.A (1993).Crop Recommendation for Benue state. Extension Bulletin No 2. Benue State Agricultural and Rural Development Authority Makurdi.

Sinclair J.B and P.A Backman, (1989). Compendium of soybean diseases, 3rd Ed. The American phytopathological society. St paul, Minnesota 55121 U.S.A.

Singh T.P (1975). Seed quality in soybeans.Tropical grain legume bulletin No. 1 July 1975. The international Grain Legume Information Centre IITA, Ibadan Nigeria.