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March 18, 2004

Dr. Mahama Ouedraogo
OAU/STRC-SAFGRAD
01 BP. 1783 Ouagadougou 01
Burkina Faso.

Dear Dr. Ouedraogo,

SUBMISSION OF 2003 REPORT

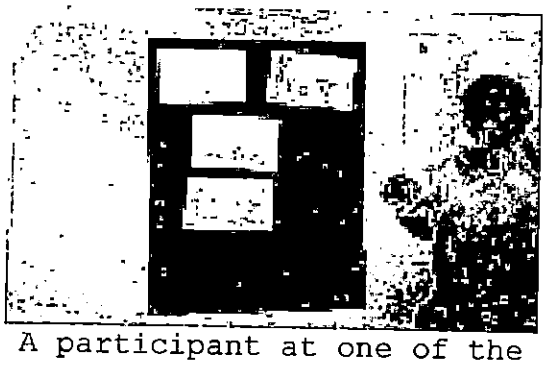
I hereby forward the Korean Government – OAU/STRC- SAFGRAD African Striga Project report for onward submission to the International Coordinator.

With kind regards.

Yours sincerely,

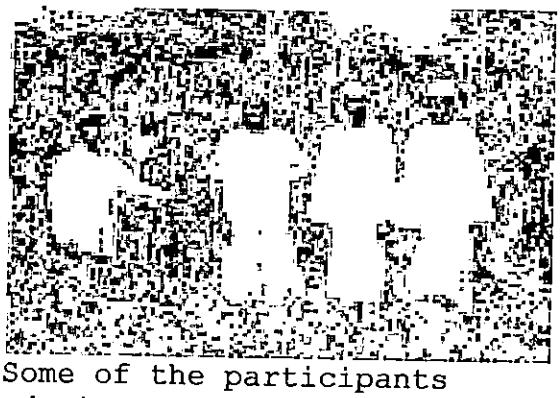
fr Dr. I Kureh
(Project Coordinator)

KOREAN GOVERNMENT-AU/STRC-SAFGRAD AFRICAN STRIGA PROJECT 2003 REPORT



A participant at one of the training sessions

Participants at the training on *Striga* biology and control



Some of the participants during the field day

An extension worker in one of the farmer's fields

PILOT SITES:
SOUTHERN AND NORTHERN GUINEA AND SUDAN SAVANNAS

Institute for Agricultural Research, A.B.U;Zaria, Nigeria.

TITLE OF PROJECT: PROMOTION OF STRIGA-TOLERANT MAIZE VARIETIES AND RELATED CROP AND SOIL MANAGEMENT PRACTICES

COUNTRY: NIGERIA (Southern and Northern Guinea and Sudan Savannas)

NAMES, DISCIPLINE AND QUALIFICATION OF COLLABORATOR(S)

I. Kureh	Agronomy Physiology	Ph. D.	IAR
S. O.Alabi	Plant Breeding	Ph. D.	IAR
B.D. Tarfa	Soil Science	Ph. D.	IAR
A. Shenew	Extension	M. Sc.	KADP
A. Danbaba	Extension	HND	SG2000
T. M. Kudi	Socio- Economist	M. Sc.	IAR

OBJECTIVES OF THE PROJECT

i. To ameliorate the effect of low N through the use of efficient N fixing legumes in rotation with maize.

ii. To ameliorate yield loss due to *Striga* soil seed bank and seed production through the use of legume trap-crops in rotation with *Striga* resistant maize.

iii. To demonstrate the effect rotation on Striga infestation soil fertility and maize yield

iv. To produce seeds of *Striga* tolerant maize variety and legume trap-crops to facilitate adoption and diffusion.

MONITOURING TOUR

A monitoring team made of Dr. V. Adetimirin, *University of Ibadan* and Dr. (Mrs) Phillip; University of Agriculture Abeokuta visited IAR on 13th August 2003. The team visited on-farm *Striga* demonstration trials at Tashan-dole (SS), on-station *Striga* tolerant maize multiplication plot and inspected facilities at premier seed company. Members of team interacted with some participating farmers on their perception of the technologies been demonstrated and were worried about the level of *Striga* infestation on farmers' fields however they were impressed with the performance of the legumes and the *Striga* tolerant maize variety.

FIELD DAYS

Field days were organized in four of the locations were demonstration trials were carried out. Over 130 farmers/Traditional rulers attended the field days. Discussions were held on farmers' perception acceptability and adoptability of the improved *Striga* tolerant maize variety for *Striga* control and the performance of the legume trap-crops. Questions and answers section form part of the discussion. The field days created public awareness and a lot of the farmers were interested in participating in the project. At Kwoi photographs (front page) were taken during the field day.

SURVEY

A survey was conducted with administration of questionnaire in sudan and southern Guinea Savannas where on-farm demonstrations were conducted. The overall objective is to ascertain famers' perception and determine the cost and returns of the improved *Striga* control technologies.

VIDEO COVERAGE

Video-taping of the activities of the project in the three ecological zones was carried out in 2003 cropping season using DVCAM (digital tape). The documentary has been translated, edited and sent to the coordinating institution (SAFGRAD).

TRAINING

An umbrella organization for all the farmers groups and extension agents in Igabi Local Government of Kaduna State had one day training on *Striga* biology and integrated control with a special session on use of flannel board. The training which was conducted in Hausa had the support of the emir, the chair and councilors of the LGA. About 50 leaders of farmers' associations, including women, participated.

MATERIALS AND METHODS

ACTIVITIES:

Establishment of Demonstration

Sixty five on-farm demonstration trials were successful established in three ecological zones of Nigeria. In NGS, 48 (four varietals and nine rotations at Kwoi , six varietals and seven rotations at Samaru-kataf and seven varietals and nine rotations at Allo-kachia) demonstrations were established. In NGS, five each of varietals and rotations demonstrations were established at Turunku. However, in SS, seven varietals and six rotations demonstrations were established at Tashan-dole.

Experiment 1: Variety Demonstration Trials

On-farm demonstration trials were conducted on 30 farmers' fields in the SGS, NGS and SS at five locations (Kwoi, Samaru-kataf, Allo-kachia, Turunku and Tashan-dole) to evaluate the reaction of maize varieties to *Striga hermonthica* infestation under sole crop. The improved technology demonstrated consist of improved *Striga* tolerant open pollinated (OP) maize variety, Acr.97TZL Comp.1-W, compared with farmers' local maize varieties. Each farm with the two plots constituted a replicate. The gross and net plot sizes were 400m^2 and 340m^2, respectively. Three maize seeds were planted on 75cm ridges at a spacing of 50cm apart. At two weeks after sowing (WAS) maize was thinned to two plants per stand. The fields were hoe weeded at 2WAS and earthen up at 6WAS followed by a careful hand pulling of other annual weeds except *Striga* at 8WAS. In order to enhance the tolerance of the improved maize varieties fertilizer was applied at

the rate of 120kg N/ha, 60kg P/ha and 60kg K/ha using NPK (15:15:15) and urea. The fertilizer was split applied at 2 and 6WAS. Data collected included *Striga* infestation (*Striga* count), host damage severity ear and plant heights, stand count, cob number and weight and grain yield. The data were subjected to analysis of variance and treatment means were compared using Duncan Multiple Range Test (DMRT). Site effect was also determined.

Experiment 2: Legume -Cereal Rotation

On-farm trials were conducted on 35 farmers' fields in the SGS, NGS and SS at five locations (Kwoi, Samaru-kataf, Allo-kachia, Turunku and Tashan-dole) to investigate the effect of legume – cereal rotation on incidence and severity of *S. hermonthica* infection in maize. The technologies demonstrated in the first year consisted of improved *Alectra* tolerant efficient N fixing legume trap-crops, soybean cv. TGX 1448-2E or early maturing double cropped cowpea cv. IT93K452-1) compared with farmers' cereal crop intended for one year rotation.. In the second year, the legume will be followed by maize compared with farmers' cereal crop followed by maize. Each farm with the two plots constituted a replicate. The gross and net plot sizes were 400m^2 and 340m^2, respectively.

All field operations on the cereals were carried out as described above for maize. Soybean was drilled on 75cm ridges at a spacing of 5cm apart. Two cowpea

seed were planted on 75cm ridges at a spacing of 25cm apart without thinning. The soybean or cowpeas were hoe wedded at 3 and 6WAS and fertilizers were applied at the rate of 20kg N/ha, 40kg P/ha and 20kg K/ha at 2WAS using NPK (15:15:15) and single super phosphate. The cowpea was sprayed with cyperplus and benlate at the rate of 1L/ha and 0.4kg/ha, respectively at flower bud initiation and podding to control diseases and insect pests.

Land Preparation and Planting

As soon as the rains were established the demonstration farms were marked out by researchers, technical and extension staff with full participation of the farmers. A farmer's field was set aside as the Farmer's Field School (FFS) where all the operations were first demonstrated to the farmers before implementation on their farms. Farmers were taught to make their ridges across the slope and 75cm apart. Planting of maize and sole cowpea were demonstrated at a distance of 50cm and 25cm spacing using sticks cut at 50cm and 25cm, respectively. Soybean plating was demonstrated by making a groove and soybean seeds were dropped at 5cm apart before closing the groove. In the inter-crop cowpea planting was demonstrated by planting simultaneously two seeds of cowpea between two maize stands at a spacing of 25cm from maize stands.

Thinning, Weeding and Fertilizer Application

At first weeding, the farmers were trained to thin their maize plants to two per stand. Also they were taught to weed their fields at 3 and 6 WAS, followed with careful hand pulling of other annual weeds except *Striga* at 8 WAS in order to

prevent competition and stress from weeds. Graduated rubber covers were used to apply the required quantity of fertilizers to holes made about 5cm away from the crops stands and covered to prevent washing away by rain or lost due to volatilization.

Analysis

Soil samples were collected from each farmer's field that selected the rotation technology in 2003. A total of 19 soil samples were analyzed. This number, however, does not correspond with number of farmers that selected the rotation technology. This is because to reduce cost of analysis where two demonstrations were conducted on the same field, the whole field is sampled and bulked and one representative sample is used. Also where neighboring fields are used, the whole area is also sampled and one representative sample is used. Sampling depth was 0-15cm. All soil samples collected were air-dried, sieved and analyzed for texture, pH, organic carbon, total nitrogen, available phosphorus, cat ion exchange capacity and exchangeable bases.

Data collected include maize stand and plant count, *Striga* shoot count (infestation), number of maize plants infested (incidence), host damage severity, plant and ear heights, yield and yield components of maize, soybean and cowpea. The data were subjected to analysis of variance and treatment means were compared using Duncan Multiple Range Test (Duncan, 1955). The relationships among *Striga* and crop parameters were determined in a correction co-efficient matrix. Crop values were calculated using farm gate prices (in November).

RESULTS

Initial soil properties of demonstration sites in Allo, Turunku, Tashan-dole and Ankung villages are shown in Tables 1. All demonstration sites have sandy loam soil

texture except 1 site in Turunku, and Tashan Dole that have loamy soil texture. All sites in Ankung are sandy clay loam in texture except one. Textural analysis indicates that all sites were free from water logging which is known to reduce maize performance and also *Striga* emergence.

Soil reaction varied from 4.78 (very strongly acidic) in Ankung to 7.30 (slightly alkaline) in Tashan Dole. Most demonstration sites have slightly acid reaction (6.1-6.5). This is common to all savanna soils. Acidic soil reaction in savanna soils is usually induced through persistent use of inorganic fertilizer (urea) and removal of crop residence which is a common farming practice.

Organic carbon and total nitrogen were all low (< 2% and, 0.15%) respectively. One site in Tashan-dole however, has medium total N content. This result suggests that all demonstration sites were low in fertility. Poor performance of maize and high *Striga* infestation and emergence are usually associated with low soil fertility. Response from the application of the technology is therefore highly expected since soil nutrient are low.

Calcium and sodium status of the soil are both low (0-2 and 0-0.1) respectively. However, many demonstration sites in Allo, Turunku, and Tashan-dole have medium magnesium and potassium content (0.3-1.0 coml. /kg soil) respectively. Some demonstration sites have high potassium content (> 0.3 coml. /kg soil). This high K content could be as a result of previous fertilizer use or burning during land preparation which is a common practice at land preparation.

Available phosphorus felt within the FAO low (0-10ppm) soil fertility class for

Allo, Turunku and Ankung villages. However, three fields in Tashan-dole have available P constant within the medium (10-15pmm) soil fertility classification. The relatively high available P in these sites could be due to previous P fertilizer use. This is further reported by relatively higher calcium levels in those sites. It is known that single supper phosphate which contain P and Ca have high residual effect, and most farmers in the study area uses it as the only straight fertilizer for p supply.

Table 1: Physico-chemical properties of demonstration sites in 2003.

NO	Farmer	Village	% Sand	% Silt	% Clay	Texture	pH H_2O	% OC	% TN	Ca	Mg	K	Na	Av. P
1	Joseph Chom	Allo	77	16	7	SL	6.30	0.49	0.053	0.50	0.20	0.14	0.07	3.10
2	Christopher Yari	Allo	53	34	13	SL	5.00	1.00	0.088	0.50	0.33	0.33	0.08	3.50
3	John Kurfi	Allo	75	16	9	SL	5.60	0.63	0.140	0.50	0.30	0.24	0.07	3.30
4	Dominic Paul	Allo	73	16	11	SL	5.40	1.27	0.070	0.50	0.38	0.44	0.08	3.70
5	Samuel Wakili	Allo	79	14	7	SL	5.40	0.70	0.105	0.50	0.20	0.21	0.08	3.60
6	Mohammed Nababa	Turunku	53	32	15	SL	6.00	0.90	0.105	1.00	0.43	0.35	0.06	5.20
7	Dari Teacher	Turunku	59	32	9	SL	6.60	0.63	0.070	0.50	0.33	0.30	0.08	4.40
8	Mohammed L.	Turunku	45	44	11	L	5.80	0.55	0.070	0.80	0.40	0.20	0.06	3.80
9	Danbaba	Tasha-d ole	57	34	9	SL	6.20	0.43	0.070	0.80	0.38	0.29	0.07	3.00
10	Shehu Amadu	Tasha-dole	49	36	15	L	6.40	0.45	0.158	1.00	0.43	0.46	0.08	13.11
11	Isiaku Nayaha	Tasha- dole	53	38	9	SL	7.30	0.68	0.070	1.80	0.50	1.02	0.08	3.2
12	Mallam Amadu	Tasha-dole	53	38	9	SL	6.80	0.43	0.053	1.00	0.38	0.31	0.07	14.1
13	Sule Mathew	Tasha-dole	57	30	13	SL	6.10	0.51	0.070	0.50	0.33	0.20	0.06	3.60
14	Saidu Mato	Tasha-dole	57	34	9	SL	6.10	0.51	0.105	1.00	0.43	0.22	0.06	4.10
15	Rabo Mato	Tasha-dole	49	36	15	L	6.20	0.65	0.088	1.00	0.33	0.20	0.06	15.2

16	Dauda Adamamu	Ankung	51	26	23	SCL	4.80	1.04	0.123	0.50	0.17	0.31	0.08	6.10
17	Victor Doe	Ankung	63	16	21	SCL	5.00	0.94	0.088	0.80	0.20	0.24	0.06	3.20
18	Garba Isah	Ankung	53	12	35	SCL	4.90	0.76	0.070	0.50	0.25	0.24	0.07	3.10
19	Sarki Nom Kashero Sabo	Ankung	71	14	15	SL	5.00	0.84	0.088	0.80	0.12	0.60	0.07	4.30

PERFORMANCE OF THE VARIETIES

The performance of the improved *Striga* tolerant maize variety at Kwoi, Samaru-Kataf, Allo-Kachia (SGS) and Tashan-dole (SS) are contained in tables 2-5 respectively while the result of the combined analysis across locations is contained in table 6.

At Kwoi, the *Striga* tolerant maize variety, Acr.97TZL Comp.1-W, produced significantly higher grain yield, cob number and weight and had more stand count at harvest than the farmers' maize varieties (Table 2). Acr.97TZL Comp.1-W supported significantly fewer *Striga* shots, was less damaged and produced taller plants with higher ear heights than farmers' varieties. The grain yield of Acr.97TZL Comp.1-W was 87% higher than the farmers' maize varieties.

At Samaru-Kataf, Acr.97TZL Comp.1-W produced significantly higher grain yield and cob number, supported fewer *Striga* plants, was less damage and had higher stand count and ear height than the farmers' maize varieties (Table 3). The grain yield of Acr.97TZL Comp.1-W was 16% higher than the farmers' maize varieties.

Similarly at Allo-Kachia, the *Striga* tolerant maize variety produced significantly higher grain yield, cob number and weight, had higher stand count and plant height, supported fewer *Striga* plants and was less damaged than the farmers' maize varieties (Table 4). The grain yield of Acr.97TZL Comp.1-W was 92% higher than the farmers' maize varieties.

At Tashan-dole in the Sudan savanna, Acr97TZL Comp.1-W produced

significantly higher grain yield and cob weight, supported fewer *Striga* shoots and was less damaged than the farmers' maize varieties (Table 5). The grain yield of Acr.97TZL Comp.1-W was 132% higher than the farmers' maize varieties.

The combined analysis across locations indicated that improved *Striga* tolerant maize variety, Acr.97TZL Comp.1-W, produced higher grain yield, cob number and weight, supported few *Striga* plants, was less damaged and produced taller plants with more stand count than the farmers maize varieties (Table 6). The grain yield of Acr.97TZL Comp.1-W was 60% higher than the farmers' maize varieties.

Correlation

Striga shoot count and damage severity were all negatively correlated to cob number and weight and grain yield at all locations (Table 6). However, only crop damage severity was consistently significant and negatively correlated to cob number and weight and grain yield at all locations.

Table 2: Effect of variety on Striga infestation, crop damage severity, yield and yield components of maize at Kwoi SGS, Nigeria, 2003 wet season.

Varieties	Stand Count/400m²	Height (m) at Harvest		Striga Count/400m² 9WAS**	Crop Damage Severity*** 9WAS	Cobs/400m²		Grain Yield (kg/ha)
		Plant	Ear			Number	Weight (kg)	
Acr.97TZ LComp. 1-W	1738a*	2.3a	0.7a	148b	2.6b	815a	68a	4560a
Farmers Variety	1332b	1.5b	0.5b	403a	5.3a	540b	47b	2438b
SE+	43.60	0.06	0.02	32.47	0.23	31.40	3.34	170.9

Table 3: Effect of variety on Striga infestation, crop damage severity, yield and yield components of maize at Samaru-Kataf SGS, Nigeria, 2003 wet season.

Varieties	Stand Count/400m²	Height (m) at Harvest		Striga Count/400m² 9WAS**	Crop Damage Severity*** 9WAS	Cobs/400m²		Grain Yield (kg/ha)
		Plant	Ear			Number	Weight (kg)	
Acr.97TZ LComp. 1-W	643a*	2.2	0.6a	944	2.3b	671a	76	6492a
Farmers Variety	551b	2.1	0.5b	913	5.2a	493b	49	5607b
SE+	18.06	0.19	0.02	177.87	0.28	18.74	8.84	139.84

Table 4: Effect of variety on Striga infestation, crop damage severity, yield and yield components of maize at Allo-Kachia SGS, Nigeria, 2003 wet season.

Varieties	Stand Count/ 400m²	Height (m) at Harvest		Striga Count/4 00m² 9WAS**	Crop Damage Severity*** 9WAS	Cobs/400m²		Grain Yield (kg/ha)
		Plant	Ear			Num ber	Weight (kg)	
Acr.97TZ LComp. 1-W	1663a*	2.5a	0.7	23b	1.5b	648a	64a	6113a
Farmers Variety	1446b	1.5b	0.7	865a	5.0a	389b	55b	3185b
SE±	31.75	0.11	0.07	52.77	0.35	43.21	0.87	285.49

Table 5: Effect of variety on *Striga* infestation, crop damage severity, yield and yield components of maize at Tashan-Dole SGS, Nigeria, 2003 wet season.

Varieties	Stand Count/40 0m²	Height (m) at Harvest		Striga Count/40 0m² 9WAS**	Crop Damage Severity*** 9WAS	Cobs/400m²		Grain Yield (kg/ha)
		Plant	Ear			Number	Weight (kg)	
Acr.97TZ LComp. 1-W	1627	1.9	1.0	256b*	1.6b	815	60a	3205a
Farmers Variety	1603	1.9	0.9	3498a	5.8a	479	27b	1378b
SE±	18.86	0.06	0.04	258.08	0.28	105.13	4.45	145.9

Table 6: Effect of variety on *Striga* infestation, crop damage severity, yield and yield components of maize combine analysis across locations, SGS, Nigeria, 2003 wet season.

Varieties	Stand Count/ 400m²	Height (m) at Harvest		*Striga* Count/40 0m² 9WAS**	Crop Damage Severity*** 9WAS	Cobs/400m²		Grain Yield (kg/ha)
		Plant	Ear			Num ber	Weight (kg)	
Acr.97TZ LComp. 1-W	1412a*	2.3a	0.7	334b	2.0b	726a	65a	5175a
Farmers Variety	1239b	1.7b	0.7	1427a	5.3a	475b	44b	3229b
SE±	15.06	0.06	0.02	79.87	0.14	21.33	1.99	99.58

Table 7: **Correlation coefficients between *Striga* and some crop parameters of maize at the various communities, Nigeria 2002 wet season.**

Striga Parameters	Crop Parameters		
	Cob Number	Cob Weight	Grain Yield
Kwoi			
Striga count at 9WAS	-0.44	-0.40	-0.65**
Crop damage severity 9WAS	-0.80**	-0.79**	-0.89**
Samaru Kataf			
Striga count at 9WAS	-0.32	-0.55*	-0.67**
Crop damage severity 9WAS	-0.54*	-0.55*	-0.82**
Allo-Kachia			
Striga count at 9WAS	-0.79**	-0.02	-0.84**
Crop damage severity 9WAS	-0.74**	-0.83**	-0.84**
Tashan Dole			
Striga count at 9WAS	-0.65**	-0.79**	-0.78**
Crop damage severity 9WAS	-0.72**	-0.78**	-0.76**

* = r(0.05) = 0.532

** = r(0.01) = 0.651

Community seed multiplication of cowpea and soybean

Contract was signed with Samaru-kataf KADP Zonal office for the multiplication of legume trap crops. The project provided seeds for planting and other inputs while the Zonal office provided land and labor for the various operations. At the end of the season one third of the produce was recovered from the Zonal office for use as seed for planting in 2003. The Zonal office was encouraged to sell their seeds to members of staff and other farmers in order to spread the varieties.

BREEDER AND FOUNDATION SEED PRODUCTION

Half-sib family method was used. At about the time of flowering the rows were arbitrarily designed as males and females in a ratio of one male to four female rows. All the plants of the female roles were detasselled. Undesirable and off types plants of the male rows were also detasselled to ensure a better control of the pollen source. About 600 ears were selected before harvest from the female rows and used as the progenitors for the next generation of breeder's seeds. A bulk of equal quantities of seed from the field cobs were sorted out and the remaining ones were threshed, cleaned and graded for use as foundation seed.

The personnel of the National Seed Service inspected our seed production fields and were satisfied with the techniques employed.

Quantities of communityseed (kg) obtained

Table 8: Cowpea cv. IT93K452-1and soybean seeds

Location	Cowpea seed yield (kg)	Amount recovered (kg)	Soybean seed yield (kg)	Amount recovered (kg)
Samaru -kataf	150	50	100	50

Table 6: Maize cv. Acr. TZL Comp.1-W (kg)

Maize variety	Breeder	Foundation	Total
Acr.97 TZL Comp. 1-W	150	2000	2150

SEED DISTRIBUTIOM

About seventy five nonparticipating farmers collected seeds of improved Striga tolerant maize variety and legume trap crops to try on the farms.

Socio-Economic Analysis of Promotion of *Striga* Tolerant Maize Variety (Acr.TZL Comp.1-W) in Sudan Savannah (SS) and Southern Guinea Savannah (SGS) of Nigeria

Farmers Perception on the *Striga* Tolerant Maize Variety and Farmers' Variety

The perception of farmers' on *Striga* tolerant maize variety farmers' variety was assessed in terms of: crop germination, crop growth, crop maturity, grain/cob filling, grain size, yield, *Striga* emergence, and crop damage/symptoms in the agro-ecological zones. The results in Table 1 indicates that *Striga* tolerant maize variety had high germination rate, fast growth, early maturing, high grain/cob filling to the brim, big grain size, high yielding, late and very low *Striga* emergence, low crop damage and less *Striga* symptoms, while the famers' variety the germination rate was very poor, slow growth rate, late maturing, poor grain/cob filling, small grain size, very low yield, early and high *Striga* emergence,high crop damage and *Striga* symptoms were observed.

Table 1: Farmers' Perception on *Striga* Tolerant Maize Variety and Farmers' Variety in Sudan and Southern Guinea Savannas of Nigeria

Farmers' Perception	***Striga* Tolerant Variety**	**Farmers' Variety**
Crop Germination	High	Poor
Crop Growth	Fast/High	Slow
Crop Maturity	Early maturing	Late maturing
Grain/Cob filling	High	Poor
Grain Size	Big	Small
Striga Emergence	Late and Low	Early and High
Crop damage/symptoms	Low and less *Striga* symptoms	High

Famers' Choice of Variety and Reasons Given for the Choice of *Striga* Control Technology

The survey revealed that all the farmers in the two agro- ecological zones preferred the *Striga* tolerant maize variety (Acr.TZL Comp.1-W) to their own variety. Majority of the farmers (76.2%) in the agro-ecological zones reported that high yield and tolerance (less *Striga* emergence and less crop damage) of the *Striga* tolerance maize variety were their main reasons for the choice of the variety, while 19.04 and 4.76% were of view that more flour, better food taste and good seed colour were their reasons for choosen the *Striga* tolerant variety. This result indicates that intensification and expansion of *Striga* tolerant maize production will reduce and or control *Striga* menace. Farmers in the two agro-ecological zones requested for more seeds of the improved maize variety for the next season's production. Thus, there is need to encourage seed multiplication of the *Striga* tolerant maize variety at farmers' level. This will enable more farmers to benefit from the technology; which invariably will lead to wide adoption of the technology to control *Striga* menace in the agro-ecological zones.

Table 2: Farmers Reasons for the Choice of Technology

Reasons	Number of Farmers	Percentage
High yield	24	38.10
Tolerance	24	38.10
Good seed colour	3	4.76
More flour	6	9.52
Better food taste	6	9.52
Total	63	100

Costs and Returns Analysis

The variable cost components considered in the analysis include seeds, fertilizers, bags (sacks), land preparation/ridging, planting, weeding, fertilizer application, earthing-up, harvesting and threshing. In Table 3 the difference in the total variable cost of production between the *Striga* tolerant maize variety and farmers varieties was attributable to the differences in costs of seeds and bags (sacks) in the two agro-ecological zones. The costs and returns analysis in the Table show that labour and fertilizers inputs accounted for greater parts of the total variable costs incurred in both varieties. Labour cost was represented by 55.25 and 57.21 for *Striga* tolerant maize variety and farmers' variety in SS, while in SGS labour cost were 56.82 and 58.81%. Fertilizers were 39.10 and 40.50% in SS; and 36.65 and 37.96% in SGS respectively. The farm gate price of maize (₦ 20/kg) was used in estimating the revenue and comparing with the total variable costs to obtain the gross margin which measured the economic performance of the two maize varieties. In SS, the gross margin analysis as indicated in Table 3 show that from one hectare of land cultivated, the total cost of production for *Striga* tolerant maize variety was ₦77765.51 and gross revenue of ₦63,833.33, thus making a gross margin of ₦ -13,932.18, while the farmers variety, total cost of production was ₦ 75,073.04 and gross revenue of ₦ 27,543.40, with gross margin of ₦ –47,529.00. The negative gross margin obtained

for the *Striga* tolerant maize variety can be attributed to short rainfall duration in the zone, while in the case of the farmers' variety, it's implies that continous cultivation of the variety will increase *Striga* infestation in the zone. However, in SGS, the total cost of production for *Striga* tolerant variety was ₦ 248,853.99 and gross revenue of ₦343,333.20, with gross margin of ₦ 94479.21, while the farmers variety had total cost of production of ₦ 240,320.67 and gross revenue of ₦ 224.636.80, with gross margin of ₦ –15,683.87. The gross margin analysis of the SGS, show that it is profitable to cultivate *Striga* tolerant maize variety than farmer's variety. This result indicates that intensification and expansion of production of *Striga* tolerant maize variety will reduce and or control *Striga* menace in the zone.

In terms of gross margin per Naira invested, in SS, for every one Naira invested on the *Striga* tolerant maize variety and farmer's variety, a net loss of –18 kobo and -63 kobo were obtained. In SGS, the gross margin per Naira invested indicates that for every one Naira invested on *Striga* tolerant maize variety and farmer's variety, 38 kobo and –07 kobo were the net gain and loss. The result indicates that *Striga* tolerant maize variety generated more returns to farmers than farmer's variety. Therefore, farmers should be encouraged to invest their resources in the improved *Striga* tolerant variety.

Table 3: Costs and Returns Analysis

		Sudan Savannah				Southern Guinea Savannah			
		Acr. TZL Comp. 1-W		Farmers' Variety		Acr. TZL Comp. 1-W		Farmers' Variety	
S/No	Costs/Returns Items	Cost (₦/ha)	Percentage	Cost (₦/ha)	Percentage	Cost (₦/ha)	Percentage	Cost (₦/ha)	Percentage
1.	**Costs:**								
	Seed	3125.00	4.02	1308.33	1.74	9375.00	3.77	3583.34	1.49
	Fertilizers	3045.50	39.10	30405.50	40.50	91216.50	36.65	91216.50	37.96
	Bags (sacks)	1276.67	1.64	400.87	0.53	6866.66	2.76	4125.00	1.72
	Labour:								
	Land preparation/Ridging	8750.00	11.25	8750.00	11.66	23041.67	9.26	23041.67	9.69
	Planting	4166.67	5.36	4166.67	5.55	16354.17	6.57	16354.17	6.81
	Fertilizer application	7083.33	9.11	7083.33	9.44	26145.83	10.51	26145.83	10.88
	Weeding	11041.67	14.20	11041.67	14.71	31458.33	12.64	31458.33	13.09
	Earthing-up	6875.00	8.84	6875.00	9.16	16250.00	6.53	16250.00	6.76
	Harvesting	666.67	0.86	666.67	0.89	16375.00	6.58	16375.00	6.81
	Threshing	4375.00	5.63	4375.00	5.83	11770.83	4.73	11770.83	4.90
	Total Variable Cost (TVC)	77765.51		75073.04		248853.99		240320.67	
2.	**Returns:**								
	Average yield (kg/ha)	3191.67		1377.17		17166.66		11231.84	
	Average price (₦/kg)	20.00		20.00		20.00		20.00	
	Gross revenue (₦/ha)	63833.33		27543.40		343333.20		224636.80	
	Gross margin (GR-	-		-		94479.21		-15683.87	

TVC) (₦/ha)	13932.18	47529.00		
Gross margin/₦ invested	-0.18	-0.63	0.38	-0.07

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