RELATIVE PROFITABILITY OF EARLY AND EXTRA-EARLY MAIZE VARIETIES AT DIFFERENT SOWING DATES IN NORTHERN GUINEA ZONE OF NIGERIA

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Abstract

Two field experiments were conducted during the wet seasons of 2000 and 2001 at Samaru (11° 11'N latitude and 7° 38'E longitude and 686 m above sea level) in Northern Guinea Savanna to study the effect of maize varieties (TZE-Comp 3, 95-TZEE-W and 95-TZEE-Y) and six different dates of sowing at two weeks intervals (beginning from mid-June) on maize production. Factorial combinations of the treatments were laid out in a Randomized Complete Block Design (RCBD) and replicated three times.

Results showed that early variety (TZE-Comp 3) was more profitable and significantly outyield 95-TZEE-W and 95-TZEE-Y which were found to be at par with each other. Each delay in sowing on the other hand was accompanied with a significant reduction in grain yield, increase in labour cost and decrease in gross margin which eventually resulted in loss for the maize sown very late.

Key words: Profitability, Maize Varieties, Sowing Dates.

Introduction

Maize has become increasingly important as a food and source of income for the inhabitants of semi-arid West Africa. Its production has increased over the past 20 years in the Guinea Savanna owing to the adoption of high yielding, early and adapted varieties and increased fertilizer use (Fajemisin, 1991). The crop has a remarkable adaptability to a wide range of environmental conditions. It is adapted to a wide range of climate which made the crop to be more extensively distributed over the world than any other crop (Onwueme and Sinha, 1991). The rapid expansion of maize production in the Northern Guinea Savanna was related to the discovery that the zone possesses the greatest potential for the cultivation of the crop (Ahmed *el al.*, 1997).

Early maturing (90-day) variety which matured within 3-4 months and requiring 600 mm of rainfall would be more appropriate in Northern Guinea Savanna (Rowland, 1993). The available improved early maturing varieties are drought-tolerant and resistant to infections by maize streak virus and foliar fungal leaf diseases that cause losses in yield (C1MMYT, 1990 and Fayemisin, 2000).

Extra-early maize varieties producing consumable fresh ears in less than 70 days .and dry grains in 80 days offer unique opportunities for the inhabitants of the Sahel. It may be cultivated alone or substituted for millet in millet-based cropping systems. The plants are shorter and have fewer leaves. Flowering occurs 40-45 days after maturing and with only 3-4 weeks of rain after silking, the yield of on-farm extra-early is 1.5 - 2.0 t/lia (Fajemisin, 1991). Extra-early maize is very useful to "catch up" with the season in situations where rainfall started late or its distribution is so adverse as to require replanting (CIMMYT, 1990). The varieties which exist in white or yeljow grain are resistant to streak virus and fungal foliar diseases. ■ ...

Time of sowing is an important agronomic factor which can cause substantial jpprgsp^ojr decrease in yield of maize crop. Early planted maize crop had tassel and silk earlier with larger deep root system and developed more ears before moisture become limiting later in the season (Rowland, 1993). The initial growth of late planted crop is generally poor because of excess moisture condition and poor aeration. Subsequent relative growth stages could be good but the plant becomes stunted, it thus remains small with low carbohydrate production during grain filling stages (Vepori, 1953 and Jones, 1974). Kamel *el* al. (1979) observed that sowing date had significant effect on the percentage of barren plants, number of ears/plant, weight of grains per ear, shelling percentage and grain yield. A loss of 25 percent in yield was reported by Venon (1953), with each week delay in sowing. Longer cob with a mean length of 24 cm was observed with early sowing (Bolan, 1979).

This study, therefore, seeks to compare profitability of three varieties of maize (one early and two extra-early) and also determine appropriate sowing date that can improve and sustain productivity of maize in the Northern Guinea Savanna of Nigeria.

Materials and Methods

The study was conducted at the Institute for Agricultural Research, Samaru (11° 1 l'N latitude and 7° 38'E longitude and 686 m above sea level) in the Northern Guinea Savanna ecological zone of Nigeria during rainy seasons of year 2000 and 2001. Randomized Complete Block Design (RCBD) was used with three replications, to study the effect of variety and six sowing dates on both physical and economic returns from maize production in the Northern Guinea Savanna zone of Nigeria. The maize varieties used were TZE-Comp 3, 95-TZEE-W and 95-TZEE-Y.

TZE-Comp 3 is an early maturing variety grown in the Savanna and rain forest of Nigeria. The extra-early maize (95-TZEE-W) is white, semi-dent, and grown in the Sudan Savanna. It is moderately resistant to foliar diseases. While extra-early yellow maize (95-TZEE-Y) is yellow in colour, flint, grown in the Sudan Savanna and is moderately resistant to foliar diseases. The six sowing dates used for the study arc at interval of two weeks. These were June 21, July 5, July 19, August 2, August 16 and August 30. The soil of the experimental site was loam, well drained and often leached ferruginous tropical soil (Table 1).

Table 1. Physico-chemical Properties of Soils at the Experimental Sites During 2000 and 2001 Seasons at Samaru.

	2000		2001	
Soil physical characteristics (%)	0-15 (cm)	15-30 (cm)	0-15 (cm)	15-30 (cm)
Sand	47	41	47	40
Silt	37	31	36	31
Clay	16	27	16	29
Textural class	Loam	Loam	Loam	Loam
Chemical Composition				
pH in H_zO (1:2.5)	5.09	4.90	5.02	4.72
pH in 0.1 $CaCl_2$ (1:25)	5.11	4.70	5.01	4.68
Organic carbon (%)	0.30	0.23	0.28	0.23
Total nitrogen (%)	0.066	0.055	0.049	0.049
Available phosphorus (ppm)	3.62	1.82	3.55	1.69
Exchangeable bases (cmol/kg)				
Ca	1.82	0.82	1.67	0.54
Mg	0.60	0.40	0.53	0.38
K	0.31	0.36	0.30	0.32
Na	0.56	0.48	0.52	0.46
CE	4.92	3.45	4.34	3.02
H+Al	0.11	0.12	0.10	

Each sub-plot measured 3 m x 5 m (four ridges). The net plot area was 3 m x 1.5 m (2 ridges). Two seeds were sown per stand on ridges 75 cm apart at intra-row spacing of 20 cm. Thinning to one plant per stand was done at 2 weeks after sowing (WAS). Weeds were controlled using hand hoe at 3 and 6 WAS and earthened up at 9 WAS.

Fertilizers were applied at the rate of 120 kg N, 26 kg P and 50 kg K per hectare. The NPK fertilizer (20: 10: 10) was first applied at sowing by drilling near the seeds. The second fertilizer application was done at 4 WAS using urea (46% N). The crops were harvested at physiological maturity when the leaves and ears turned brown. The weather conditions during the trial period are given in Appendix 1.

Gross margin was estimated for every treatment to examine the economic implication of varietal difference and variable sowing date on maize production in the' Northern Guinea Savanna. Gross margin is expressed as:

GM = TR-TVC

where, GM = Gross margin (N/ha)
TR = Total Revenue (N/ha)
TVC = Total variable cost (N/ha).

Results and Discussion

Yield Response to Variety and Sowing Date

Effect of variety and sowing dates on grain yield (kg/ha) is shown in Table 2. Early variety (TZE-Comp 3) significantly oulyield the two extra-early maize varieties in both seasons. The extra-early maize varieties which were found to be at par with each other, in terms of yield, except at combined analysis, where 95-TZEE-W significantly gave higher yield than 95-TZEE-Y. Similar effect was reported by Fajemisin (1991) that sole cropped early maize variety (TZE-Comp 3) could produce on-farm yield of 3 tons/ha compared to extra-early maize variety which produce 1 . 5 - 2 tons/ha.

Each delay in sowing was accompanied with a significant reduction in yield, except at combined analysis where last and second to the last sowing dates were found to be statistically similar. Similar responses were reported by Venon (1953) and Jones (1974) that the initial growth of late planted maize is generally poor because of the excess moisture condition and poor aeration. Subsequent relative growth stages could be good buf the plants becomes stunted. It thus, remain small with low carbohydrate production during grain filling stages. Similarly, Rowland (1993) reported that early planted maize had tassel and silk earlier with longer and deeper root system and developed more ears before moisture becomes limiting later in the season.

Table 2. Effect of Variety and Sowing Dates on Grain Yieid (kg/ha).

Treatments	Grain yield (kg/ha)		
	2000	2001	Combined
Variety			
TZE-Comp 3	1779.2a	1711.8a	1745.5a
95-TZEE-Y	1193.9b	1181.1b	1187.5c
95-TZEE-W	1303.8b	1272b	1289.0b
SE(±)	48.2	49.4	48.8
Sowing date			
June 21	2233.2a	2333.2a	2283.2a
July 5	1925.3b	2027.8b	1976.6b
July 19	1563.1c	1676.4c	, 1619.8c
August 12	1207.7d	1282.0d	1244.8d
August 16	965.2e	575.8e	770.5e
August 30	693.Of	441,3f	567.2e
SE(±)	68.2	69.9	69.0
Interaction			
VxD	**	NS	*

Means followed by the same letter(s) within a treatment group are not significantly different using DMRT at 5% level of probability.

* and ** = Significant at 5% and 1 %, respectively.

NS = Not significant.

Costs and Returns Analysis

The costs of three variable inputs (seed, fertilizer and labour) constituted the total variable cost. The revenue from maize crop was obtained as product of price of one kilogramme of maize and the total output measured in kilogramme. The farm gate price of N25/kg was used in computing the revenue. Gross margin which measures profitability was estimated as revenue less the total variable cost.

In this study, costs of seed and fertilizer remained the same for all the treatments as same quantities of seed and fertilizer were used for the treatments. In Table 3, the cost of labour varied among the three maize varieties. This is attributable to difference in yields which called for different labour requirement for harvesting and threshing. The highest gross margin of N10,280.00 was observed for TZE-Comp 3 maize variety in consonance to the variety's high yield recorded. TZEE-Y maize variety had the least gross margin of N461.00.

Table 3. Average Costs and Returns per Hectare for Production of three Different Varieties of IMai/.c.

Variety	Seed Cost (N)	Fertilizer cost m	Labour cost m	Total cost (N)	variable	Revenue (N)	Gross margin m
TZE-Comp 3	4125	5500	23958	33583		43863	10280
95-TZEE-Y	4125	5500	19602	29227		29688	461
95-TZEE-W	4125	5500	21780	31405		32225	820

Table 4 shows variation in profitability levels at different sowing dates. The total variable cost increased from the first sowing date to the sixth. The increase in labour cost component was responsible for this. The more the delay in sowing, the more the labour cost; especially the labour was costly at the peak of rainy season (in August) when the demand for the labour was high. It was discovered that maize sown earlier (June 21) as rain established was more profitable compared to other dates of sowing. The maize sown very late (August 2 - 30) at the peak of rainy season recorded negative gross margin (loss). The two factors responsible for this were poor yields and high cost of labour.

Table 4. Average Costs and Returns Per Hectare for Maize Production at Different Sowing Dates.

Sowing date	Seed Cost (N)	Fertilizer cost (N)	Labour cost (N)	Total variable cost (*)	Revenue (N)	Gross margin (N)
June 21	4125	5500	11880	19305'	57080	37775
July 5	4125	5500	11880	19305	49415	30110
July 19	4125	5500	23760	33385	40495	7110
August 2	4125	5500	23760	33385	31120	-2265
August 16	4125	5500	29700	39325	19263	-20062
August 30	4125	5500	29700	39325	14180	-25145

Conclusion

In line with the findings in this study, it should be suggested that:

- Early maize variety (TZE-Comp-3) appeared to be appropriate for the Guinea Savanna ecology owing to sufficient rainfall.

- Extra-early maize varieties (05-TZEE-W and 95-TZEE-Y) are more adopted to Sudan and Sahel environments, because of insufficient and irregular rainfall of the areas.
- Where a farmer wants to produce two or more crops of maize in a season, these varieties (95-TZEE-W and 95-TZEE-Y) can be successfully grown in the Northern and Southern Guinea savanna areas.
- For good growth and yield of maize crop, it should be planted when the rains are established sometime in June. Delayed planting to August resulted to a significant loss in yield of maize crop; this was depicted with a negative gross margin.

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References

Ahmed, B., A.O. Ogungbile, J.O. Olukosi, M.K. Kolawole and V.O. Chude (1997). Economic Analysis of Maize Response to Nitrogen Fertilizer in the Northern Guinea Savanna of Nigeria. *Samaru Journal of Agricultural Research,* 1AR/ABU, Zaria, Nigeria. 14: 3-10.

Bolan, O. (1977). Optimum Date of Sowing of Some Cool Resistance Maize Hybrid. *Refracting Journal* 7(8). *Field Crop Abstract,* 31(1978).

C1MMYT, (1990). C1MMYT World Maize Facts and Trends: Realising the Potential of Maize in Sub-Saharan Africa, Mexico D.F., 38p.

Fajemisin, J.M. (1991). Approaches to Increased Production of Early-maturing Maize in Semi-Arid West Africa. In: *Influence Du Climal Sur La Production des Cultures Tropicales.* Burkina Faso, Sept. 1991, pp. 225-231.

Jones, M.J. (1974). Effect of Previous Crop on Yield and Nitrogen Response of Maize at Samaru, Nigeria. *Experimental Agriculture-,* 10: 273-9.

Kamel, M.S., E.A. Mahmoud, D.A. El-Kadi and A.M. Ba-Momah (1979). Differential Yield Response of Corn Varieties and Hybrid to Different Sowing Dates. *Research Bulletin,* Faculty of Agriculture, Shams University 787; 1977 (of Field Crop Abstracts 33 (1137), 125pp.

Onwueme, J.C. and T.D. Sinha (1991). Field Crop Production in Tropical Africa. *Technical Centre for Agricultural and Rural Cooperation* (CTA). The Netherlands. 480p.

Rowland, J.R.J. (1993). Dryland Farming in Africa. *Technical Centre for Agricultural and Rural Co-Operation,* CTA Macmillan Education Limited, 336p.

Venon, A.J. (1953). The Effect of Planting Date on Early Maize Crop. Department of Agriculture, Ibadan, No. 500-538.

Appendix 1. Saniaru Meteorological Observation
2000

	Rainfall	Temperature (°C)		Relative humidity (%)		Sunshine
Months	(mm)	Max.	Min.	10.00 a.m.	4.00 p.m.	(hrs)
May	149.5	37.0	25.0	84.1	37.7	7.9
June	193.4	31.8	22.4	82.1	61.2	7.0
July	■ 221.3	30.1	22.2	85.9	71.5	5.9
August	245.2	29.3	21.5	87.9	78.5	5.3
September	182.1	31.0	22.0	82.4	73.1	6.4

October	**78.0**	**32.6**	20.2	**71.2**	**58.6**	**7.4**
Total	**1068.50**					
2001						
May	**160.3**	**34.5**	**24.2**	**75.7**	**48.6**	8.1
June	**177.7**	**31.8**	22.8	**87.2**	**71.0**	**7.1**
July	**388.4**	**30.4**	22.0	**89.9**	**79.8**	**5.9**
August	**330.7**	**29.7**	22.1	**86.7**	**77.5**	**4.0**
September	**256.3**	**31.0**	22.0	**3.0**	**47.8**	6.0
October	-	**32.0**	20.0	**28.0**	22.0	**7.1**
Total	**1056.00**					