AGRONOMIC PERFORMANCE AND OIL CONTENT OF SUNFLOWER [*Helianthus annuus L.*] IN THE NIGERIAN SAVANNA.

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SUMMARY

Two cultivars of sunflower were tested at three locations of the Nigerian savanna ecologic zone to determine the range of adaptability of the crop. Seed yields obtained ranged from 978 kg per hectare to 2633 kg per hectare for the variety Funtua at Samaru and Alatako respectively. For the variety Isaanka, the seed yields ranged from 1178 kg per hectare at Damaturu to 2622 kg per hectare at Alatako. The mean oil content of the varieties ranged from 30.65% for Funtua at Damaturu to 45.01% for Isaanka at Alatako. The highest mean seed and oil yields were recorded at Alatako. Over all the locations, the variety Isaanka was shorter in stature and had smaller heads, but had higher seed yield and oil content than the Funtua variety.

INTRODUCTION

The Nigerian savanna covers an area of 700,000 km^2, constituting over 75% of the country's total land area. It is situated between latitudes 07-13°N and longitudes 02-15°E (Kowal and Knabe, 1972; Balasubramanian et al., 1984). The savanna region has been sub-divided into four zones. These are the southern guinea, the northern guinea, the sudan and the sahel zones (Fig. 1). The savanna vegetation consists of grasses with trees and bushes which are mostly of fire resistant species. The natural savanna regions are determined by the duration and intensity of the dry season and are not directly related to the total rainfall. The total annual rainfall in the region ranges from 500 mm in the sahel zone to 1500 mm in the southern guinea zone. The mean monthly minimum and maximum temperatures range from 12-21°C to 33-41°C respectively. The soils are mainly ferruginous tropical types.

The area covered between 10-12°N is suitable for groundnut production and the bulk of Nigeria's groundnut was produced in this zone prior to 1973. However, since the drought disaster of 1973 which caused massive crop losses of groundnut and cereals north of 11°30'N, and the rosette outbreak of 1975 which destroyed about 682,000 ha of groundnut, the production of groundnut had declined considerably. This resulted in the importation of vegetable oils as well as raw materials for the extraction of oils including sunflower seeds by the numerous oil mills in Nigeria. A search for alternative oilseeds to complement groundnut has therefore become imperative. Sunflower was reported to be less sensitive to soil fertility when compared to maize for example and short periods of drought may not greatly reduce seed yield because growth can proceed at night when transpiration is low (Robinson, 1978). This suggests that sunflower could be a suitable oilseed crop for the savanna zones of Nigeria.

Because many biological populations are exposed to variations both in time and space, information on the performance of different populations in different locations is clearly desirable in order to measure the range of adaptation of the populations. Such information on sunflower is available from the reports of various workers in different parts of the world (Kinman and Earle, 1964; Johnson and Jellum, 1972; Zubriski and Zimmerman, 1974; Vijayalakshimi et al., 1975; Lugo-lupez, 1977; Robles and Villarreal, 1977; Green et al., 1978; Ogunremi, 1979; Vranceanu et al., 1982; 1984; Seiler, 1984). However, no such studies have been conducted on sunflower at various locations of the Nigerian savanna. The objective of this paper was therefore to report the performance and chemical composition of the seed of two open pollinated

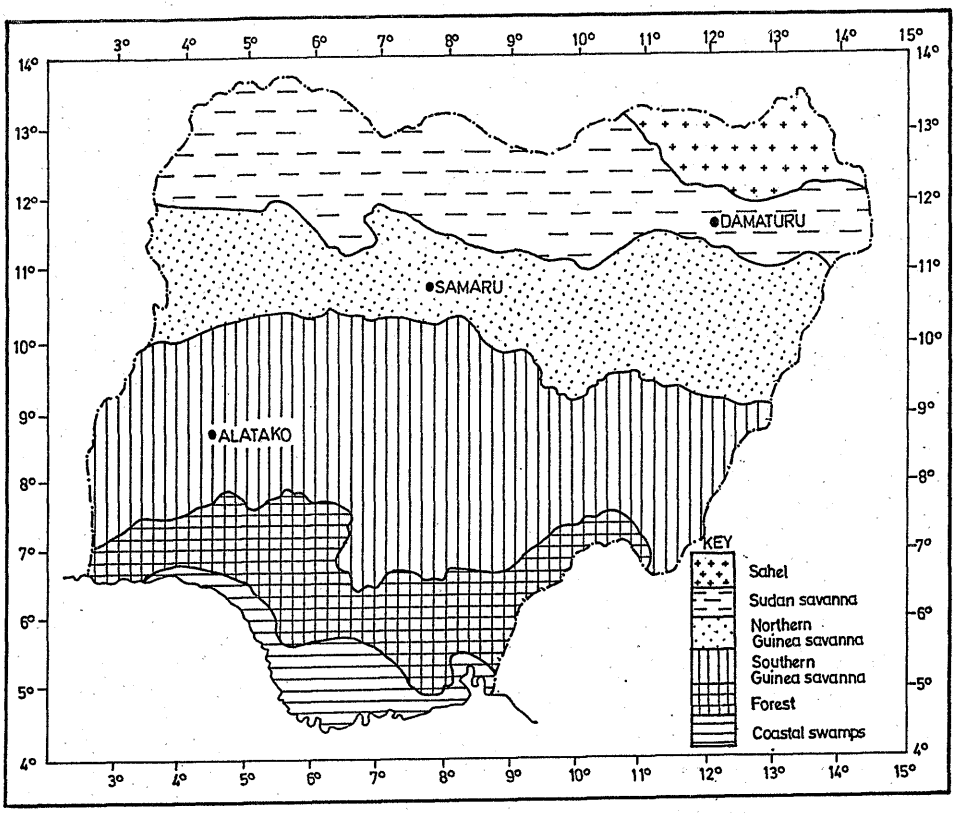

FIG. 1. MAP OF NIGERIA SHOWING DIFFERENT ECOLOGICAL ZONES AND THE LOCATIONS WHERE THE EXPERIMENT WAS SITED.

sunflower varieties grown in three distinct locations of the Nigerian savanna.

MATERIALS AND METHODS

Two open pollinated sunflower varieties were used in the study. Funtua is a tall variety (105-195 cm) and Isaanka is a short variety (95-165 cm) depending on environment. Three locations were selected to represent the savanna regions in order to find the range of adaptability of the varieties. Damaturu (11°45'N; 11°57'E) representing the sudan savanna is 457 m above sea level and has an annual rainfall of 760 mm which falls within 100 days. Samaru (11°11'N; 07°38'E) representing the northern guinea savanna is 686 m above sea level and has an annual rainfall of 1090 mm which falls within 160 days. Alatako (08°40'N; 04°30'E) which is 307 m above sea level with an annual rainfall of 1270 mm falling within 210 days was chosen to represent the southern guinea savanna. The experiment was carried out in 1986. In each location, the experiment was laid out in a randomised complete block design with three replications. Each plot of 9.0 m^2 consisted of four rows 0.75 m apart and 3.0 m long. Seeds were over-planted at a spacing of 30 cm between hills in the rows. The seedlings were later thinned to one plant per hill at 16 to 20 days after sowing giving a population of approximately 44,100 plants per hectare. Fertilizers at the rates of 100 kg N/ha as calcium ammonium nitrate (26% N), 50 kg P_2O_5/ha as single superphosphate (18% P_2O_5) and 30 kg K_2O/ha as muriate of potash (62% K_2O) were applied in shallow trenches along the ridge at sowing. At harvest, data on plant height and head diameter were

recorded on 20 representative plants per plot. Seed yield was recorded and samples were collected and analysed in the laboratory for oil, nitrogen, ash and dry matter contents.

The data collected were analysed separately for each location. When the homogeneity of the error variances was tested no significant differences were observed and a combined analysis over the locations was performed.

RESULTS AND DISCUSSION

The result of the performance of the varieties for seed yield, oil yield, plant height and head diameter in each location is given in Table 1. The combined analysis of variance indicated significant differences between locations for both seed and oil yields, and oil and nitrogen contents of the seed. The highest seed and oil yields were recorded at Alatako in the southern guinea savanna (Table 3). The variety Isaanka gave significantly higher seed yield at Samaru and higher oil yield at Alatako than the variety Funtua, while the latter variety produced significantly taller plants with larger heads at Damaturu. The non-significant varietal differences in plant height, head diameter, and nitrogen, ash and dry matter contents at all the locations (Table 3) suggests a possible genetic resemblance of the varieties for these characters. The variety x location interaction effects were significant for seed yield, oil yield and oil content. This shows that the yields and the oil content of the varieties vary with location and this is clearly evident in Tables 1 and 2. This result is not unexpected because extremely different environmental conditions determined a great variation in the response of sunflower genotypes, both for seed yield and oil content as well as for other agronomic characteristics as was reported by Vranceanu et al. (1984).

The height of the short variety, Isaanka, ranged from 79 cm at Damaturu to 105 cm at Samaru while that of the tall variety, Funtua, ranged from 101 cm at Damaturu to 114 cm at Alatako. The head diameter for Isaanka ranged from 8.40 cm at Damaturu to 11.93 cm at Alatako. Plant height and head diameter were correlated hence selection for height may result in change in head diameter and vice versa. Similar results were observed by Seiler (1984) in population of wild annual sunflower.

CONCLUSIONS

These are results of a one year preliminary study to determine the suitability of sunflower as an oilseed crop in the Nigerian savanna. There are currently on-going interdisciplinary studies to develop high yielding adaptable varieties from the introduced cultivars, and to determine their agronomic requirements as well as any pest and disease problems that may be encountered in the Nigerian savanna.

In general, the results show that sunflower could adapt to the savanna ecological zones of Nigeria since yields obtained from preliminary trials indicate that the performance is comparable to what obtains in the traditional sunflower producing countries.

Table 1: Some agronomic characters of two open pollinated sunflower varieties at three locations of the Nigerian savanna in 1986.

Location	Plant height (cm)			Head diameter (cm)			Seed yield (kg/ha)			Oil yield (kg/ha)		
	Funtua	Isaanka	Difference	Funtua	Isaanka	Difference	Funtua	Isaanka	Difference	Funtua	Isaanka	Difference
Damaturu	101.00	79.00	22.00*	11.90	8.40	3.50*	1222	1178	44.44^{ns}	375	377	-2^{ns}
Samaru	113.00	105.00	8.00^{ns}	10.73	9.45	1.28^{ns}	978	1256	-277.78*	333	396	-62^{ns}
Alatako	113.66	103.00	10.66^{ns}	11.35	11.93	-0.58^{ns}	2633	2622	11.11^{ns}	834	1180	-346**
LSD (.05)	ns	21.69	-	ns	1.93	-	269	246	-	221	273	-

* = Significant at 5% level, ns = not significant.

Table 2: Composition of the seed of two open pollinated sunflower varieties at three locations of the Nigerian savanna in 1986.

Location	Oil %[a]			Nitrogen %[b]			Ash %			Dry matter %		
	Funtua	Isaanka	Difference	Funtua	Isaanka	Difference	Funtua	Isaanka	Difference	Funtua	Isaanka	Difference
Damaturu	30.65	32.01	-1.36^{ns}	3.95	4.35	-0.40^{ns}	6.05	5.39	0.66^{ns}	94.71	95.93	-1.22^{ns}
Samaru	34.00	31.55	2.45^{ns}	4.08	4.12	-0.04^{ns}	6.53	5.33	1.20^{ns}	96.27	96.19	0.08^{ns}
Alatako	31.80	45.01	-13.21**	3.07	3.11	-0.04^{ns}	5.37	5.25	0.12^{ns}	96.06	96.06	-1.32^{ns}
LSD (.05)	4.15	3.53	ns	ns	ns	ns	ns	ns	-	ns	ns	-

[a]Determined by soxhlet method, [b]Multiplying by 6.25 gives protein content (%), * = significant at 5% level, ** = significant at 1% level, ns = not significant.

Table 3: Mean effects of location on performance and composition of the seed of two open pollinated sunflower varieties in the Nigerian savanna[a].

Locationa	Plant height (cm)	Head diameter (cm)	Seed yield (kg/ha)	Oil (%)	Oil yield (kg/ha)	Nitrogen (%)	Ash (%)	Dry matter (%)
Damaturu	90.00	10.15	1200	30.65	368	4.15	5.73	95.32
Samaru	109.00	10.10	1117	32.78	366	4.10	5.93	96.23
Alatako	108.33	11.65	2628	38.41	1009	3.09	5.31	95.40
LSD (.05)	ns	ns	334	3.42	266	ns	ns	ns

[a]Average of two varieties and three replications. ns = not significant.

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