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Evaluation of Advances Medium Maturing Rosette Resistant Lines of Groundnuts (*Arachis hypogaea* L.) for Adaptation to a Southern Guinea Savanna Ecology

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ABSTRACT: Fifteen medium maturing rosette-resistant groundnut accessions collected from I>A>R. germplasm pool were evaluated for their adaptation to a southern guinea savanna ecology of Kwara State using a local cultivar as a reference crop. The investigation consisted both potted planting and field studies in a randomized complete block design replicated three times in each case.

The result showed variable but comparable performance with the reference cultivar in terms of flowering and maturity time, haulm weight and seed yield. However, nearly all the improved varieties showed evidence of adaptability prospects in the alien environment. It is suggested that further evaluation would enhance yield stability of the elite groundnut accessions in the ecological zone.

Key Words: Groundnuts; *Arachis hypogaea*; Rosette-resistant; Guinea Savanna.

Introduction

Accurate cultivar evaluations and the ability to differentiate between cultivars in respect of genetic changes associated with the criteria for adaptedness in cultivated plants and their wild progenitors are critical to any plant breeding programme. The possibility of the existence of unfavourable genetic linkages should be considered by legume breeders since a negative association between seed yield and seed size has been reported by White and Conzalez (1990). Therefore, successful selection among genotypes for improved performance is dependent on obtaining estimates of their genetic value from past evaluation that are predictive of future performance (Clay and Dombek, 1995). Lack of sufficient informative genetic background have hindered genetic performance evaluations of plant breeding populations (Keim et al., 1994). However restricted populations of crop species have been successfully utilized by plant breeders in cultivar adaptation and population development since natural selection has been imposed on such populations to increase seed yield and alter seed composition (Burton et al., 1990).

Rosette attack on groundnuts (*Arachis hypogaea* L.) is one of the most important diseases recorded in almost all African countries South of the Sahara, extending to Madagasca. The damage may lead up to 48% in yield reduction in West Africa (Mayeux, 1984).

The objective of this study is to evaluate and possibly identify and/or select among 15 improved medium maturing rosette-resistant groundnut accessions developed at the Institute of Agricultural Research (I.A.R.), Samaru – Zaria for adaptation to a Southern guinea savanna ecology of Kwara State. A popular local groundnut cultivar usually cultivated at Ilorin is included as a reference crop.

Materials and Method

The experimental materials consisted of 15 lines of advanced medium maturity rosette – resistant groundnuts collected from the Institute of Agricultural Research, Ahmadu Bello University, Samaru – Zaria (see Table 1).

Table 1: A list of medium rosette-resistant accessions of groundnut evaluated for adaptation to Southern guinea savanna ecology.

I C G – 1S – 96806
I C G – 1S – 96803
I C G – 1S – 96843
I C G – 1S – 96813
I C G – 1S – 96812
I C G – 1S – 96811
I C G – 1S – 96844
I C G – 1S – 96894
I C G – 1S – 96814
I C G – 1S – 96846
I C G – 1S – 96839
U G A – 2
U G A – 5
U G A – 7
U G A – 4
Local cultivar (as a check).

The investigation consisted of a green house study followed by field plantings of the accessions, both greenhouse and field studies were carried out at the University of Ilorin (Lat. 08°26’N, Long. 04°29’E)at about 344.7M above sea level in the Southern guinea Savanna ecology. In the greenhouse study, groundnut plants were raised in 26 cm diameter plastic bags filled with sterilized top soil. The potted plants were replicated three times in a randomized complete block design with two plants per pot of each of the accessions in each block.

In the field experiment, the layout was a randomized complete block design consisting of three replicates. The plot size was $12M^2$. Spacing was 20cm within 75cm between rows. Both the greenhouse and field plots were kept weed-free throughout the experimental period.
The following data were collected from both the potted and field experiments:

(a) Flowering date was taken as when inflorescence was observed on 50% of the plants in each accession.

(b) Maturity date was recorded as the time when the leaves of 75% of the plants in each accession had turned yellow.

(c) Plant spread (diameter (cm) of average plant)

(d) Plant height (cm)

(e) Length of primary branch (cm)

(f) Number of primary branches

(g) Number of secondary branches

(h) Haulm weight

(i) Weight of randomly selected 100 seeds

(j) Yield tons/ha

The data collected were analysed statistically on a standard computer.

Results and Discussion

Tables 2 and 3 show the summary statistical analysis of variance of the data on the groundnut accessions in the greenhouse and field plantings respectively. Values with asterisks in the Table show the traits with differences among the experimental lot as the indices of genetic and agronomic diversity within the materials (Ezeaku and Awopetu, 1992).

Table 4 shows the Duncan Multiple Range Test values for the greenhouse and field studies on the groundnut accessions. Values with the same letters in each column are not significantly different from one another. The range of flowering and maturity periods of the groundnut accessions in the greenhouse and field studies would suggest that values for the advanced medium rosette-resistant cultivars are comparable with the reference local variety especially in ICG-1S-96894. However, the accession ICG-1S-96811 is an extreme case in attaining a longer duration in flowering and maturity time while others compare favourably with the reference local cultivar. This will be an adaptive advantage of nearly all the accessions in respect of early flowering and maturity time. The advantage of using early maturity groundnut production system is to increase yield stability by cultivating genotypes with a range of maturity dates such that a proportion of the total groundnut will escape random periods of environmental stress (Schwartz and Pastor-Corrales, 1989). This fact has been advanced as an edge against drought stress that has contributed to a large reduction in production areas of the crop species. Crop cultivars that tolerate water stress would stabilize and expand production in drought endemic environments (White and Singh, 1991).

Yield attributes of haulm weight, hundred seed weight and pod weight per hectare are generally higher in the accessions than the local reference crop except in UGA-4. This may not be unexpected in view of the fact that the accessions are improved cultivars that may have undergone some primary yield selection criteria.

Table 2: Mean sources of the analysis of variance of 16 groundnut accessions (Pot experiment).

Source of variation	**Degree of freedom**	**HW**	**FD**	**PS**	**PH**	**LPB**	**NOPB**	**NOSB**	**MD**	**HSW**	**Y**
Replication	2	650.4	4785.0	6450	40.2	560.1	5.65	14.3	185.2	258.4	18.5
Treatment	15	120.4*	260.5*	185.2*	20.5*	60.5*	45.2*	65.3*	85.6*	95.67*	75.2*
Error	30	80.1	35.6	190.7	19.26	79.5	35.7	6.70	37.8	40.5	50.6
Total	47										

HW = Haulm weight
FD = Flowering date (50%)
PS = Plant spread (cm)
PH = Plant height (cm) NS
LPB = Length of primary branch
NOPB = Number of primary branch
NOSB = Number of secondary branch NS
MD = Maturity date (50%)
HSW = Hundred seed weight
Y = Yield (tons/ha).

Table 3: mean squares of the analysis of variance of 16 groundnut accessions (Field experiment)

Source of variation	**Degree of freedom**	**HW**	**FD**	**PS**	**PH**	**LPB**	**NOPB**	**NOSB**	**MD**	**HSW**	**Y**
Replication	2	670.4	4855.0	647.2	75.3	570.2	15.2	28.3	60.7	87.4	65.7
Treatment	15	190.3	265.2*	170.5*	36.5	60.4	59.7	24.2	70.3	108.5	77.5
Error	30	60.4	36.5	190.3	85.7	1256	185.2	86.7	68.6	70.6	80.1
Total	47										

HW = Haulm weight
FD = Flowering date (50%)
PS = Plant spread
PH = Plant height
LPB = Length of primary branch
NOPB = Number of primary branch
NOSB = Number of secondary branch
MD = Maturity date (50%)
HSW = Hundred seed weight (G)
Y = Yield (tons/ha).

Table 4: Duncan Multiple Range Test (DMRT) values of 16 groundnut accessions (Pot and Field Experiments)

VARIETIES			**POTTED**	**EXPERIMENT**			
	FD	**PS**	**NOPB**	**MD**	**(HW(g)**	**HSW (g)**	**Y t/ha**
ICG-1S-96806	36.5b	59.4c	8.72b	60.5b	31.2de	56.73ab	1.45ab
ICG-1S-96803	33.5c	53.3d	9.8a	58.2b	60.50	51.07c	1.36c
ICG-1S-96894	28.9d	52.7d	8.00b	57.5b	25.6e	51.60c	1.54a
ICG-1S-96814	36.45b	84.1a	8.39b	61.3b	81.3a	55.57ab	0.925c
ICG-1S-96812	31.10cd	62.3b	7.33c	57.2b	25.3e	43.77d	1.14c
ICG-1S-96811	45.25a	59.3c	7.17c	65.7a	27.3e	49.57c	1.27bc
ICG-1S-96846	32.80c	61.3c	7.93b	58.4b	33.2de	50.87c	1.06c
ICG-1S-96844	36.67b	63.3b	8.56b	60.5b	28.3e	49.00c	1.73a
ICG-1S-96843	33.4c	53.2d	7.83c	55.7c	23.2c	57.7ab	1.52a
ICG-1S-96839	31.67c	57.5c	7.81c	58.3b	37.7d	58.23a	1.51a
ICG-1S-96813	36.7b	79.9a	8.76b	60.7b	74.2b	59.90a	1.32c
UGA – 2	32.67c	62.2b	8.37b	58.3b	42.5d	55.00ab	1.49ab
UGA – 5	36.0b	65.6b	10.37a	59.1ab	40.3d	62.37a	1.67a
UGA – 7	39.2ab	78.3a	10.67a	62.aab	84.2a	54.8ab	1.08c
UGA – 4	35.6b	54.4d	10.22a	60.1b	32.3de	54.9ab	0.97d
Local	29.02d	52.6d	5.22d	57.3b	25.45e	53.97b	0.94d

Table 4 (Contd.)

			FIELD	**EXPERIMENT**			
ICG-1S-96806	35.7d	60.2c	9.6a	61.3b	36.1d	60.5a	1.6ab
ICG-1S-803	32.6c	55.3c	9.3a	60.5b	63.2c	52.7bc	1.4b
ICG-1S-96894	29.8d	56.2c	9.4a	60.3b	35.2de	53.4bc	1.6ab
ICG-1S-96814	38.3a	86.3a	8.5b	60.4b	75.6b	44.2d	1.1bc
ICG-1S-96812	30.8cd	65.7b	7.4c	58.2b	30.5de	50.0c	1.2bc
ICG-1S-96811	48.3a	63.2b	8.0b	66.4a	30.8de	50.2c	1.5ab
ICG-1S-96846	33.1c	61.8b	8.2b	60.5b	38.3d	49.8c	1.08c
ICG-1S-96844	37.2b	65.5b	9.5a	61.2b	32.5de	60.3a	1.9a
ICG-1S-96843	30.5c	50.5d	7.5c	56.7c	28.3e	61.2a	1.6ab
ICG-1S-96839	32.2c	60.8b	7.8c	59.4b	45.3d	60.4a	1.4b
ICG-1S-96813	37.7b	81.2a	8.8c	60.5b	80.1a	56.1b	1.4b
UGA – 2	30.7cd	62.8b	9.2a	59.3b	41.5d	62.4a	1.52ab
UGA – 5	36.0b	60.7b	9.8a	60.1b	42.5d	55.4b	1.7a
UGA – 7	39.5ab	80.5a	11.2a	62.3b	84.5a	57.2b	1.0bc
UGA – 4	36.7b	54.7d	10.3a	60.5b	30.5e	50.1c	0.95c
Local	28.5d	50.7d	6.5d	59.4b	27.3e	55.2d	0.98c

N.B.: Values with same letters in each column are not significantly different from one another at 5%.

FD = Flowering date (50%, Days from sowing)
PS = Plant spread (cm)
NOPB = Number of primary branches
MD = Maturity date (50%, days of sowing)
HW = Haulm weight (gms)
HSW = Height of hundred seeds (gms)
Y = Yield (tons/ha).

Clay and Dombek (1995) advanced that successful selection among genotypes for improved performances is dependent on obtaining estimates of their genetic value from past evaluations that are predictive of future performance. The limited variations observed in these groundnut accessions in respect of haulm weight, hundred seed weight and overall yield may be due to differential responses to environmental factors related to adaptation (Awopetu, 1988). Generally, genetic variability is usually low in predominantly inbreeding species since they consist of a number of inbred lines each of which maintain itself as a constantly genetically homozygous entity for a large number of generations as proposed by Allard (1965). The continued improvement of adaptive characteristic in terms of drought, yield, maturity time and physiological potential for disease and past resistance in crop species would depend largely on genetic manipulation of crop species. It is suggested that aspects of embryo morphogenesis and pod maturity characteristic would play significant roles in crop adaptive fitness (Awopetu, 1988). Observations from this pioneer work at Ilorin would attest to the suitability of the experimental materials for adaptation to a typical southern guinea savanna ecology. However more research work on performance stability of the accessions is suggested especially in areas of seed yield and haulm weight.

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