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Evaluation of Some Newly Developed Popcorn Varieties for Tolerance to Diseases and Pest and Popping Quality in South-western Nigerian Agro-Ecologies

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ABSTRACT

Effort to boost the production of popcorn like other cereal crops such as maize, is hindered by production constraints such as low yield, poor adaptation, poor popping quality, as well as susceptibility to pest and disease. The major constraints to increases in popcorn production and expansion of hectareage in the rainforest ecologies of Nigeria, are low yield, susceptibility of available cultivars to insect and bird pest, disease as well as inherent low popping quality. This study was conducted to evaluate some newly developed popcorn varieties for adaptation to major agro-ecologies of south western Nigeria in terms of yield performance, disease/pest tolerance, popping quality and consumers' acceptability. Six newly developed popcorn varieties (Ashland, Golden pop, DMR-SR, Yellow composite, Mix-grain, Pear shape) by the Institute of Agricultural Research and Training (IAR&T), Ibadan, Nigeria and a widely grown and adapted variety (Ibadan local) were evaluated from field trials in five locations spanning south western Nigeria agro-ecologies - Ballah (southern guinea savanna), Ibadan (forest) Ikenne (high rain forest), Ilora (derived savanna) and Orin Ekiti (rain forest). The results showed that while all the newly developed varieties were downy mildew resistant with tolerance of 0.40, Golden pop is more resistant to stem borer infestation with a score of 1.67. The results also showed that DMR-SR was higher yielding in term of grain production (1.17t/ha) while Yellow composite, Pear shape, and Golden pop were better in popping quality and acceptability than the local variety. Therefore, DMR-SR, Pear shape, Golden pop and Ashland are more desirable for production in the humid zone (agro-ecologies) of south western Nigeria and are recommended for testing on-farm for adoption by farmers to boost popcorn production.

Key words: Popcorn ,Tolerance, Diseases, Pest , Popping Quality.

Introduction

In Nigeria, it has become the delight of millions to eat popcorn as snacks, which are prepared in various forms, colour, sizes and design at amusement parks, Art Theaters and sporting galleries which prompt the need to increase its production (supply). The production, processing and sale of popcorn constitute additional source of income to farmers and traders. Palanisamy *et al.*[16]. stated that popcorn production and processing is a profitable

venture especially in a commercial scale. Although maize and popcorn are adapted to the tropics, in Nigeria, the guinea savanna has been shown to be the most suitable ecological zone for their production [18]. Plant breeders had aimed at developing popcorn varieties that are adapted to Nigeria agro-ecologies since the cultivation of popcorn has increased in popularity by farmers[11]. In the humid tropics, the production of maize and popcorn is faced with myriad of problems, including low yield potentials of the available cultivars[7]. susceptibility to the

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prevailing pests and diseases of the humid forest environment (such as downy mildew disease of maize and stem-borer infestation), poor soil nutrient status[1]. Others include *striga* parasitic weed[13,14]. and stress such as drought in the northern-region of Nigeria and general vertebrate pest problems. These collectively made many cultivars of popcorn unadaptable to the agro-ecologies of Nigeria[11]. These problems have stemmed down the productivity of this crop. There is however a growing demand for maize (and popcorn) to cope with ever increasing population rate of 3 percent per annum is a problem[5].

The South Western Nigerian agroecologies is a hot and humid environment characterised by various pest and diseases, in addition, the variable environmental conditions (weather pattern) of the different agro-ecologies[3]. prompt the need for testing newly developed varieties for adaptation to these agro-ecologies. Prevalence and severity of plant (popcorn) disease varied according to the growing environmental factors such as temperature, moisture and soil conditions[6]. These diseases are more prevalent during humid hot season. Maize streak is especially the most prevailing biotic constraint to maize and popcorn production during the second planting season in Nigeria. This disease is caused by a virus that are transmitted by an insect belonging to *Cicadulina spp.* Stem-borer infection has been reported to be one of the major causes of low grain yield of popcorn in the second season of the bimodal rainfall zone of Southern Nigeria[10]. The presence of one or two stem-borer in maize plant reduce yield of popcorn by about 25%. More insect pest damage usually occurs in the late season crop[3]. and this has made the late maize cultivation difficult and non-profitable[10]. Popcorn is also extremely susceptible to rust, leaf blight, ear or stalk rots and downy mildew, corn root-warm, stem borer-pests and severe bird damage[1]. Recent breeding (selection) effort has resulted in the development of some streak, downy mildew and fungi resistant varieties. Popcorn ear kernel at the harvest should have moisture content of about 18-20% for ear corn, and 16-18% for shelled corn. Kernels that are too dry will not pop properly and as such, effort should be made to maintain the recommended moisture content[9].

In order to further boost popcorn production and to develop locally adaptable popcorn cultivars, the Institute of Agricultural Research and Training (IAR&T), Ibadan embarked upon the development of new cultivars and improvement of existing local cultivars of popcorn. In order to realize the objectives of this effort, it is imperative to evaluate the adaptation of these newly developed popcorn varieties to the Nigerian agro ecologies in terms of popping quality, consumers' acceptability and pest and disease tolerance. The present study therefore

attempts to evaluate some newly developed popcorn varieties for their adaptation in terms of yield, disease/pest tolerance, for popping quality and consumers' acceptability in the major agro-ecologies (humid rainforest, derived savanna transition and the southern guinea savanna)of south western Nigeria.

Materials and methods

Six newly developed popcorn varieties (Ashland, Golden pop, DMR-SR, Yellow composite, Mix-grain, Pear shape) by the Institute of Agricultural Research and Training (IAR&T), Ibadan, Nigeria and a widely grown and adapted variety (Ibadan local) were evaluated from field trials in five locations spanning south western Nigeria agro-ecologies. These are Ballah (southern guinea savanna), Ibadan (forest), Ikenne (high rain forest), Ilora (derived savanna) and Orin Ekiti (rain forest). Tables 1a and b present the ecological description and some meteorological variables at the sites (location) of the experiment. Samples of the six newly developed varieties were collected from the breeder stock of the Cereal Improvement Programme of the Institute of Agricultural research & Training, (IAR&T), Moor Plantation, Ibadan, Nigeria. In each location (agro-ecology), the experimental site was ploughed and harrowed. Popcorn seeds were planted during the late planting season in the locations Ibadan (rain forest), Ikenne (rain forest), Ilora (derived savanna), Orin-Ekiti (derived savanna) and Ballah (southern guinea savanna) of south western Nigeria between July and August, 2004. Planting was done on the 1st of August in Ballah, 3rd of July in Ikenne, July 10, Ibadan July 2 in Ilorin, June 29 in Orin all in 2004). The layout used was 3 x 3 m plot size and the seed were planted 4 seeds per hole at 4 row/plot with a spacing of 50cm within rows. The varieties were randomly assigned to plots, and were replicated three times. At 2 weeks after planting (WAP), thinning operation was carried out to in order to maintain only 2 plants per hole given a plant population of 53,333 per hectare. A compound mineral fertilizer (NPK 20: 10: 10), was applied at 400 Kg/ha as a starter and urea fertilizer at 100 kg/ha was applied (top dressing) thereafter at 5 WAP. The popcorn varieties were randomly assigned to plots. Weed control was carried out or maintained by spraying once with pre-emergence herbicides (Primextra) immediately after planting (pre-emergence) at 5lit/ha and a supplementary manual weeding was carried out 6 weeks after planting (WAP).

Data were collected on seed yield, pest and disease status and popping quality characters from 10 sampled plants at the two middle rows. The percentage of plant damaged by stem borer was taken while disease status (leaf blight and downy mildew infection), The severity of fungi diseases was

rated on a scale of 1-5 while severity of streak-virus disease was also rated using a scale of 1-5. Consumer acceptability tests were rated using hedonic scale of 1 - 5. Rating score established were 1(excellent), 2 (good), 3 (fair), 4.(poor) and 5 (very poor). Popping quality and acceptability tests were rated using hedonic scale of 1 - 5. Rating score established were 1(excellent), 2(good), 3(fair), 4 (poor) and 5 (very poor). Seed yield characters were taken and this includes: ear weight, number of kernel per row, seed yield per plot after shelling at 15% moisture. Other data collected included seed moisture content which was measured using a digital electronic moisture meter. Data collected were subjected to statistical analysis using SPSS for analysis of variance (ANOVA) and separation of means of pertinent values using New Duncan

Multiple Range Test (NDMRT)[17].

Varietal effect on disease ratings is presented in Table 2b. Among the varieties, downy mildew infection was not significantly different, however, stem borer infestation differed significantly for example, stem borer ratings varied from 1.67 in Golden pop, 6.88 in DMR-SR and 3.40 in Asland. Results of some popping quality characters among the varieties are presented in Table 2c. Popping acceptability varied between 1.73 (Pear shape) and 2.60 (DMR-SR) and these two varieties (Pear shape and DMR-SR) were responsible for the significant variation in the popping acceptability. There were significant differences in percentage moisture content of the grains, and Pear shape was responsible for the significant difference in grain moisture.

Table 1a: Agroecological description of sites (locations) of experiment

Location	Mean Temp.	Latitude	Longitude	Annual Rainfall (mm)	Ecology
Ballah (Ilorin)	31.6 °C	4° 5'N	8° 30'E	974 mm	Southern guinea savanna
Ibadan	30.7 °C	3° 5'N	7° 22'E	1450 mm	Rain forest
Ikenne	30.9 °C	3° 2'N	6° 24'E	1400 mm	Rain forest
Iloria	31.3 °C	3° 5'N	7° 45'E	1154 mm	Forest-savanna transition (Derived savanna)
Orin-Ekiti	31.1 °C	5° 8'N	5° 14'E	1163 mm	Forest-savanna transition (Derived savanna)

Table 1b: Some meteorological variables at sites (locations) of experiment during popcorn growth (2004).

	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Ibadan							
Rainfall (mm)	205.1	268.7	253.6	211.9	129.4	27.8	5.3
Max. Temp.(°C)	30.6	29.2	29.9	29.4	30.1	31.8	31.2
Rel humidity (%)	71	80	67	79	72	63	48
Ikenne							
Rainfall (mm)	218.3	246.7	267.5	203.1	141.4	33.7	3.2
Max. Temp.(°C)	30.9	30.1	29.4	29.8	30.4	31.5	30.9
Rel humidity (%)	73	78	69	80	75	61	45
Iloria							
Rainfall (mm)	189.2	209.4	221.3	176.4	105.3	21.5	0
Max. Temp.(°C)	31.5	1.9	30.2	30.8	31.3	32.3	31.2
Rel humidity (%)	70	73	66	77	71	51	46
Orin - Ekiti							
Rainfall (mm)	193.5	214.1	228.4	183.7	111.5	28.1	2.2
Max. Temp.(°C)	31.2	31.6	30.4	31.3	30.8	31.7	30.5
Rel humidity (%)	71	76	69	80	74	58	47
Ballah (Ilorin)							
Rainfall (mm)	177.2	195.3	206.8	153.3	97.6	22.4	0
Max. Temp.(°C)	31.4	31.8	30.7	31.5	31.4	31.9	30.8
Rel humidity (%)	68	72	65	78	70	54	41

Results and discussion

The effects of location was significant on pest (stem-borer damage) and disease (downy mildew and leaf blight) ratings and on seed moisture content, popping quality and popping acceptability. The popcorn varieties were not significantly different in their reactions to downy mildew (DM) in virtually all locations. In Ibadan, Ikenne and Ballah there were no infections while pockets of infections noticed in Iloria and Orin-Ekiti were not statistically important. This trend was consistent among all varieties tested (Table 2a).

Location and varietal effects were significant ($P = 0.05$) on seed yield (Table 3a and b). Grain yield ranges from 0.72t/ha (Check) to 1.17t/ha (DMR-SR) among improved varieties, it thus appears that the newly developed varieties are having a yield advantage of above 62% over Check. Among the tested popcorn varieties seed yield characters were affected by both genotype and environmental conditions of the site of planting. This trend was also obtained[4]. who reported significant contribution of temperature to maize grain yield in multilocation evaluation in Nigeria. Our results confirmed the

earlier report of [12]. The interactions of variety x location on downy mildew ratings, stem borer scores, percent grain moisture content at harvest and popping quality is presented in Table 4a. Variety x location interaction effects was significant on stem borer scores (Table 4a). Varietal response to stem borer infection differed significantly in Ibadan and Orin-Ekiti. In these two locations, DMR-SR, Mix grain and Check entry (Ibadan local) were responsible for the significant differences with about 25% stem borer infestation. The responses of the popcorn lines in the different locations to leaf blight were consistent with what was observed for downy mildew and stem borer ratings among varieties (Table 4b). No stem borer infection was recorded in Orin Ekiti.

Variety x location interaction for percent moisture at harvest is presented in Table 5a. Significant differences in moisture content among the varieties were obtained in Ikenne and Orin-Ekiti with % moisture of 13.00 to 14.30. Ibadan, Ilora and Ballah recorded moisture % of between 9.0 and 12.0. Pear shape and Golden pop seems to be responsible for significant difference observed in Ikenne. The significant differences observed among popcorn varieties for popping quality on these locations appeared to have been caused by Mix grain, Pear shape and Golden pop in Ibadan, Pear shape, Yellow comp and Mix grain in Ilora, Yellow comp. and Ashland in Ikenne, and Yellow pop in Ikenne; Ballah and Orin-Ekiti (Table 5b). Varieties x location effect on grain yield was significant (Table 6). It was observed that Ashland, Mix grain, Golden pop and Yellow composite were responsible for significant differences in grain yield in Ibadan, Ikenne, Ballah and Orin-Ekiti respectively with mean yields of 0.46, 1.73, 1.67 and 1.30 t/ha respectively. Ballah and Ikenne seemed the most favourable locations for popcorn production. Yields above 1t/ha in all varieties were obtained. Among the varieties, mix grain, yellow composite, and DMR with 1 t/ha. Other varieties yielded low and may be dropped in this location. Ilora location appeared suitable for cultivation of Mix grain, Yellow composite, and DMR. In general, Mix grain and Yellow composite were good varieties for all ecology.

From the results of this study, location effect was highly significant for almost all parameters evaluated for popcorn. Among the varieties tested, traces of downy mildew infection was observed in Ilora and Ikenne [7]. had reported that forest humid environments are prone to pest and disease infestation. However, leaf blight infection was slightly noticed for all the varieties and in all the locations. Breeders of these varieties may need to select for resistance to blight in these populations for better adaptation while farmers may adopt treatments of seed against fungal infection using fungicides.

Orin Ekiti did not condoned leaf blight infection for all varieties, probably due to its characters as transition location of forest - savannah ecology. The percentage damaged by stem borer was highly significant for varieties, however, Ibadan local, a check had greater a percentage damage by stem borer infestation. Ibadan, Ikenne, Orin Ekiti are in the rain forest ecologies of South Western Nigeria and had been classified as stem borer prone ecologies. Popcorn farmers in this region may be encouraged to plant Golden pop which had displayed considerable tolerance to stem borer in this study. The percentage damaged by stem borer was more in Ibadan especially for check and DMR-SR popcorn. This was obvious since Ibadan is located in the forest - ecology where stem borer activities are prevalent especially during second season (late) planting. The use of insecticide such as furadan may be adopted to control this, while stem borer resistant varieties should be used.

Moisture content of popcorn grains was higher in Ikenne (13.04%) compared to Ibadan with 10.13%. This probably revealed the humid nature of high rain forest of Ikenne. This moisture percentage was actually good and seems desirable for good popping quality. Extremely low moisture percentage by exposure reduces popping expansion. The effect of this moisture percentage in popcorn produced at Ikenne was seen in its acceptability rating in terms of taste, colour and flavour compared to those produced in other location. Ikenne therefore is highly suitable for commercial popcorn production for taste, flavour and acceptable colour. Variety x location interaction for moisture content was significantly higher in Ikenne and Orin Ekiti, this might be due to the fact that these two locations were in humid forest zone of the agro-ecology. Pear shape in Ibadan recorded percentage moisture content of 9, this may help in good preservation of the seed for planting, but popping quality may decline as moisture percentage reduces below 10%. The popping quality of the evaluated materials was generally good. Pear shape in Ilora gave highest value of this parameter. The popping quality of pear shape and Golden pop were relatively better than the other varieties. Ashland produced in Ibadan and Ilora were also better with respect to this trait Ibadan and Ilora therefore seems to be good ecologies for production of popcorn for good popping quality. Other varieties that are high yielding could be improved upon for popping quality by breeders in order to make them suitable for commercial production as indicated by [19]. Our results conform to the reports of other workers including Iken, who reported a popping quality of 1650 for the same variety. Therefore, pear shape could be nominated for on-farm trial for possible release.

Table 2a: Effect of location on disease/pest rating and grain quality in popcorn lines

Disease/Pest/ Popping quality	Ibadan	Ilorra	Ikenne	Ballah	Orin-Ekiti
DMR rating	0.00	1.00	0.00	0.00	1.35
Leaf blight	1.38	1.34	1.95	1.00	0.00
% Stem borer	16.43	0.00	0.57	1.19	0.43
%Moisture content	10.13	11.53	13.1	12.14	12.50
Popping quality	1429.1	1490.5	1001.4	1130.0	1162.9
Popping acceptability	2.33	2.57	1.04	2.43	2.00

Figures with different letters in the same column are significantly different at P<0.05

Table 2b: Effect of variety on disease/pest rating in popcorn lines

Variety	DMR rating (1-5)	Leaf blight (1-5)	% Stem borer rating
Mix Grain	0.40 ^a	1.07 ^b	3.80 ^{ab}
Pear Shape	0.53 ^a	1.33 ^{ab}	2.27 ^{ab}
Check	0.53 ^a	1.33 ^{ab}	5.00 ^{ab}
Yellow Comp.	0.53 ^a	1.07 ^b	2.33 ^{cb}
Golden Pop	0.40 ^a	1.33 ^{ab}	1.67 ^c
DMR-SR	0.47 ^a	1.33 ^{ab}	6.88 ^a
Ashland	0.47 ^a	1.33 ^{ab}	3.40 ^{cb}

Figures with different letters in the same column are significantly different at P<0.05

Table 2c: Effect of variety on popping quality assessment of the popcorn lines.

Variety	% moisture content	Popping quality	Popping acceptability
Mix grain	11.93 ^a	1270.67 ^c	2.07 ^{ab}
Pear shape	10.44 ^b	1394.00 ^b	1.73 ^b
Check	12.12 ^a	936.67 ^c	1.87 ^b
Yellow comp.	12.14 ^a	1540.00 ^a	2.07 ^{ab}
Golden pop	12.25 ^a	1318.00 ^b	2.20 ^{ab}
Dmr-SR	11.93 ^a	1106.67 ^d	2.60 ^a
Ashland	12.23 ^a	1133.33 ^d	2.00 ^{ab}

* Figures with different letters in the same column are significantly different at P < 0.05

Table 3a: Effect of location on yield components among popcorn lines

Location	No of Ear harvested	Ear weight	Ear length	No of kernel/ row	No of rows/cob	Grain yield (t/ha)
Ibadan	11.52	1.06	14.26	31.43	13.90	0.69
Ilorra	23.9	2.0	26.14	39.2	13.6	0.93
Ikenne	18.14	1.88	16.5	35.1	14.9	1.35
Ballah	15.21	1.53	16.1	26.9	14.4	1.3
Orin-Ekiti	17.45	1.17	15.73	34.6	14.3	0.76

Figures with different letters in the same column are significantly different at P<0.05

Table 3b: Effect of variety on yield components among popcorn lines.

VARIETY	No of Ear harvested	Ear weight	Ear length	No of kernel/ row	No of rows/cob	Grain yield (t/ha)
Mix grain 1	17.73 ^{ab}	1.63 ^{ab}	17.55 ^a	34.83 ^a	14.60 ^a	1.20 ^a
Pear shape 2	17.00 ^{ab}	1.34 ^{cb}	17.82 ^a	32.89 ^a	13.62 ^a	0.85 ^{ab}
Check 3	15.60 ^{ab}	0.88 ^c	17.43 ^a	32.29 ^a	13.93 ^a	0.72 ^c
Yellow comp 4	19.73 ^a	1.87 ^a	17.81 ^a	32.57 ^a	15.03 ^a	1.11 ^{ab}
Golden pop 5	13.67 ^b	1.52 ^{ab}	18.54 ^a	35.29 ^a	14.50 ^a	1.03 ^{ab}
DMR-SR 6	19.33 ^a	1.85 ^{ab}	17.20 ^a	32.28 ^a	13.81 ^a	1.17 ^a
Ashland 7	17.80 ^{ab}	1.60 ^{ab}	17.97 ^a	33.97 ^a	15.04 ^a	0.99 ^{cab}

Figures with different letters in the same column are significantly different at P<0.05

Table 4a: Variety by location interaction on percent stem borer damage among popcorn lines

LOCATIONS					
Varieties	IBADAN	ILORA	IKENE	BALLAH	ORIN-EKITI
Mix Grain	18.33±5.77	0.00±0.00	0.00±0.00	0.00±0.00	0.66±0.58
Pear Shape	10.00±5.00	0.00±0.00	0.00±0.00	0.00±0.00	1.33±1.15
Check	25.00± 5.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Yellow Comp.	11.67±2.87	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
Golden Pop	8.33±2.87	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
DMR-SR	25.00±10.00	0.00±0.00	0.00±0.00	0.00±0.00	0.67±1.15
Ashland	16.67±2.878	0.00±0.00	0.00±0.00	0.00±0.00	0.33±0.58
SE (70df)	4.07	-	-	-	0.12

Table 4b: Variety by location Interaction on leaf blight among popcorn lines

LOCATIONS					
Varieties	Ibadan	Ilorra	Ikene	Ballah	Orin-Ekiti
Mix Grain	1.33±0.58	1.00±0.00	2.00±0.00	1.00±0.00	0.00±0.00
Pear Shape	1.00±0.00	1.67±0.58	2.00±0.00	1.00±0.00	0.00±0.00
Check	1.67±0.58	2.00±0.00	2.00±0.00	1.00±0.00	0.00±0.00
Yellow Comp.	1.00±0.00	1.33±0.58	2.00±0.00	1.00±0.00	0.00±0.00
Golden Pop	1.67±0.58	1.00±0.00	2.00±0.00	1.00±0.00	0.00±0.00
DMR-SR	1.67±0.58	1.33±0.58	1.67±0.58	1.00±0.00	0.00±0.00
Ashland	1.33±0.58	1.33±0.58	2.00±0.00	1.00±0.00	0.00±0.00
SE (70df)	0.33	0.31	0.42	-	-

Table 5a: Variety by location Interaction on grain moisture content among popcorn lines

LOCATIONS					
Varieties	IBADAN	ILORA	IKENE	BALLAH	ORIN-EKITI SE
Mix Grain	10.13±0.15	11.33±0.58	13.67±0.67	11.67±0.76	12.87±0.64
Pear Shape	9.00±0.10	11.53±0.31	14.30±6.5	10.83±0.58	12.63±7.55
Check	10.03±.15	11.73±0.58	13.63±0.58	11.17±1.15	13.03±0.35
Yellow Comp.	10.07±0.12	11.57±0.58	13.00±0.87	10.50±0.00	13.27±1.10
Golden Pop	10.13±0.06	11.57±0.21	14.10±0.82	10.00±0.87	13.47±0.46
DMR-SR	10.20±0.17	11.47±0.58	13.13±0.25	11.83±0.76	13.00±0.66
Ashland	10.43±0.121	11.50±0.00	13.97±1.0	12.00±0.50	13.23±0.67
SE (70df)	0.52	0.18	0.31	1.27	0.35

Table 5b: Variety by location interaction on popping quality among popcorn lines.

LOCATIONS					
Varieties	IBADAN	ILORA	IKENE	BALLAH	ORIN-EKITI
Mix Grain	1493.33±90.18	1493.33±80.83	1200.00±0.00	116.67±144.34	1050.00±180.28
Pear Shape	1520.00±51.96	1706.67±344.29	1210.00±79.37	1250.00±50.00	1283.33±104.08
Check	1316.67±104.08	1380.00±117.90	1109.00±0.00	1010.00±36.06	976.67±25017
Yellow Comp.	1323.33±87.37	1676.67±88.46	1583.33±45.47	1583.33±76.38	1533.33±75.83
Golden Pop	1400.00±174.36	1476.67±136.50	1250.00±10.00	1183.33±57.74	1280.00±60.83
DMR-SR	1350.00±217.94	1133.33±15.47	1033.33±28.87	983.33±115.47	1033.33±76.38
Ashland	1600.00±278.39	1566.67±306.16	733.33±115.47	783.33±76.38	983.33±104.08
SE (70df)	78.6	96.4	105.7	88.3	111.6

Table 6: Effect of variety x location interaction on grain yield

LOCATIONS					
Varieties	Ibadan	Ilorra	Ikene	Ballah	Orin-Ekiti
Mix Grain	0.99±0.53	1.05±0.22	1.77±0.21	1.11±0.49	1.08±0.21
Pear Shape	0.56±0.35	0.73±0.34	1.27±0.42	1.06±0.53	0.63±0.30
Check	0.57±0.10	0.78±0.36	0.73±0.58	1.35±0.65	0.18±0.83
Yellow Comp.	0.83±0.63	1.07±0.25	1.13±0.57	1.22±0.63	1.30±0.13
Golden Pop	0.70±0.25	0.99±0.85	1.23±0.35	1.67±0.18	0.53±0.30
DMR-SR	0.70±0.26	1.01±0.23	1.60±0.44	1.48±0.35	1.05±0.17
Ashland	0.46±0.23	0.85±0.51	1.73±0.35	1.22±0.38	0.68±0.50
SE (70df)	0.27	0.19	0.31	0.34	0.45

Conclusion

In terms of grain yield and ear weight, the newly developed varieties seem to be better than the local variety and DMR-SR out yielded other varieties. Popping quality of Pear shape and Golden pop were relatively better than other varieties, while Ashland produced in Ibadan appears to be better than other in term of popping quality. Extremely low moisture percentage depresses popping quality and acceptability. Popcorn produced in Ikenne location had 13 percent moisture content at harvest. This location therefore, seems to be ideal for popping quality and acceptability compared to Ibadan, where moisture (10%) was obtained. Lower pest and disease ratings were obtained in Orin_Ekiti, Ballah and Ilora suggesting the adaptability of popcorn varieties to these derived savanna and southern guinea savanna ecologies of south western Nigeria.

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