Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.4, No.2, 2014

Performance of Some Elite Spring Wheat Genotypes under Irrigation at Kirenowa, Borno State, Nigeria

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Abstract
Field study was conducted in 2007/2008 and 2008/2009 dry seasons at the Lake Chad Research Institute experimental site at Kirenowa in the Sudano sahelian zone of north east Nigeria to determine the performance of twenty elite spring wheat genotypes under irrigation conditions. Results showed significant differences in all the characters studied. Plant establishment was significantly higher in 2007/2008 than in 2008/2009. Entries 2, 14, 17, 18, 19 and 20 established better than the local check. The local check took significantly less number of days to attained 50% heading compared with improved genotypes. The results further revealed that the genotypes produced higher number of seeds per spike, heavier thousand grain weight and yield in 2007/2008 than in 2008/2009. Average over two years showed that twelve out of the twenty genotypes tested yielded over 3,000kg/ha than the local check. and are recommended for pre-release evaluations.
Keywords: Genotype, Elite Spring Wheat, Irrigation, Kirenowa, Nigera.

INTRODUCTION

WHEAT (*Triticum aestivum (L.)* is the most widely cultivated cereal in the world. It is grown in a wide range of environments but thrives best in temperate zones where there is adequate rainfall and temperature. Wheat is a major dietary constituent of about a quarter of the world population. It is used in a variety of ways. It is used for human consumption in different forms such as food, bread, biscuits, pastries, cakes, crakers, macaroni and spaghetti. It is also used as livestock feed as well as for industrial purposes. Wheat dominates world cereal trade, with global trade increasing from 15 million tonnes in the 1950’s to 100 million tonnes in the eighties.

Since the ban on wheat importation into Nigeria in 1987 the Federal and the State Government in the wheat growing areas in Nigeria have intensified efforts in boosting wheat production. A total of 213,881hectares of land was put under wheat cultivation in 1988/1989 dry season.

In Nigeria, wheat is grown under irrigation in the northern parts between latitudes 10 and 14^0 N from November to March during the cold harmattan period which provides the much needed low temperature (20 to 30^0c) for its production (Olugbemi, 1990). Since the harmattan period is short, only early maturing spring wheat varieties can be cultivated. The earlier released varieties are late maturing and low yielding (Ikwelle, 1990; Orakwe, 1993. He et al; 2001, Zhang 2007; Olabanji *et al*; 2004; Thapa et al, 2009). It therefore becomes necessary to identify early maturing and high yielding varieties that could fit into this period along which wheat would grow well in Nigeria.

Fifty elite spring wheat genotypes were introduced from CIMMYT, Mixco in 2004 and screened for two seasons to identify promising genotypes. Twenty promising genotypes that are outstanding in performance were identified and further advanced to a replicate yield trial. The present paper presents the performance of these genotypes under irrigation conditions in Kirenowa in the semi-arid environment of north east Nigeria.

Materials and Methods

Experimental Site

Kirenowa lies at the boarder of Nigeria and Chad in the Sudano saliehian Zone of the North east of Nigeria. The area is characterized by distinct annual long dry season (9 months or more) and short rainy (3 months or less). Rainfall in the experimental area is monomodal starting in May-June with a peak in August and terminating in September/October. Wheat planting is done under irrigation in November and harvested in March during the cold harmattan period under irrigation (Table 1). Soil type varies from light textured loam to clay loam with good internal drainage.

Table 1: Mean Maximum and Minimum Temperature (^{0}c) for 2007/2008 and 2008/2009 dry seasons at Marte Station

	Temperature (^{0}c)			
Month	**Maximum** 2007/2008	**Maximum** 2008/2009	**Minimum** 2007/2008	**Minimum** 2008/2009
November				
1st - 10th	26	29	14	15
11th - 20th	28	29	14	16
21st - 30th	30	32	12	18
December				
1st - 10th	31	30	12	15
11th - 20th	33	31	12	16
21st - 30th	33	32	11	18
January				
1st - 10th	32	33	12	11
11th - 20th	33	33	10	13
21st - 30th	32	31	11	12
February				
1st - 10th	31	30	10	12
11th - 20th	32	32	11	11
21st - 30th	33	34	13	11
March				
1st - 10th	**34**	**36**	**13**	**11**
11th - 20th	**34**	**40**	**14**	**13**
21st - 30th	**40**	**42**	**18**	**13**

Source: Chad Basin Development Authority (CBDA) Meteorological Station, Marte, Borno State.

Experimental Procedure

The field was ploughed and harrowed to a fine tilth and marked out in to plots of 3m x 2m with six rows spaced at 0.3om apart. A distance of 1.0m and 0.5m was allowed between replicates and plots, respectively.

The treatment consisted of twenty elite spring wheat genotypes namely:

1. Seri M82 (check)
2. Rayon F T.89
3. Kaue/pastor
4. Weaver/4/NAC/THAC/3x PUR 4/3/Marco/99
5. Pastor/Kauz
6. Site/Mo/3/Vorona/Bau/Bau
7. Chen/aegilops squarrosa (Taus)/Bol/3/9
8. Chen/aegilops squarrosa Taus)BCN/3/25x
9. Chen/aegilops squarrosa (Taus) Turaco/4
10. Vee/rtn/kauz/3/pastor
11. HBottan/vee/3/2x/Pgo/4/chen
12. Babax/Lr 39/Babax
13. BabaxLr 49/Babax
14. Babax/Lr 43/Babax-Ib/AY
15. Babax/Lr 43/Babax – 25B-OY
16. Pfau/Seri: IB/Amad
17. Pr//2x pastor
18. Attilla x 2/pastor
19. Ituw 234+Lr34x2//PRL/VEENO
20. Huw 234 + Lrx 34x/2x//pastor

The experiment was laid out in a randomized complete block design and replicated three times.

The seeds of all genotypes were treated with Apron star 40WS at the recommended rate of one sachet (10g) to 3kg of seed and drilled 30cm apart in plots measuring 3m x 2m. Fertilizer was applied at the recommended rate of 100kg N, 40Kg P_20_5 and K_20/ha. Half of the N and all P and K were applied at sowing. The remaining half N (as urea) was applied at four weeks after crop emergence (WAE). Thereafter, irrigation was applied and maintained at seven days intervals. Manual weeding was done at 2 and 6 WAE.

Data Collection and Analysis

Data was taken on stand establishment, number of days to 50% heading, plant height, number of seeds/spike, 1000 grain weight and grain yield. Data collected were subjected to analysis of variance (ANOVA) and differences between treatment means were separated using least significant difference (LSD) at 50% level of significance (Gomez and Gomez, 1984).

Results and Discussion

Growth Characters

The results showed significant ($P<0.05$) differences in stand establishment, days to 50% heading and plant height (Table 2). Plant establishment was significantly higher in 2007/2008 than in 2008/2009. Entries 2, 14, 17, 18, 19 and 20 established better than the local check in 2007/2008 but not in 2008/2009 (Table 2). The reason for good stand establishment in 2007/2008 could be due to favourable climatic condition such as low temperature experienced at early seedling stage (Table 1). Owen (1971 reported that the critical maximum temperature for wheat is 30^0 C. Olugebemi (1990) also reported that temperature at planting time is usually the most critical for wheat yield in the tropics. Stand establishment is very important yield indicator and contribute to final yield of wheat crop.

The number of days to 50% heading ranged between 57 to 63 and 47 to 63 days in 2007/2008 and 2008/2009 respectively (Table 2). The local check took significantly less number of days to attained 50% heading compared with other entries in both seasons (Table 2). The earlier heading in 2008/2009 could be attributed to higher temperature experienced during the growing season which hastened plant developmental stages (Table 1). The variation in number of days to 50% heading among genotypes may be due to genetic composition of the genotypes and also may do to differences in climatic factors between years during which genotypes were evaluated.

The genotypes showed significant ($P<0.05$) variation in plant height between years (Table 2). Entries 7 and 18 recorded the tallest plants in 2007/2008 and

Table 2: Effect of genotypes on growth characteristics of some Elite Spring wheat at Kirenowa in 2007/2008 and 2008/2009 dry seasons.

Genotypes	Establishment		Heading (DAS)		Plant height (cm)	
	2007/8	2008/9	2007/8	2008/9	2007/8	2008/9
Seri M82 (check	299	147	57	47	19.30	91.00
Rayon F 89	304	105	62	52	86.50	84.00
Kaue/pastor	288	177	62	60	92.47	81.33
Weaver/4/NAC/THAC/3XPUR4 /3/Marco/99	275	127	60	55	90.67	85.33
Pastor/Kauk	264	126	60	50	85.40	88.67
Site/MO/3/Varona/Bau/Bau	285	130	61	51	91.20	87.67
Chen/Aegilops squarosq (tans) Bo1/9	279	122	60	61	115.90	85.00
Chan/Aegilops squarosa (tans) BCN/3/25x	271	107	57	53	97.70	85.00
Chan/Aegilops squarosa (tans) Turaco/4	265	115	62	51	86.30	85.00
Vee/rtn/kau2/3/pastor	299	129	61	61	94.70	83.67
Hbo tan/vee/3/2x1/Pgo/4/chen	288	113	59	54	92.93	88.67
Babax/Lr39/Babax	293	128	63	62	88.27	84.67
Babax/Lr49/Babax	298	129	61	63	87.43	90.00
Babax/Lr 43/Babax/1b/AY	300	105	60	61	89.97	89.33
Babax/Lr43/Babax-25B-OY	285	123	61	59	100.43	89.33
Plau/seri.1B-Amad	292	88	59	55	91.80	88.67
Pr//2x pastor	317	97	58	57	87.17	84.00
Atilla x2/pastor	301	111	60	58	97.33	92.67
Ituw 34xLr34+Lr34X2//PRL/2/Prt/VeeNO	304	122	61	62	85.15	85.67
How 234+Lr x 34x/2x\Pastor	314	131	62	62	76.37	82.33
Mean	291	118	60	57	92.52	87.12
LSD ($P<0.05$)	25.80	9.15	3.15	2.85	7.74	2.92

2008/2009, respectively. The variation in plant height between years could partly be due to soil and climatic factors and also genetic differences among the genotypes.

Yield Components

The results showed significant influence of genotypes on both number of seeds per spike and 1000 grain weight (Table 3). The genotypes produced higher number of seeds per spike and heavier 1000 grain weight in 2007/2008 than in 2008/2009. Fifteen out of nineteen of the improved genotypes produced significantly higher number of seed per spike than the local check in 2007/2008, thus Hbo tan/Vee/3/2x/Pgo/4/Chem and Babax/Lr 43/Babax Ib/AY consistently produced the highest number of seed per spike in 2007/2008 and 2008/2009 indicating the superiority of these genotypes over the local check. (Table 3). The results further revealed that fourteen out of eighteen genotypes recorded heavier 1000 grain weight than the local check. The 1000 grain weight produced by entries 4.6 and 16 were statistically similar. The highest 1000 grain weigh was produce by Babax/Lr43/Babax-Ib/AY and Pr//2x pastor in 2007/2008 and 2008/2009 respectively. This could be attributable to genetic makeup of the genotypes and their ability to adapt better in the environment in which they were tested.

Table 3: Yield components of some Elite spring wheat genotypes at Kirenowa in 2007/2008 and 2008/2009 dry seasons.

Genotypes	**1000 grain weight (g)**		**Number of seeds per spike**	
	2007/8	2008/9	2007/8	2008/9
Seri M82 (check	39.00	35.59	45	32
Rayon F89	41.23	35.57	46	41
Kaue/pastor	36.41	36.06	48	38
Weaver/4/NAC/THAC/3XPUR 4/3/MARCO/99	42.01	37.66	42	35
Pastor/Kauk	37.50	37.60	46	35
Site/MO/3/Varona/ Bau/Bau	42.34	38.59	46	39
Chen/Aegilops squarosa (tans) Bo1/9	37.45	35.58	44	41
Chan/Aegilops squarosa (tans) BCN/3/25x	41.87	38.36	53	42
Chan/Ageilops squarosa (Tans) Turaco/4	40.22	38.33	47	44
Vee/rtn/Kau2/3/pastor	37.84	40.05	50	42
Hbo tan/vee/3/2x1/Pgo/4/chen	40.84	40.68	51	38
Babax/Lr43/Babax	41.79	39.86	49	39
Babax/Lr49/Babax	40.70	40.17	38	43
Babax/Lr34/Babax/1b/A	45.20	42.70	48	43
Babax/Lr 43/Babax/1b-25-BOY	44.15	43.52	51	39
Plau/seri.1B-Amad	42.50	39.00	50	44
Pr//2x pastor	45.12	46.31	46	39
Atilla x2/pastor/Lr34X	40.90	40.26	44	34
Ituw234 x Lr34 + 2/prt/vee No	39.58	44.94	45	42
Hblw 234fr x 34x/2x/pastor	42.05	44.44	48	40
Mean	40.89	39.87	47	40
LSD ($P<0.05$)	3.85	4.34	3.85	2.67

Grain Yield

Significant differences ($P<0.05$) in grain yield were observed among the genotypes in 2007/2008 and 2008/2009 seasons. The result also revealed higher grain yield among the genotypes in 2007/2008 than in 2008/2009. BABAXLr49/BABAX produced significantly highest grain yield in 2007/2008 while BABAX/Lr43/BABAX25B-OY and BABAX/Lr43/BABAX 1b/AY recorded statistically similar grain yield in 2008/2009 compared with the local check Average over two years showed that twelve genotypes yielded over 3,000kg/ha in high temperature environments than others (Table 4). Similar observations were made by Kamani and Jadon (1985). The genotype BABAX/Lr49/BABAX produced the highest grain yield of 3885kg/ha, however, this yield, compared favourably with those of BABAX/Lr49/BABAX and BABX/Lr43/BABAX25B-OY. The reasons for higher grain yield recorded in 2007/2008 compared with 2008/2009 could be attributable to the higher number of seeds/spike, heavier 1000 grain weight probably due to favourable weather conditions in 2007/2008. These results are in agreement with the observations made by Owen (1971), and Olugbemi (1990) that, higher temperatures during the
growing season has ten plant developmental stages, thus is making it in possible
for the plant to achieve its yield potential in full. Similar observations were also

Table 4: Grain Yield (kg/ha) of some Elite Spring Wheat genotypes at Kirenowa in 2007/2008 and 2008/2009 dry seasons.

Genotypes	Grain yield (kg/ha)		
	2007/8	2008/9	Comb
Seri M82	1234	1365	1299
Ray on F-89	3889	2296	3092
Kave/Pastor	3611	3056	3333
Weaver/4/NAC/thac/3/xpur4/3/marco/99	3843	2407	3126
Pastor/Kaux	2899	2037	2467
Site/MO/3/Varona/Bau/Bau	3249	2278	2763
Chen/Aegilops squarosq (tans) B01//3/9	3674	1879	2777
Chan/Aegilops squarosa (Tans) BCN/3/25X	3943	2852	3398
Chan/Aegilops squarosa (Tans)Turaco/4	2530	2472	2501
Vee/rtn/kau2/3/pastor	3273	3055	3164
HBOt tan/vee/3/2x1/Pgo/4/Chen	3245	2963	3104
Babax/Lr43/Babax	3764	2454	3109
Babax/Lr49/Babax	4732	3037	3885
Babax/Lr34/Babax -1b/Ay	3674	3287	3480
Babax/Lr43/Babax -25B-oy	4336	3287	3811
Plau/seri.1B-Amad	4187	2204	3195
Pr//2x pastor	4394	2500	3447
Atilla x2/pastor	2910	2194	2552
Itan 234 +Lr34x2/Prt/vee No	2668	2139	2404
How 234+Lrx34x2/Pastor	3177	2790	2987
Mean	3462	2528	2995
LSD ($P<0.05$)	740.85	172.58	185.84

made by Fischer and Maorer, 1976; Fate *et al*, 1972 and Owen, 1971, Rajaram, 1990.

The study has shown that the genotypes produced significantly higher grain yield than the local check. Average over two years revealed that twelve genotypes yielded over 3,000kg/ha than others. These genotypes also headed within 50 – 63 days and thus could be classified as early maturing. The genotypes are recommended for pre-released trials that could lead to release of some of them for cultivation by wheat farmers in wheat growing areas of the country.

Acknowledgement

The authors acknowledge with thanks the financial support provided by Executive Director, Lake Chad Research Institute, in carrying out this work. We also thank messer Jacob Daniel and Mallam Abubakar Umar for their technical support.

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