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Yield Evaluation of Selected barley (Hordeum vulgare L.) Genotypes in the Sudan Savanna Zone of Kebbi State, Nigeria

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ABSTRACT **Original research paper**

Two field experiments were conducted at the Teaching and Research Farm of the Abdullahi Fodio University of Science and Technology, Aliero, during the 2021 and 2023 dry seasons. The aim was to evaluate performance of selected barley genotypes in terms of yield, and yield-related traits. The study involved six barley genotypes: Traveler, Focus, Explorer, Brennus, Prunella, and Zhana, laid out in a completely randomized block design (RCBD) replicated three times. The findings indicated that genotype Zhana outperformed the others in several yield parameters, including Days to 50% Booting (50.62days), Days to 50% heading (57.80), spike length (8.77cm), weight of 1000 grains (45.52g) and grain yield (4.51 tha-1). In conclusion, Zhana genotype demonstrated superior performance among the tested genotypes and is therefore recommended for cultivation by farmers in Jega and other areas with similar agro-ecological conditions, to enhance barley productivity.

Keywords: Barley, Genotypes, Yield, Sudan Savanna.

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Introduction

Barley (*Hordeum vulgare* L.) is a staple crop adaptable to temperate climates, although some genotypes thrive in harsh environments. It was one of the ancient cereal crops ranked fourth most productive cereal crop after rice, wheat, and maize (FAOSTAT, 2022). The crop shows a very large genetic diversity and is grown under a wide range of environmental and soil conditions. It thrives best at high altitudes as well as in desert regions (Dawson et al., 2015). Barley is mainly used for human consumption, animal feed, and for production of industrial malt. Due to its nutritional value, and original flavor, the crop is gaining popularity in the field of nutrition, especially because of its high content of β-glucans and low gluten (Decouard *et al.*, 2022). Barley is considerably important as it has potential to reduce blood cholesterol and glucose levels as well as enhance weight loss, control of heart disease, and type-2 diabetes (Berengere *et al.*, 2021). It is mostly used as human food in countries like

Ethiopia, North Africa, and Asia, more frequently than in the rest of the world (Decouard *et al.*, 2022).

Barley (*Hordeum vulgare* L.) is a strategic cereal for food, feed, and malting, yet it is scarcely cultivated in the Sudan savanna of Nigeria, leaving domestic demand largely unmet and opportunities for cereal diversification underexploited. The Sudan Savanna zone presents a challenging but potentially suitable environment characterized by high intra- and inter-annual rainfall variability, frequent heat episodes, and generally low soil fertility conditions known to depress barley yields and amplify genotype × environment interactions (G×E) (El-Hashash and El-Absy, 2019). However, there remains a critical evidence gap on which barley genotypes respond best to the climatic conditions of the Sudan savanna zone of Kebbi State. The main aim of this study was to evaluate yield and yield related traits of some promising barley genotypes in the study area.

Material and Methods

Experimental Site

The field trials were carried out during 2021 and 2023 dry seasons at Research farm of Abdullahi Fodio University of Science and Technology Aliero, located in Jega. The treatment consisted of six Barley genotypes (Traveler, Focus, Explorer, Brennus, Prunella, and Zhana) arranged in a RCBD in three replications.

Data Collection

Days 50%booting was determined by recording the number of days from the date of sowing to the time when about 50% of the plants in each net plot have booted. Days to 50% heading was recorded by counting the days from sowing to when about 50% of the plants in the net plot have headed. Spike length was measured in centimeters, using meter rule from five (5) randomly selected spikes from net plot and the average was recorded. Weight of 1000 grains was taken by weighing 1000-dried grains from each net plot using a mettler Toledo SB 16001 weighing balance and the average was recorded. Grain yield was determined by weighing the threshed spikes from each net plot using a mettler Toledo SB 16001 weighing balance and thereafter expressed in tons per hectare.

Data Analysis

The data obtained was subjected to analysis of variance (ANOVA) using SAS where treatments that showed significant differences were separated using DMRT at 5% level of probability.

Result and Discussion

Barley genotypes were significantly different (P<0.05) on all the yield and yield-related attributes measured. On **days to 50% booting,** Zhana genotype took longer days to attain 50% booting compared to all other genotypes evaluated. A similar trend was also observed in **Days to 50% heading.** The delayed booting and heading observed in Zhana could be associated with its relatively late maturity, which allows the plant to accumulate more assimilates before flowering. This result is in conformity with the finding of Faralli *et al.* (2019) who reported that, early or late attainment of booting and heading of barley is a genotypic and is influenced by environmental adaptability. With respect to **spike length,** Zhana recorded the longest spikes, which significantly differed from the other genotypes that were statistically similar. The superiority of Zhana in spike length could be attributed to its ability to promote vigorous vegetative growth, thereby enhancing the plant capacity to produce larger and more productive tillers. Kassie and Tesfaye (2019) also reported that variations in spike length among barley genotypes are primarily due to inherent genetic potential, which determines tiller formation ability and spike development.

The result of **1000-grain weight** indicated that the Explorer genotype recorded the highest mean value, which was statistically at par with Zhana and Prunella but significantly different from Traveller, Focus, and Brennus. Higher 1000 grain weight is an important indicator of better grain filling and seed size, which directly influences final yield. According to Gasparis and Miloszewski (2023), differences in 1000-grain weight among barley genotypes are largely attributed to genetic factors and their efficiency in assimilate translocation during the grain filling period. Zhana genotype also recorded the highest mean value of grain yield, which significantly differed from all other genotypes, while Explorer recorded the lowest mean value. The high yield performance of Zhana could be linked to its longer spike length, delayed maturity, and better tiller formation capacity, which enhance the production of more grains per spike. Similar observations was reported by Wakwaya, (2021), who found that differences in yield among barley genotypes are strongly influenced by their genetic makeup, growth duration, and spike-bearing capacity.

Table 1: Days to 50% Booting, Days to 50% Heading, Spike Length, 1000-grain weight and Grain yield of Barley Genotypes at Jega during 2022/2023 Dry Season

GENOTYPES	Days to 50% Booting	Days to 50% Heading	Spike length (cm)	1000 Grain weight (g)	Grain Yield (t ha^{-1})
Brennus	49.37^{ab}	56.21^{ab}	8.20^{ab}	38.52^{b}	3.08^{ab}
Explorer	49.64^{ab}	55.33^{b}	7.91^{b}	46.25^{a}	2.12^{b}
Focus	48.65^{b}	56.57^{ab}	7.57^{b}	39.22^{b}	3.53^{ab}

Prunella	49.73[ab]	58.06[ab]	8.14[ab]	43.49[a]	2.99[ab]
Traveller	49.19[ab]	56.83[ab]	7.80[b]	39.69[b]	3.06[ab]
Zhana	50.62[a]	57.80[a]	8.77[a]	45.52[a]	4.51[a]
SE ±	**0.462**	**0.833**	**0.224**	**1.305**	**0.514**

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

Conclusion

Based on the findings, it could be concluded that the Zhana genotype exhibited superior performance in most of the evaluated yield and yield attributes. Zhana recorded the longest spike length, delayed booting and heading which favored higher assimilate accumulation, and ultimately produced the highest grain yield compared to the other genotypes. The results therefore highlighted that Zhana is high yielding and well adapted genotype for cultivation in the Sudan Savanna zone of Kebbi State, Nigeria.

Recommendation

It is recommended that Zhana genotype could be adopted by farmers in the study area for improved barley production. Further multi location trials are encouraged to validate its performance across different agro ecological zones. Future breeding programs could focus on Zhana as a parent material for developing new high yielding and stress tolerant barley varieties.

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