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Full Length Research Article

EVALUATION OF THE PERFORMANCE OF GINGER (*ZINGIBER OFFICINALE* ROSC.) GERMPLASM IN KADUNA STATE, NIGERIA

Sodangi, I. A.

Department of Crop Science
Kaduna State University

*Corresponding Author's Email Address: ibrahim.sodangi@kasu.edu.ng

ABSTRACT
Studies were conducted in the wet season of 2018 to evaluate the performance of three ginger cultivars in five Local Government Areas of Kaduna State, Nigeria. The treatments consisted of three cultivars of ginger (UG_1, UG_2 and "China") planted in five locations (Kafanchan in Jema'a LGA, Kagoro in Kaura LGA, Samaru in Zangon Kataf LGA, Kubatcha in Kagarko LGA and Kwoi in Jaba LGA).The results showed significant effects of location and cultivar on some of the parameters evaluated. The "China" cultivar at Kafanchan, Kubatcha and Kwoi as well as UG_1 at Kubatcha produced statistically similar yields of ginger by dry weight (16.8t/ha, 21.7t/ha, 17.9t/ha and 19.6t/ha, respectively) which were significantly higher than the other interactions. The paper recommended that a further research should be conducted by or in collation with a Biochemist or Food Nutritionist to determine the pungency, aroma and oleoresin contents of the ginger cultivars to enable a good recommendation to ginger farmers in the study area.

Keywords: Evaluate, performance, ginger, cultivars

INTRODUCTION

Ginger (*Zingiber officcinale* Roscoe) belongs to the family *Zingiberaceae* and is an important commercial crop grown for its aromatic rhizomes. It is one of the oldest and renowned commercial spices esteemed for its aroma, flavour and pungency. Spices are high value and export oriented crops, which play an important role in agricultural economy of the countries that grow them. Among the spices, ginger is the main cash crop supporting the livelihood and improving the economic level of many ginger growers. Today, the use of ginger in different forms is increasing which has resulted in a hike in demand the world over. The top five ginger producing countries (2011 figures) are India (702,000 metric tons), China (388,886 metric tons), Nepal (216,289 metric tones), Nigeria (160,000 metric tons) and Thailand (152,630 metric tons) (FAO, 2014).

The ginger crop, in spice sub-sector, has an immense potential for economic development and poverty reduction through creation and expansion of employment opportunities and distribution of income and foreign exchange earnings. Despite all the potentials and opportunities of having such a long history with a diversified conducive agro-ecology base, this spice sub-sector potential remains unexploited. The sub-sector is still not organized or packaged, low in productivity and inefficient. This is attributed to several factors, including poor soil fertility, shortage of improved cultivars, and poor agronomic practices and effects of pests and diseases (Hailemichael *and* Tesfaye, 2008; MOARD, 2007; Amadi *et al*., 2010).

Although Nigeria is the largest producer and exporter of ginger in Africa (FAO, 2008), the level of production is generally low compared to other export crops. The yield is low but of high quality that has high demand in the world market. 80% of Nigeria's ginger comes from the southern part of Kaduna State where, according to Momber (1942), it has been in production since 1927. Several farms in Southern Kaduna could only produce about 2–5 t/ha and the average yield of ginger under farmer management conditions in Nigeria is reported to be about 2.5 - 5 t/ha which is far short of yield currently obtained in most parts of the world. According to FAO (2011) ginger yield in Nigeria was about 3-4t/ha in 2009. Yet under improved cultivation conditions, yields could be as high as 38 t/ha elsewhere (Purseglove, 1976). It is evident that the actual yields of ginger in Nigeria fall short of the yields that are currently obtained in other parts of the world, and even short of the potential yields of the crop.

One major shortcoming of ginger production in Nigeria is the very narrow gene pool on which the industry is based. Farmers have relied almost exclusively on two cultivars, namely UG_1 (yellow ginger "tafin giwa") and UG_2 (Black ginger "yatsun biri"). Tremendous losses are incurred each year by farmers who fail to mulch, weed, fertilize and harvest at the appropriate times or with the appropriate methods. This study was carried out to evaluate the performance of ginger germplasm across locations in Kaduna State.

MATERIALS AND METHODS

Three to five centimeter long, one-year-old ginger rhizomes having at least one active bud were used as planting material. The treatments consisted of three cultivars of ginger (UG_1, UG_2 and "China") planted in five locations (Kafanchan in Jema'a LGA, Kagoro in Kaura LGA, Samaru in Zangon Kataf LGA, Kubatcha in Kagarko LGA and Kwoi in Jaba LGA). Rhizomes were planted at a seed rate of 1500 kg/ha mother rhizomes. N, P and K were applied at the rate of 150, 50 and 50 kg/ha, respectively. The crop was planted in June, 2018 and harvested in December of the same year across the five locations.

Data was collected on number of shoots per plant, number of leaves per shoot, plant height and rhizome dry weight. All data collected was subjected to analysis of variance (ANOVA) using Statistix version 10.0 (Statistix, 1985). Differences between treatment means were compared using Duncan multiple range test (DMRT).

RESULTS

Location significantly affected the number of shoots per plant of ginger but cultivar did not (Table 1). Ginger grown in Kubatcha,

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Kwoi and Kafanchan had statistically similar number of shoots per plant, which was significantly higher that the number of shoots per plant by the ginger grown in Kagoro and Samaru. The interaction between location and cultivar had a significant effect on the number of shoots per plant (Table 1).

The effect of interaction between location and cultivar on number of ginger shoots per plant is presented in Table 2. The highest number of shoots per plant was produced by UG_1 at Kubatcha.

Table 1: Effects of location and cultivar on some growth and yield parameters of ginger in five locations in Southern Kaduna, 2018

Treatment	Number of shoots/plant	Number of leaves/shoot	Plant height (cm)	Rhizome dry weight (t/ha)
Location				
Kafanchan	4.6ab	14.2	28.1a	12.6b
Kagoro	4.2b	12.5	22.9b	11.8b
Samaru	3.8b	12.9	22.8b	12.7b
Kubatcha	5.6a	13.0	22.3b	16.4a
Kwoi	5.0ab	13.9	23.2b	13.8ab
SE (±)	1.15	1.10	2.16	1.50
Cultivar				
"China"	4.8	13.1	28.8a	17.6a
UG_1 ("Tafin Giwa")	4.9	13.5	21.1b	14.5b
UG_2 ("Yatsun biri")	4.3	13.3	21.7b	8.4c
SE (±)	0.89	0.86	1.67	1.16
Interaction (Loc x Var)	*	*	*	*

Means followed by the same letter(s) in the same column for each factor are not significantly different at P≤0.05

This was comparable to the number of shoots per plant produced by "China" at Kubatcha, UG_1 and Kwoi and UG_2 at Kwoi but significantly higher than all other interactions.

Neither location nor cultivar affected the number of leaves per shoot significantly but the interaction between the two factors did (Table 1).Cultivar "China" at Kwoi produced the highest number of leaves per shoot (Table 3). This was comparable with all other interactions except "China" at Kagoro and Samaru which produced significantly the lowest number of leaves per shoot. Plant height was significantly affected by both location and cultivar, with the tallest plants produced at Kafanchan by the "China" cultivar (Table 1). The interaction between location and cultivar had a significant effect on the height of ginger (Table 1). The interaction between "China" cultivar and Kafanchan location produced significantly the tallest plants (Table 4). Kubatcha location produced the highest quantity of ginger by dry weight (Table 1), which was comparable with that of Kwoi location but significantly higher than the other three locations. The "China" cultivar produced more ginger by dry weight than UG_1 and UG_2. The interaction between location and cultivar on dry weight of ginger was significant. "China" at Kafanchan, Kubatcha and Kwoi as well as UG_1 at Kubatcha produced statistically similar yields of ginger by dry weight (16.8t/ha, 21.7t/ha, 17.9t/ha and 19.6t/ha, respectively) which were significantly higher than the other interactions (Table 5).

Table 2: Effect of interaction between location and cultivar on number of ginger shoots per plant in five locations in Southern Kaduna, 2018

Cultivar	Location				
	Kafanchan	Kagoro	Samaru	Kubatcha	Kwoi
China	4.6bc	4.4bc	4.1bc	6.0ab	4.7bc
UG_1 (Tafin Giwa)	4.7bc	4.1bc	3.7c	6.7a	5.4a-c
UG_2 (Yatsun biri)	4.5bc	4.1bc	3.7c	4.2bc	4.8a-c
SE (±)	1.99				

Means followed by the same letter(s) are not significantly different at P≤0.05

Table 3: Effect of interaction between location and cultivar on number of ginger leaves per shoot in five locations in Southern Kaduna, 2018

Cultivar	Location				
	Kafanchan	Kagoro	Samaru	Kubatcha	Kwoi
China	14.8ab	11.3b	11.3b	12.3ab	15.8a
UG_1 (Tafin Giwa)	14.1ab	12.8ab	13.1ab	18.8ab	13.7ab
UG_2 (Yatsun biri)	13.7ab	13.3ab	14.2ab	13.0ab	12.2ab
SE (±)	1.91				

Means followed by the same letter(s) are not significantly different at P≤0.05

Table 4: Effect of interaction between location and cultivar on height of ginger shoot in five locations in Southern Kaduna, 2018

Cultivar	Location				
	Kafanchan	Kagoro	Samaru	Kubatcha	Kwoi
China	37.1a	27.9b	27.2bc	25.4b-d	26.4b-d
UG_1 (Tafin Giwa)	23.0b-d	21.2b-d	21.2b-d	20.7b-d	19.4d
UG_2 (Yatsun biri)	24.1b-d	19.5d	20.0cd	21.0b-d	23.8b-d
SE (±)	7.66				

Means followed by the same letter(s) are not significantly different at P≤0.05

Table 5: Effect of interaction between location and cultivar on dry weight of ginger in five locations in Southern Kaduna, 2018

Cultivar	Location				
	Kafanchan	Kagoro	Samaru	Kubatcha	Kwoi
"China"	16.8a-d	16.0b-d	15.4b-e	21.7a	17.9a-c
UG_1 ("Tafin Giwa")	13.3c-f	12.2d-g	12.4d-g	19.6ab	15.4b-e
UG_2 ("Yatsun biri")	7.8g	7.1g	10.3e-g	8.4f	8.2fg
SE (±)	2.60				

Means followed by the same letter(s) are not significantly different at P≤0.05

DISCUSSION

For a long period of time now, Nigeria has had the highest area of land under ginger cultivation globally. The country had 195,000 hectares under ginger cultivation in 2007 (which represented about 45.4% of world total for that year) and has continued to maintain this trend (FAO, 2009). In spite of this, the productivity of ginger per unit area has remained very low in the country. According to FAO (2011) ginger yield in Nigeria was about 3-4t/ha in 2009. Yet under improved cultivation conditions, yields could be

as high as 38 t/ha (Purseglove, 1976). It is evident that the actual yields of ginger in Nigeria fall short of the yields that are currently obtained in other parts of the world, and even short of the potential yields of the crop.

Findings from this study show dry yield ranges of 15.4 – 21.7t/ha for the "China" cultivar, 12.2 – 19.6t/ha for UG_1 and 7.1 – 10.3t/ha for UG_2 across the five locations, thus agreeing with the report of FAO (2011) that actual yields of ginger in Nigeria fall short of the potential yields of the crop. The yields obtained in this research also agree with a recent report by Thrive Agric (2020) that the average yields of ginger is between 13 and 27 t/ha. Also, current yields of 12 – 15t/h and 9 – 11t/ha for UG_2 and UG_1, respectively have been reported by the National Root Crops Research Institute, Umudike (nrcri.gov.ng).

Omenukor (1983) and Okwuowulu (1988) observed in ginger a relationship between sett size and most of its vegetative characters. According to these authors, large setts possessed more sprouting loci and produced more sprouts per sett than smaller setts. Also large setts produced more vigorous plants than smaller setts and therefore were taller, produced more leaves and had higher yielding ability than plants from smaller sett sizes. A similar trend was observed in this study especially regarding plant height and yield, in which case the big-sized "China" cultivar out - performed the other cultivars. Njoku *et al* (1995) reported that ginger from Nigeria'is highly valued for its aroma, pungency, high oil and oleroresin content. Out of the two cultivars commonly grown in Nigeria, the yellow cultivar (UG_1) is more popular than the black cultivar (UG_2) apparently due to its high yielding capacity and pungency (Kure, 2007).

Recommendation

It is recommended that a further research should be conducted by or in collation with a Biochemist or Food Nutritionist to determine the pungency, aroma and oleoresin content to enable a good recommendation to ginger farmers in the study area.

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