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

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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 (UG₁, UG₂ 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 UG₁ at Kubatcha produced statistically similar yields of ginger by dry weight (16.8t/ha, 21.7t/ha, 17.9t/ha and 16.6t/ha, respectively) which were significantly higher than the other interactions. The paper recommended that a further research should be conducted by or in collaboration 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 officinale 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 the livelihood and improving the economic level of many ginger growers. Today, the use of ginger in different forms is increasing

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, 1978). 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 UG₁ (yellow ginger “tafin giwa”) and UG₂ (black ginger “yatsun bin”). 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 (UG₁, UG₂ 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,
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 UG1 at Kubatcha.

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

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of shoots/plant</th>
<th>Number of leaves/shoot</th>
<th>Plant height (cm)</th>
<th>Rhizome dry weight (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kafanchan</td>
<td>4.6ab</td>
<td>14.2</td>
<td>28.1a</td>
<td>12.9b</td>
</tr>
<tr>
<td>Kagoro</td>
<td>4.2b</td>
<td>12.5</td>
<td>22.9b</td>
<td>11.8b</td>
</tr>
<tr>
<td>Samaru</td>
<td>3.8b</td>
<td>12.9</td>
<td>22.8b</td>
<td>12.7b</td>
</tr>
<tr>
<td>Kubatcha</td>
<td>5.8a</td>
<td>13.0</td>
<td>22.3b</td>
<td>16.4a</td>
</tr>
<tr>
<td>Kwoi</td>
<td>5.0ab</td>
<td>13.9</td>
<td>23.2b</td>
<td>13.8ab</td>
</tr>
<tr>
<td>SE (*)</td>
<td>1.15</td>
<td>1.10</td>
<td>2.16</td>
<td>1.50</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Location</th>
<th>Number of shoots/plant</th>
<th>Number of leaves/shoot</th>
<th>Plant height (cm)</th>
<th>Rhizome dry weight (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;China&quot;</td>
<td>Kafanchan</td>
<td>4.8</td>
<td>13.1</td>
<td>28.1a</td>
<td>17.9a</td>
</tr>
<tr>
<td>UG1 (&quot;Talifin Giwa&quot;)</td>
<td>4.9</td>
<td>13.5</td>
<td>21.1b</td>
<td>14.5b</td>
<td></td>
</tr>
<tr>
<td>UG2 (&quot;Yatsun bin&quot;)</td>
<td>4.3</td>
<td>13.3</td>
<td>21.7b</td>
<td>8.4c</td>
<td></td>
</tr>
<tr>
<td>SE (*)</td>
<td></td>
<td>0.8b</td>
<td>0.86</td>
<td>1.97</td>
<td>1.16</td>
</tr>
</tbody>
</table>

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, UG1 and Kwoi and UG2 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 5), 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 UG1 and UG2. The interaction between location and cultivar on dry weight of ginger was significant. "China" at Kafanchan, Kubatcha and Kwoi as well as UG1 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).

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 – 21.7 t/ha for the “China” cultivar, 12.2 – 19.6 t/ha for UG1; and 7.1 – 10.3 t/ha for UG2; 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 – 15 t/ha and 9 – 11 t/ha for UG2 and UG1, respectively have been reported by the National Root Crops Research Institute, Umudike (nrcri.gov.ng).

Omenkor (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’s highly valued for its aroma, pungency, high oil and oleroresin content. Out of the two cultivars commonly grown in Nigeria, the yellow cultivar (UG1) is more popular than the black cultivar (UG2) 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 collaboration 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.

Acknowledgement/Appreciation
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