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# Adaptability and yield evaluation of some Acha (*Digitaria exilis* and *Digitaria iburua* Kippis Stapf) accessions at Kusogi – Bida, Niger State, Nigeria

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ABSTRACT: Fifteen acha (*D. exilis* and *D. iburua* Kippis Stapf) accessions were evaluated for adaptability and grain yields at Kasogi-Bida village in a two-year study. The experiment was established in a Randomized Complete Block accessions in terms of number of tillers per plant, height at harvest, number of days to maturity and grain yield. Generally, grain yield and other parameters determined showed significant difference across all the accessions in both years. Also, grain yield was observed to range from 210.24kg/ha to 473.74 kg/ha in 2005 and 211.0kg/ha to 435.81kg/ha in 2006. Araspia, Kure'ep and shalak accession had significantly higher grain yields above the remaining accessions in year 1 and 2. However, combined analysis shows that there was no significant difference in grain yield.

Key Words: Adaptability; Yield evaluation; Acha; *Digitaria exilis; Digitaria iburua.*

## Introduction

Food remains the basic need of Africans where famine is a continues enemy of peace and stability in the mostly agrarian societies. This seems to be the price Africans pay for abandoning most of its traditional crops that can sustain them for many years. Among the more than 2000 crops that are native to Africa, grains such as rice, pearl millet, finger millet, sorghum and acha (fonio) could be effective tools in fighting hunger in the continent (Vietmeyer *et al*, 1996).

Acha or fonio, sometimes considered as "a small seed with a big promise" provides food early in the season when other crops are yet to mature for harvest (Ibrahim 2001). Acha grains are the testiest and most nutritious of all grains (Vietumeyer et al, 1996) and is said to contain 7% crude protein, that is high in leucine (19.8%), methionine and cystine of about (7%) and valine (5.8%) (Temple and Bassa, 1991).

It forms the staple food in some of the producing areas where it is processed into various kinds of menus. In Nigeria, about 70,00 metric tones of the crop is produced annually (CBN, 1998) and that the economic returns of acha when computed showed that it is profitable to grow the crop compared to other crops like rice, sorghum and cowpea. (Dauda *et al* 2003)

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Acha is an important cereal crop that is called with many names. Some of these popular names in Africa are: fonio, findi, kabuga, fundo and pom while the Europeans coined the English name "Hungry rice" which is considered misleading by some authors Know-Ndung and Misari, (1999), Ibrahim (2001). Anonymous, (2003). Acha or fonio is suggested to be the oldest indigenous African cereal with cultivation records dating back to 7,000 years (Cruz, 2004). Recent discoveries revealed that fonio is cultivated and used as food and forage in the Dominican Republic Island of South America Pablo *et al*, 2003). The global land area being put to its production is estimated to be 380,00 ha with an annual production of 250,000 tones (Cruz, 2004). The average production of acha per hectare has remained low ranging from 600-700kg/ha (Cruz, 2004).

This crop, fits into the low-input farming systems of the resource-poor African farmers as it has a unique ability to tolerate poor and marginal soils and can withstand drought (Vietmeyer *et al*, 1996; Aslafy, 2003). In an earlier study, Dachi and Omueti (2000) reported that acha responds positively to fertilizer application. Though the crop has been completely neglected in the past, (Kwon-Ndung and Misari, 1999). It is now considered as an important crop for improvement as a cultivated species (Ibrahim, 2001, Morales-Payan *et al*., 2002). This study was therefore conducted to evaluate the adaptability and grain yields of fifteen selected acha accessions. This will serve as a prelude in the improvement of acha at the. National Cereals Research Institute, Badeggi which has the National Mandate for the genetic improvement of the crop.

## Materials and Methods

Two trials were conducted on the demonstration field of the Niger State Agricultural Development Project (NSADP) located at Kusogi – Bida village during the 2005 and 2006 cropping seasons in the Southern Guineas Savannah ecological zone of Nigeria. Field operations included clearing, ploughing harrowing and leveling. The experiment was conducted in a natural filed condition using Randomized complete Block Design (RCBC) with three replications. Planting materials consisted of fifteen acha accessions (Table 1). These accessions were selected based on their adaptability and yield performances out of the thirty-three accessions collected in November, 2003 from Bokkos and Mangu local government areas of Plateau State and were Planted in June, 2004. All, except shalak and Kure'ep which are erect, have prostrate growth habit.

Plot size was 3.0m x 4.0m. Planting method was by broadcasting and no any fertilizer was applied. Weeds were controlled by hand pulling at five and nine weeks after planting (WAP). Data were collected on number of tillers per plant at 6 WAP, number of days to 50% panicle emergence, plant height at harvest, number of days to maturity and grain yield (kg/ha). Data collected were subjected to analysis of variance (ANOVA) for test of significance and significance difference (LSD) at 5% level of probability.

## Results and Discussion

The results of the adaptability and yield performance of fifteen Acha accessions are presented in tables 1 and 2. From the results, there were significant differences in all the parameters measured. In both years, the accessions showed high adaptability responses. Generally, the accessions produced good gain yields in the studies. The results from Table 1 shows that number of tillers per plant in all accessions ranged from 3 in Araspia and zengabanya accessions to 17 and 20 in kure'ep and shalak accessions.

TABLE 1: GRAIN YIELD AND OTHER AGRONOMIC CHARACTERS OF SOME ACHA ACCESSIONS AT KUSOGI-BIDA IN 2005.

| Accession Name | No. of tillers/plant | No of days to 50% P.E. | Plant height at maturity (cm) | N. of days to maturity | Grain yield (kg/ha) |
|---|---|---|---|---|---|
| Araspiya | 3 | 80 | 80.1 | 114 | 454.12 |
| Bayama | 5 | 83 | 81.1 | 118 | 301.47 |
| Egwo | 6 | 78 | 81.6 | 112 | 280.13 |
| Fomeboro | 4 | 81 | 79.8 | 113 | 257.36 |
| Fulu | 4 | 86 | 84.2 | 118 | 254.04 |
| Gindiri | 5 | 77 | 81.3 | 112 | 311.40 |
| Gongeseng | 6 | 80 | 81.3 | 112 | 228.77 |
| Kure'ep | 17 | 106 | 101.9 | 142 | 473.74 |
| Kypio | 5 | 76 | 84.9 | 111 | 229.47 |
| Nipiya | 4 | 75 | 83.5 | 107 | 316.77 |
| Shalak | 20 | 105 | 118.5 | 143 | 471.84 |
| Tishiyong | 4 | 90 | 90.8 | 118 | 210.23 |
| Vahakal | 4 | 70 | 85.2 | 106 | 261.73 |
| Yajelti | 4 | 80 | 75.2 | 119 | 270.23 |
| Zengabanya | 3 | 90 | 90.5 | 124 | 261.17 |
| L.S.D. (0.05) | 3.82 | 6.92 | 5.72 | 2.01 | 36.68 |
| CV (%) | 35.81 | 4.94 | 3.95 | 1.02 | 7.35 |

P.E. = Panicle emergence

Also, there was similar variation in number of days to 50% panicles emergence which ranged from 70 days in Shalak accession to 106 days in Kure'ep accession.

The same variation was observed in plant heights that ranged from 75.2cm in yajelti accession to 118.5cm in Shalak accession. The number of days to maturity indicating earliness of the accession showed that vakahal accession with 106 number of days to maturity was the earliest as compared to Kure'ep and Shalak accessions which had 142 and 143 days maturity respectively (Table 1). In table 1, the least grain yield of 210.24 kg/ha in Tishiyong accession while grain yields of 471.84 kg/ha and 473.74 kg/ha were recorded in Kure'ep and Shalak accessions in 2005.

While in 2006 (Table 2), number of tillers per plant varied from 3 in vahakal accession to 8 in Egwo and Kure'ep accessions. Similarly, the least number of days to 50% panicle emergence of 69 was observed Bayama Also, Shalak accorded the highest of days of 105 top while the least of 69 was observed in Bayama accession. While the heights of 105 recorded in Shalak accession. The highest plant height of 125 was observed in Shalak accession, and the least of 75.0cm, was recorded in Fulu accession. Also, Bayama accession has the least number of days to maturity of 106 while both Kure'ep and Shalak had the highest days of 143 to maturity respectively. Grain yield varied significantly from 211.05kg/ha in zengabanya accession to 435.81 kg/ha in Kure'ep accession.

Table 3 on the other hand shows that number of tillers varied from 4 in eight accessions (Araspia, Bayama, Fomeboro, Kypio, Nipiya, Tishiyong, Vahakal and Zengabaya) to 13 in Shalak accessions.

TABLE 2: GRAIN YIELD AND OTHER AGRONOMIC CHARACTERS OF SOME ACHA ACCESSIONS AT KUSOGI- BIDA IN 2006.

| Accession Name | No. of tillers/plant | No of days to 50% P.E. | Plant height at maturity (cm) | N. of days to maturity | Grain yield (kg/ha) |
|---|---|---|---|---|---|
| Araspiya | 4 | 82 | 86.5 | 112 | 422.78 |
| Bayama | 4 | 69 | 84.6 | 106 | 297.64 |
| Egwo | 8 | 82 | 91.2 | 118 | 285.20 |
| Fomeboro | 4 | 70 | 84.3 | 107 | 331.67 |
| Fulu | 5 | 80 | 75.0 | 113 | 261.83 |
| Gindiri | 4 | 76 | 83.5 | 113 | 282.77 |
| Gongeseng | 5 | 87 | 101.5 | 120 | 215.90 |
| Kure'ep | 8 | 104 | 101.2 | 143 | 435.81 |
| Kypio | 6 | 84 | 99.4 | 120 | 221.60 |
| Nipiya | 4 | 86 | 80.6 | 118 | 358.60 |
| Shalak | 7 | 105 | 125.1 | 143 | 430.63 |
| Tishiyong | 4 | 88 | 97.6 | 122 | 219.87 |
| Vahakal | 3 | 72 | 96.1 | 108 | 217.25 |
| Yajelti | 7 | 80 | 78.5 | 121 | 278.30 |
| Zengabanya | 5 | 91 | 81.1 | 124 | 211.05 |
| L.S.D. (0.05) | 5.88 | 2.17 | 3.36 | 2.30 | 67.58 |
| CV (%) | 6.81 | 1.55 | 2.21 | 1.15 | 13.62 |

P.E. = Panicle emergence

Number of days to 50% panicle emergence was observed to range significantly from 75 days in Araspia accession to 105 days in Shalak accession, while the highest plant height of 121.8cm was recorded in Shalak accession, the least plant height of 76.9 was absolved in Yajelti accession for number of days to maturity, Shalak accession had the highest days of 143 and the least days of 111 were recorded in Asapia and Fomeboro respectively. There was no significant difference in grain yields among the accessions.

TABLE 3: COMBINED ANALYSIS OF THE 2 YEARS, FOR GRAIN YIELD AND OTHER AGRONOMIC CHARACTERS

| Accession Name | No. of tillers/plant | No of days to 50% P.E. | Plant height at maturity (cm) | No. of days to maturity | Grain yield (kg/ha) |
|---|---|---|---|---|---|
| Araspiya | 4 | 75 | 83.8 | 111 | 438.44 |
| Bayama | 4 | 76 | 82.9 | 112 | 299.55 |
| Egwo | 7 | 80 | 86.4 | 115 | 282.67 |
| Fomeboro | 4 | 75 | 82.1 | 111 | 294.52 |
| Fulu | 5 | 83 | 79.6 | 116 | 257.92 |
| Gindiri | 5 | 77 | 82.4 | 112 | 297.08 |
| Gongeseng | 6 | 84 | 91.4 | 116 | 222.33 |
| Kure'ep | 12 | 104 | 101.5 | 142 | 225.06 |
| Kypio | 4 | 81 | 92.2 | 116 | 454.76 |
| Nipiya | 4 | 79 | 82.1 | 113 | 225.53 |
| Shalak | 13 | 105 | 121.8 | 143 | 337.68 |
| Tishiyong | 4 | 89 | 94.2 | 120 | 411.24 |
| Vahakal | 4 | 78 | 90.6 | 114 | 215.06 |
| Yajelti | 6 | 80 | 76.9 | 115 | 216.99 |
| Zengabanya | 4 | 91 | 85.8 | 124 | 274.11 |
| L.S.D. (0.05) | 4.96 | 5.13 | 4.69 | 2.16 | NS |
| CV (%) | 5.41 | 3.66 | 3.16 | 1.09 | 10.93 |

P.E. = Panicle emergence

*Conclusion*

This study has confirmed the adaptability of this African native cereal crop in Kusogi-Bida village in the Southern Guinea Savannah of Nigeria. In view of its importance in fighting hunger in Africa, to the poor-resource farmers and its exceptionally high nutritional quality, it is hoped that more attention will be given in promoting this crop through research and development to enhance the nutritional status of all Nigerians.

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