



GROWTH AND YIELD OF ACHA (*Digitaria exilis* Kippis Stapf) AS INFLUENCED BY SOWING METHODS AND NITROGEN RATES IN THE GUINEA SAVANNA AREA OF NIGERIA

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ABSTRACT

Field experiments were conducted in the cropping season of 2015 and repeated in 2016 at the National Cereals Research Institute, Acha Sub-Station Riyom, Plateau State to determine the appropriate sowing method and optimum nitrogen rate for acha (*D. exilis*) production in Southern Guinea Savanna Zone of Nigeria. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The treatments consisted of two sowing methods (Broadcasting and drilling at 30cm inter-row spacing) and three nitrogen rates (0, 30 and 60kg Nha⁻¹). Plot size was 3.0m x 4.0m. The parameters studied were number of tillers, leaf area, spike length, straw weight and grain yield (kg ha⁻¹). The results indicated that drilling method of sowing had superior influence on number of tillers, leaf area, spike length, straw weight (kg ha⁻¹). While the maximum grain yield (kg ha⁻¹) was also recorded under drilling method of sowing than under broadcasting method and the lowest grain yield was produced at when nitrogen was not applied.

Key words: *Acha, Digitaria exilis, grain yield, nitrogen fertilizer, sowing method.*

INTRODUCTION

Acha (*D. exilis*) also known as *fonio*, *findi* or *fundo* are being cultivated throughout West Africa, The Dominican Republic and in the Francophone countries where they are produced and are now in high demand worldwide (Jideani, 2011). Acha (*D. exilis*) is one of the most important staple food crops for most of the resource poor famers in the Sub-Saharan Africa. The crop is included in the list of grains considered as whole grains when consumed as wholegrains (Jones, 2009; Jideani, 2011). Traditionally, the crop is consumed whole as *tuwo*, *gwete*, *couscous*, *achajollof*, and as traditional beverage drink known as *kunun-acha* (Jidean, 1990).

Studies have shown that Acha (*D. exilis*) as a whole grain diet is beneficial for several health outcomes (Jones, 2009; previous workers (Jideani, 1999; Jideani and Jideani, 2011) and Balde *et al.*, 2008) reported that Acha (*D. exilis*) helps diabetic patients. Among other cereals, the health benefits of acha (*D. exilis*) consumed as products are now widely recognized (Slavin, 2010) and is considered to result from the presence of a range of bioactive components, including dietary fibre and photochemical (Shewry, 2009a), hence Acha (*D. exilis*) helps millions of people in the Sub-Sahara Africa.

The global food problems with severe impact on food scarcity in the world has been as a result of various factors such as rising prices of food, declining output, civil unrest, lost of agricultural land due to drought, flood, storms and erosion resulting from climate change, very low funding of agricultural research and development, increasing world population and lack of appreciation of traditional indigenous food (Mwebaza, 2008, Clarke, 2009). On the contrary, there is enormous potential growth in the Sub-Sahara Africa as well as abundant labour and favourable climate condition and some promising advances in the post harvest transformation of the crop to ease the drudgery involved. In order to address these threatening situations, it will require looking inwards to indigenous food, especially those being neglected due to influx of industrially manufactured foods all over the world.

It is in view of this understanding, perhaps the good nutritional values and prospects of the indigenous food crops have to be exploited. This work focused on acha (*D. exilis*) one of the indigenous crops that could be exploited in an attempt to have healthier sufficient food grain for active healthy life by the growing population.

This study was aimed at evaluating the best sowing method and the optimum nitrogen fertilizer rate for Acha (*D. exilis*) production in the Southern Guinea Savanna Zone of Nigeria.

MATERIALS AND METHODS

The experiments were carried out during the wet season of 2015 and repeated in 2016 at the National Cereals Research Institute, Acha Sub-Station, Riyom (Lat. 9°c 37'E, Long. 8°c 40'N and 1,250m above sea level) in the Southern Guinea Savanna Zone of Nigeria. To determine the best sowing method and optimum nitrogen rate for Acha (*D. exilis*) production in the Southern Guinea Savannah of Nigeria. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The treatments consisted of two sowing methods (broadcasting and Drilling at 30cm inter-row spacing) and three nitrogen rates (0, 30 and 60kg N ha⁻¹). Plot size was 3.0m x 4.0m. All the required cultural practices were followed in all the plots throughout the growing period of the crop. Data on number of tillers, leaf area, spike length, straw weight and grain yield (kg ha⁻¹), were subjected to analysis of variance and Duncan Range Test (DMRT) was used to compare means at 5% level of significance.

RESULTS AND DISCUSSION

Number of tillers per plant: Sowing method and nitrogen rates had significant influence on number of tillers per plant (Table 1.). In both years of experimentation, significantly higher number of tillers was produced under drilling method of sowing and with the application of 60kg N ha⁻¹ and the lowest number of tillers was recorded under broadcasting method and at when nitrogen fertilizer was not applied. This could be attributed to high concentration of available nutrients and other growth factors that facilitated the vegetative growth of the crop. This result in line with Dachi (2014), who obtained higher growth and yield parameters of Acha (*D. exilis*) under drilling method of sowing than broadcasting method. Similarly, Umed *et al.*, (2009) reported that sowing methods exhibit significant variations in respect of all growth and yield parameter of wheat (*Triticum aestivum* L.).

It was observed that the application of 60kg N ha⁻¹ produced significantly higher number of tillers and the lowest number of tillers was recorded at when no nitrogen fertilizer was applied. The increase in number of tillers at 60kg N ha⁻¹ might be due to high concentration of nutrients that facilitated the production of more tillers. The result obtained is in agreement with Ahmed *et al.*, (2015) who reported increase in number of tillers in millet with increase in nitrogen fertilizer rate.

Table 1: Effect of Sowing methods and Nitrogen rates on Number of tillers

Treatment	2015	2016
Sowing Method		
Broadcasting	26.56b	16.86b
Drilling	61.59a	18.70a
SE	0.964	0.189
Nitrogen rates(kgha ⁻¹)		
0	28.57	15.29c
30	28.50	17.82b
60	30.16	20.21a
SE	1.506	0.284

Means in a column of a set of treatments followed by same letter (s) are not significantly different at (P < 0.05) level of probability using DMRT.

Leaf Area (cm²): Sowing method and the application of nitrogen fertilizer indicated significant influence on leaf area per plant in 2015 and 2016 respectively (Table 2). Significantly high leaf are per plant was obtained under drilling method of sowing and the j[lowest leaf are per plant was recorded with the application of 60kg Nha⁻¹ and the lowest leaf area per plant was produced at when nitrogen fertilizer was not applied.

This can be due to high concentration of available nutrients that resulted in increase in the vegetative growth of the crop and hence wider leaves. This result corroborated with Ayuba *et al.*, (2003) who reported that nitrogen fertilizer is associated with greater number of leaves, leaf area, plant height number of tillers and grain yield.

Table 2: Effects of Sowing Methods and Nitrogen rates on Leaf Area (cm²)

Treatment	2015	2016
Sowing Method		
Broadcasting	4.49b	4.83
Drilling	6.08a	4.80
SE	0.114	0.120
Nitrogen rate(kgha ⁻¹)		
0	5.23	4.87b
30	5.66	4.57b
60	5.65	5.01a
SE	0.194	0.142

Means in a column of a set of treatments followed by same letter (s) are not significantly different at (P < 0.05) level of probability using DMRT.

Spike Length (cm): The result of spike length indicated that sowing and nitrogen application had significant effect on spike length (Table 3). Significantly longer spike length was recorded under drilling method of sowing in 2016 and the lowest spike length under broadcasting method in the same year. This could be due to intra and inter-specific competition for available growth factors among the plant. Similar result has been discussed and reported by Olorunkooba (2011). While nitrogen fertilizer applied at 30kgNha⁻¹ gave statistically higher spike length than the remaining N rates also in the same year. The increase in spike length might be due to more available nutrients led to meristematic growth of the crop that culminated into the production of more vegetative parts of the crop. The result obtained is in line with Violeta *et al.*, (2015) who reported longer spike length at higher N rates in wheat (*Triticum aestivum* L.).

Table 3: Effects of Sowing methods and Nitrogen rates on Spike length (cm)

Treatment	2015	2016
Sowing Methods		
Broadcasting	12.80	12.46b
Drilling	12.81	13.07a
SE	0.135	0.159
Nitrogen rates(kgha ⁻¹)		
0	12.91	12.49b
30	12.78	12.70ab
60	12.72	13.12a
SE	0.192	0.166

Means in a column of a set of treatments followed by same letter (s) are not significantly different at (P < 0.05) level of probability using DMRT.

Straw weight (Kg ha⁻¹): The effect of sowing method and nitrogen application exerted significant effect on straw weight in 2016 (Table 4). The maximum straw yield was recorded under drilling method of sowing and the minimum straw weight under broadcasting method. While nitrogen applied at 60kg N ha⁻¹, produced significantly higher straw weight but was not statistically different from the straw weight obtained when 30Kg N ha⁻¹ was applied. This could be as a result of high concentration of available nutrients, high plant density and the availability of other growth factor that led to the production of high plant biomass of the crop. This finding is in line with Pablo *et al.*, (2003) who reported increase biomass production in acha (*D. exilis*) with the use of chemical and goat fertilizers.

Table 4: Effects of Sowing Methods and Nitrogen rates on straw weight (kg ha^{-1})

Treatment	2015	2016
Sowing Methods		
Broadcasting	939.50	661.32b
Drilling	1,114.80	784.61a
SE	77.153	34.723
Nitrogen rates(kg ha^{-1})		
0	907.41	29.94b
30	1,101.90	784.61ab
60	1,072.20	821.91a
SE	115.088	51.927

Means in a column of a set of treatments followed by same letter (s) are not significantly different at ($P < 0.05$) level of probability using DMRT.

Grain yield (Kg ha^{-1}): Sowing method and nitrogen application showed significant influence on grain yield (Table 5). The maximum yield of 403.89 and 698.21kg ha^{-1} were recorded under drilling method of sowing and at 30Kg ha^{-1} respectively in both years of studies. While the minimum grain yield of 280.16 and 441.22kg ha^{-1} was obtained under broadcasting method of sowing and at when nitrogen was not applied in both years of experimentation.

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CONCLUSION

This study revealed that proper sowing method and appropriate N rate increases plant vitality and yield. It also enhances nutrient availability, better sunlight penetration for photosynthesis, better soil environment for nutrient uptake and water use – efficiency which is necessary for crop growth and yield.

Table 5: Effects of Sowing Methods and Nitrogen rates on grain yield (kg ha^{-1})

Treatment	2015	2016
Sowing Method		
Broadcasting	531.12b	280.16b
Drilling	623.91a	403.89a
SE	13.253	10.550
Nitrogen rate(kg ha^{-1})		
0	164.62c	441.22c
30	406.54a	698.21a
60	301.93b	591.67b
SE	17.587	23.109

Means in a column of a set of treatments followed by same letter (s) are not significantly different at ($P < 0.05$) level of probability using DMRT.

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GROWTH AND YIELD RESPONSES OF SOYA BEAN (*Glycine max L.*) TO VARYING SPACING IN JALINGO, TARABA STATE.

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ABSTRACT

A field experiment was carried out to study the effects of plant spacing on the growth and yield of soybeans (*Glycine max L.*), variety TGX 448-2E during 2016 cropping season at the Research farm of the Taraba State University, Jalingo. The experiment was laid out in a Randomized Complete Block Design (RCBD) having nine treatments replicated three times. Treatments included 5x30cm (T1), 5x45cm (T2), 5x60cm (T3), 10x30cm (T4), 10x45cm (T5), 10x60cm (T6), 15x30cm (T7), 15x45cm (T8) and 15x60cm (T9). Parameters monitored were plant height, number of leaves plant⁻¹, number of days to 50% flowering, number of flowers plant⁻¹, number of pods plant⁻¹, number of seeds pod⁻¹, number of seeds per plant⁻¹ and total grain yield plot⁻¹. Results of Analysis of Variance (ANOVA) of data collected revealed that plant height varied significantly ($p < 0.05$) with tallest plants (41.5cm) obtained with 5x30cm spacing and lowest with 10x45cm spacing. Number of leaves plant⁻¹ was highest (19.4) with 15x60cm and lowest with 5x30cm spacings accordingly. Number of seeds pod⁻¹ was similar in all inductive spacings. Number of seeds plant⁻¹ varied significantly ($p < 0.05$) between the treatments with highest number of seeds obtained from the 15x30cm spacing. Total seed weight plot⁻¹ was significantly ($p < 0.05$) highest with 5x45cm and 15x60cm spacings. These results showed that the plant spacings 5x45cm and 15x60cm which gave the highest yield may be recommended for the location for best yields.

Keywords: *Soybean, Plant spacing, growth, yield, Jalingo.*