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Research Article

Effects of Sowing Methods, Nitrogen and Seed Rates on Straw weight and Grain Yield of Acha *(Digitaria exilis Kippis* Stapf) at Naraguta Village, Jos, Plateau State

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Abstract

The Study was Carried out at the Experimental Research Field of the Department of Crop Production, Naraguta Village, University of Jos, Plateau State during 2023 and 2024 cropping seasons to determine the appropriate sowing method, nitrogen and seed rates to increase the production and productivity of Acha (D. exilis and D. iburua) straw and grain yield for livestock and human use. The experimental design was a split- plot with three replications Nitrogen and seed rates were assigned to the main plot and sowing methods in the sub-plots. The treatments consisted of two sowing methods (broadcasting and drilling), three Nitrogen rates (0, 30 and 60 kg Nha^{-1}) and three seed rates (10, 20 and 30kg ha^{-1}). Each treatment was accommodated in a plot size of 4.0 m x 5. 0 m and alleyways of 0.5m and 1.0m were maintained between plots and replications respectively. The seeds were sown by broadcasting and drilling at 50cm inter- row spacing. The parameters measured were number of tillers, plant height, straw weights and grain yields. The results indicated that treatments had significant ($P < 0.05$) effect on all the parameters measured (number tillers, straw and grain yields) except plant height. Based on the results of the study, drilling method of sowing, nitrogen and seed rates at 30kgha^{-1} and 60kg Nha^{-1} were optimum for straw production. While drilling method, nitrogen at 30kg Nha^{-1} and seeding rate also at 30kg ha^{-1} produced the highest grain yield over the remaining treatments.

Keywords: *Acha, broadcasting, drilling, methods, nitrogen, rates and Seeds*

Introduction

Acha (D. exilis and D. iburua) *fonio* are two cultivated species of the Digitaria family being referred to as small millets in the genus *Digitaria* that are important staple crops in the West African and the Island of the Dominican Republic in South America. Its cultivation dates back to 7,000 years (Cruz, 2004). It is a low input demanding crops that tolerates a wide range of soil types and can produce appreciable yields on marginal lands. However, due to decline and neglect in its production due to in the region as a result poor yield, inappropriate sowing methods, seed rate and poor soil fertility. Drilling method of sowing has negative effects on weed and positive effects on crop biomass and yield. Seed rate on the other hand, reduces the area occupies by weeds and lessens competition for light and other nutrients are improved in favour of the crop (Robert et al., 2004). Appropriate nitrogen application increases number of tillers, plant height, effective and non-effective tillers, flag leaf length, grain filling,

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filled grains, protein content and 1000 grain weight (Babul *et al.,* 2020). The small seed size (0.4 – 05mm of Acha (*D. exilis* and *D. iburua*) made its production tedious coupled with lack of its mechanization that used to be non- existent. Hungry rice as it is referred in some literatures is being coined by the Europeans (Kwon – Ndung and Musari, 1999, Ibrahim, 2001, Anon., 2003). However, the crop has been discovered, reconsidered and improved as a cultivated species (Ibrahim 2001, Morales – Payan *et al.,* 2002).

Acha or fonio is the most nutritious cereal grain that contains crude proteins, leucine, methionine and cycsteine that are deficient in major cereals such as rice (Oryza *sativa L.*), maize (*Zea mays L.*) and sorghum (*sorghum bicolor L.* (Temple and Bassa, 1991). The diets from Acha or fonio are being recommended for the diabetics due to its low glycemic index. The crop has long shelf life of up to 50 years and is still eatable. On the field, it is tolerant to pests and diseases. While in storage, it is hardly attacked by weevils and other storage insects due to its size and tight seed cords that prevents insects from borrowing into the seeds. The straws of the crop are being used for feeding ruminant animals like cattle, goats, horses, donkeys sheep and goats. Also, in the production of local potash, cooking, thatching of houses, mixed with mud to mould blocks, as part of dowry for marriage, the seeds and bran for feeding monogastric animals such as pigs, dogs, poultry. The good amounts of proteins, phosphorus, potassium and trace minerals (Cu, Fe, Mn and Zn) are reliable minerals for formulating poultry and pig feed to meet the nutrient specification of such feed. The study was aimed at determining the appropriate sowing method, optimum nitrogen and seed rates to increase the production and productivity of straw and grain yields of Acha for livestock and human use respectively.

Materials and Methods

The experiments were carried out in 2023 and 2024 cropping seasons at the Research field of the Department of Crop Production, Naraguta Village, University of Jos. Six composite soil samples were taken using a soil anger of 15 cm diameter at 0- 30 cm depth on the experimental plot. The soil samples were bulked, air- dried, ground and a representative sample was taken and analyzed at the laboratory of the Federal College of Forestry, Jos, Plateau State for routine physical and chemical properties of the soil of the site. The experiment was laid in a split – plot design with three replications, nitrogen and seed rate were assigned in the main plots and sowing methods in the sub-plots with 0.5m and 1.0m alleyways between plots and replications respectively.

The treatments were made up of two sowing methods (broadcasting and drilling (at 50 cm inter-row spacing), three Nitrogen rates (0, 30 and 60kgNha^{-1}) and three seeding rates (10, 20 and 30kgha^{-1}) respectively. The land was cleaned manually, ploughed and harrowed before sowing. The plot size was 4.0m x 5.0. Seeds were broadcast and drilled (at 50cm inter- row spacing) in each plot according to treatments.

Fertilizer treatments were applied in two split doses at 4 weeks and 8 weeks after sowing (WAS) respectively. Weed management was by manual hand pulling of weeds at 4 and 8 weeks after sowing for both sowing methods..

Data collection begun at 8 (WAS) and later 12 weeks after sowing (WAS). Five plants were selected and tagged with a masking tape in each plot to determine all the parameters except for straw and grains yields. For number of tillers, the tillers of five tagged plants were counted at 8 weeks after sowing (WAS) and the sum was computed and divided by the number of plants tagged) to give the number of tillers per plant. Also, for plant height, the heights of the five tagged plants in each plot were measured from grand level to the tip of the plant using a meter rule at 12 (WAS). Straw weight, the straws from each plot were weight after threshing and expressed in kilogram per hectare (kgha^{-1}) per treatment. While the grain yield was obtained by weighing the yields obtained from each plot according to treatments and expressed in kgha^{-1} per treatment. The data collected were subjected to analysis of variance (ANOVA) using CropStat, version 7.2 and means were separated by manual computation of Duncan Multiple Range Test.

Results and Discussion

The effect of sowing methods, nitrogen and seed rates on number of tillers (at 8 WAS), plant

height, straw weight and grain yield at harvest (12 WAS) are presented in Table 1. Sowing methods had significant effect on number of tillers and plant heights. More tillers and taller plants were produced under drilling method sowing than broadcasting method all in 2023 and the lowest number of tillers and plant heights were obtained under broadcasting methods. This could be due to high concentration of available nutrient under drilling method that resulted in the production of more tillers and taller plants. It has been reported that all plant growth and yield parameters were significantly improved under drilling method of sowing and that sowing methods exhibit significant variations in respect of all growth and yield parameters studied (Illias *et al.*,2006). While sowing methods showed no significant effect on number of tillers and plant height in 2024. While nitrogen at 60kg Nha^{-1} and seed rate of 30$kgha^{-1}$ gave significantly higher ($P < 0.05$ number of tillers per plant in the second year but non-significant in the first year. when nitrogen was not applied and at 10kg ha^{-1} seed rate.

The increase in number of tillers and plant height could be attributed to the availability of nutrients and maximal use of solar radiation that resulted in increased photosynthesis (Dachi, 2014) and also the finding is in line with Ausiku *et al.*, (2020) who reported increase in number of tillers with increase in nitrogen fertilizer rates but it was observed that nitrogen and seed rates had no significant influence on plant height in both years of experimentation. Sowing methods showed significant effects on straw weight where the highest was recorded under the drilling method of sowing than u nder broadcasting method. The superiority of drilling method of sowing over broadcasting method is that in drilling method of sowing, seeds are distributed uniformly, leading to higher germination, uniform stand, seeds are dropped in furrows and are covered with soil that increases plant vigor and couple with high concentration of available nutrient. This finding is in line with Dachi (2014) who reported higher straw weight due to high plant densities and high concentration of available nutrients, proper penetration of light and adequate rainfall. Nitrogen and seed rates at 60kg Nha^{-1} and 30kg ha^{-1} produced higher straw weight ($kgha^{-1}$) in both years and the lowest at no application of nitrogen and 10$kgha^{-1}$ seed rate and also, similar result with urea fertilizer. It was observed that sowing methods had no significant effect on grain yield in 2023, except in 2024 where drilling method of sowing produced significantly higher grain yield. This could be due to the fact seed drilling method of sowing provides better seed –to-soil contact than broadcasting method. The high concentration of nutrients under drilling method culminated into continuous growth and development of the crop that increased yield. Nitrogen and seed rates at 30kg Nha^{-1} and 30kgha-1 produced the highest grain over the remaining treatments indicating that it is optimum nitrogen and seed rates that can be used in the production of the crop and the lowest at no nitrogen application and 10$kgha^{-1}$ seed rate. This finding is in agreement with Dachi and Kwon-Ndung (2007) who reported increase in straw in weight and grain yield of Acha with the application of NPK 15: 15: 15 fertilizer.

Conclusion

Amongst the two sowing methods used, drilling method produced significantly higher number of tillers, straw weight and grain yield over broadcasting method in the studies. The application of 30 and 60 $kgNha^{-1}$ gave higher number of tillers, straw weight and grain yield. While the use of 30$kgha^{-1}$ seed rate produced significantly more tillers, straw weight and grain yield respectively

References

Anonymous (2003). Little known grains; Pseudocereals. Primal seeds available at htt//primalseeds.nologic.org./grains.htm, pp. 46- 49.

Ausiku, P., Ausiku, J., Annandale, G., Martin Steyn, J., and Andrew, J.S. (2020). Improving Pearl Millet (Pennisetum glaucum) Production through adaptive management of water and nigrogen. water – 12: 00422.

Babul, A., Nazmun, N., Sohel, R., Niloy, H., and Abu, R. (2020). Nitrogen effect on the growth and yield contributing characters of Binadhun-19. Asian Journal of Crop Science and Plant nutrition, Vol 04:02: 157 -164

Crus, J. F. (2004). Fonio; a small grain with potentials. Magazine on low external input

and sustainable Agriculture, March, 2004, 20 (1): 16- 17.

Dachi S.N. (2013). Effects of nitrogen levels, seed rates and planting methods on weed infestation, growth and yield of Namuruk Acha (Digitaria exilis kipp stapf Jaccession in Riyom, Nigeria, Unpulbished Ph.d. Thesis submitted to the Department of Agronomy Ahmadu Bello University Zaria. Pp. 114- 115.

Dachi, S. N. and Kwon-Ndung, E. H. (2007).Response of Acha (Digitaria exilis Kippis Stapf) to NPk fertilizer at Badeggi, Southern Guinea Savannah of Nigeria. Production Agriculture and Technology (PAT). An International Journal of Agricultural Research, PAT, 2007, 23: 131 – 136, ISSN-0794 – 5213.

Ibrahim, A. (2001). Hungry Rice (Acha). A neglected Cereal Crop, NAQAS Newsletters, Vol. 1 No. 4: pp. 4- 5.

Illias, H., Khairul, C. I., Meiner, C.A. and Sayeedul., I. (2006). Effect of Planting Method and Nitrogen Level on the Yield attributes of Wheat Journal of Bio-Science. 14: 127 – 130.

Kwon – Ndung, E.H. and Misari, S.M. (1999). Overview of Research and Development of Fonio Digitaria exilis Kippis Stapf) and prospect for genetic improvement in Nigeria. In Genetic and Food Security in Nigeria. GSN Publ. Nigeria. Pp. 77- 76.

Morales – Payan, J. P., Orite, J.R. Jr., Cicero, J. and Taveras, F. (2002). Digitaria exilis as a Crop in the Dominican Republic. supplement to: Trends in New Crops and new Uses. J. Janick and A. Whikpkey (eds) ASH Press, Alexandria, V. A. Robert, N. S., and

Temple, V. J. and Bassa, J. D. (1991). Proximate Chemical Composition of Acha (Digitaria exilis grain. J. Sc. Food Agr., 56:561 -564.

Table 1: Effect of sowing Methods, Nitrogen and Seeding rates on growth Parameters and Yield of Acha or fonio (*D. exilis and D.iburua)* in 2023 and2024.

Treatment	Number of tillers		Plant eight(cm)		Straw weight ($Kgha^{-1}$)		Grain Yield ($Kgha^{-1}$)	
	2023	2024	2023	2024	2023	2024	2023	2024
Sowing Methods								
Broadcasting	10.1b	9.1	79.7b	73.5	403.7	640.7	939.5	661.3
Drilling	13.5a	9.3	85.2a	75.6	492.1	746.9a	1,114.80	784.61a
S+	0.2	0.2	1.3	0.8	39.7	61.8	77.2	34.7
Nitrogen rates ($KgNha^{-1}$)								
0	11.5	15.3c	68.4	80.8	344.4c	291.9	164.6c	269.1
30	11.3	17.8b	66.2	82.8	477.8ab	717.0a	406.3a	490.1a
60	11.4	20.2a	65.4	83.8	522.2a	821.9a	301.1b	371.3b
S+	0.7	0.3	2.3	1.9	49.5	51.5	17.6	17.3
Seeding rates ($Kgha^{-1}$)								
10	11.5	17.1c	65.9	84.4	450.0	629.9	280.0	274.3
20	11.2	17.7b	66.1	81.9	427.0	719.3b	278.4b	371.2b
30	11.5	18.6a	68.1	81.1	466.6	762.7a	313.7a	385. 6a
S+	0.7	0.3	2.3	1.9	49.5	51.9	17.6	17.3

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