



Influence of Crop Establishment Methods and Weeding Regimes on Yield and Some Yield Components of Fonio (*Digitaria exilis* Kippis Stapf) at Badeggi, Nigeria

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ABSTRACT

An experiment on the influence of crop establishment methods and weeding regimes on the yield and yield components of fonio (*D. exilis*) was carried out during the cropping season of 2017 and 2018 at the research field of the National Cereals Research Institute, Badeggi (Lat. 9° 45' N and Long 6° 97' E). The treatments consisted of two crop establishment methods (broadcasting and drilling at 30cm inter-row spacing and four weeding regimes (weeding once (w_1), weeding twice (w_2), weeding thrice (w_3) and a weedy check (w_0)). A split-plot design was used such that crop establishment methods were allocated to the main plots and weeding regimes were assigned to the sub-plots. The experiment was replicated four times. The land was prepared manually but ensured to be leveled properly. The plot size was 3.0m x 4.0m leaving a distance of 1.0m between replications and 0.5m between plots as alleyways. Fonio (Vakahal (Local) accession was used. Fertilizer (NPK 15:15:15) was used to supply 30kg N ha⁻¹, 30kg P₂O₅gha⁻¹ and 30kg K₂O ha⁻¹ basal. Weed management was by manual hand pulling of weeds 4 weeks after sowing (WAS). Data taken include number of tillers, plant height, length of spikes and grain yield respectively. Results showed that drilling method of sowing produced more tillers, taller plants and higher grain yield in both years compared to broadcasting method. Crop establishment methods had no significant influence on length of spikes in both years of experimentation. Among the weeding regime treatments, weeding thrice had significantly higher tillers, plant height and grain yield over the other treatments in both years. From this study, the best method of sowing fonio (*D. exilis*) is by drilling and weeding thrice.

Keywords: *Digitaria exilis*, Crop establishment, Fonio, Sowing methods, Weeding regime.

INTRODUCTION

At this time of climate change and its influence on Food Security and Insecurity, many people in the dry environments of Nigeria and Africa will depend on cereals that

are grown in drought, water stressed and marginal environments such as millet, sorghum and finger-millet, among other dry land crops (Consultative Group 2002).

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The poor rural farmers whose major occupation is farming require crops of low input demand and can also give appreciable and stable yields on their poor environments. Fonio (*D. exilis*) is an important candidate crop for food security in West Africa and is assuming greater importance in the context of changing climate and increasing demand for highly nutritious food with low cost of input (Animasaun et al., 2014). Fonio (*D. exilis*) has high potentials for fighting hunger in the Sub-Saharan Africa (Vietmeyer, et al., 1996). The crop is grown as human food and as forage (Aliero & Morakinyo, 2001) in the Savanna Zones of West Africa and also as a staple. The crop is traditional, well adapted to local conditions and possesses good nutritional and culinary properties (Cruz, 2014).

The tiny grain of fonio (*D. exilis*) can be used to make tuwo, couscous, porridge, malt drinks, as animal feeds due to its high methionine and cysteine content, in pharmaceutical industries as a binder in the production of Paracetamol (Musa et al., 2008), good for human health, recommended for people with diet challenges because of its low glycemic index. It is reported that dishes of fonio (*D. exilis*) show higher preference than those of rice, millet, maize, among growers (Cruz, 2014). The production of fonio (*D. exilis*) in Nigeria and elsewhere is faced with a number of problems such as weed control, seeding rate, establishment methods, small seed size, low yield and its post-harvest transformation (Ukwungwu et al., 2003), Dachi, et al., 2014). Fonio (*D. exilis*) has the potential of producing higher grain yield with good agronomic practices such as appropriate establishment method, seed rate and proper weed control. Few studies have been conducted as regards appropriate establishment method and weeding regime in fonio (*D. exilis*). The objective of this study was to obtain the best establishment method and weeding regime for growth yield and yield components of fonio (*D. exilis*).

MATERIALS AND METHODS

The experiment was conducted at the National Cereals Research Institute, Badeggi (Lat. 9°

45' N and Lon. 6° 07' E) during 2016 and 2017 cropping season. The soil of the site was sandy loam. The treatments consisted of two crop establishment methods (broadcasting and drilling at 30cm inter-row spacing) and four weeding regimes (weeding once (W_1), weeding twice (W_2), weeding thrice (W_3) and a weedy check (w_0)). The experimental design was a split-plot with four replications. Establishment methods were allocated to the main plots and weeding regimes to the sub-plot. Plot size was 3.0m x 4.0m. Fonio (*D. exilis*) Vakahal accession (local) was sown by broadcasting and drilling into each of the plots. Weed weeding regime was carried out according to treatments by manual hand pulling of weeds. Basal fertilizer application of 30kg N ha⁻¹, 30kg P₂O₅ha⁻¹ and 30kg K₂Oha⁻¹ using NPK 15:15:15 fertilizer, source. Data were taken on number of tillers, plant height, leaf area, length of spikes and grain yield. The data were subjected to analysis of variance and treatment effects were compared using least significant difference at 0.5 percent level of probability.

RESULTS AND DISCUSSION

The influences of crop establishment methods and weeding regimes had significant effects on number of tillers and plant height in both years of studies. Significantly higher number of tillers, and taller plants were produced in drilling method of sowing and in weed free (w_3) than broadcasting method and no weeding (w_0). The increase in these parameters recorded in drilling method of sowing and weed free (w_3) conditions than in broadcasting method and no weeding conditions (w_0) could be attributed to better micro environment in the drilling method of sowing and weed free conditions compared to those in broadcasting method and no weeding (w_0) conditions. Also, the better crop stand establishment in drilling method of sowing and weed free (w_0) conditions might have been responsible for the increase in number of tillers and plant height due to less competition for growth factors (Tables 1 and 2). This finding is in line with (Dachi et al., 2014) and Mondal et al., (2013). who reported similar results in drilling method

of sowing than in broadcasting in acha (*D. exilis*) and weed free (w_0) in Aus rice respectively.

In both years, crop establishment methods had no significant influence on length of spikes per plant. This might be due to genetic factor of the crop (Table 3). Crop establishment methods and weeding regimes had significant influence on grain yield in both years. The highest grain yields were found in drilling method of sowing and weed free (W_3), followed by weeding twice (W_2) in both years and the lowest grain yields were recorded from

broadcasting method of sowing and no weeding (W_0) condition (Table 4). This could be attributed to the fact that in drilling method of sowing and weed free (W_3) conditions, plants got higher nutrients, light, water and less competition from weeds which resulted in higher grain yields. The obtained result is in close agreement with (Dachi et al., 2014) and Mondel et al.,(2013) who reported highest grain yields in drilling method of sowing in acha (*D. exilis*) and weed free (W_3) condition in AUS rice respectively (Table 4).

Table 1: Influence of crop establishment methods and weeding regimes on number of tillers per plant

Crop establishment methods	2017	2018
Broadcasting	10.95	20.32
Drilling	13.03	22.26
Lsd(0.05)	1.64	1.63
Weeding regimes		
w_0	18.85	8.83
w_1	22.87	10.47
w_2	25.17	12.63
w_3	28.27	14.03
Lsd(0.05)	2.31	2.22
Interaction	ns	Ns
Cv (%)	17.8	8.4

W_0 = No weeding, W_1 = Weeding once, W_2 = Weeding twice, W_3 Weeding thrice

Table 2: Influence of crop establishment methods and weeding regimes on plant height

Crop establishment methods	2017	2018
Broadcasting	67.72	81.67
Drilling	79.16	89.28
Lsd (0.05)	5.16	3.13
Weeding regimes		
W_0	70.89	43.77
W_1	78.00	51.98
W_2	83.00	60.70
W_3	86.99	71.31
Lsd(0.05)	4.42	7.29
Interaction	ns	ns
Cv (%)	9.1	4.4

W_0 = No weeding, W_1 = Weeding once, W_2 = Weeding twice, W_3 Weeding thrice

Table 3: Influence of Crop Establishment methods and weeding regimes on number of spikes per plant

Crop establishment methods	2017	2018
Broadcasting	11.47	12.65
Drilling	11.68	12.61
Lsd (0.05)	Ns	Ns
Weeding regimes		
W ₀	12.19	11.49
W ₁	12.66	11.73
W ₂	12.76	11.62
W ₃	12.92	12.05
Lsd(0.05)	ns	Ns
Interaction	ns	Ns
Cv (%)	4.3	4.7

W₀ = No weeding, W₁ = Weeding once, W₂ = Weeding twice, W₃ Weeding thrice

Table 4: Influence of crop establishment methods and weeding regimes on grain yield (kg ha⁻¹)

Crop establishment methods	2017	2018
Broadcasting	468.75	348.65
Drilling	611.67	487.92
Lsd (0.05)	133.12	91.82
Weeding regimes		
W ₀	255.00	187.50
W ₁	358.33	327.78
W ₂	399.17	436.95
W ₃	560.83	666.61
Lsd(0.05)	129.86	188.26
Interaction	ns	Ns
Cv (%)	29.2	28.5

W₀ = No weeding, W₁ = Weeding once, W₂ = Weeding twice, W₃ Weeding thrice

CONCLUSION

From the result of this study, it is concluded that drilling method of sowing and weeding thrice are best for fonio (*Acha*) (*D. exilis*) production at Badeggi, Nigeria.

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