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EFFECT OF THE FREQUENCY OF FOLIAR APPLICATION OF NUTRIENT ORGANIC PLUS FERTILIZER® ON Telfaiaria occidentalis (L) IN A DEGRADED ULTISOL OF HUMID RAINFOREST OF CROSS RIVER STATE, NIGERIA

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ABSTRACT
A field trial was conducted in 2016/2017 early cropping season at the Crop Research Farm of the University of Calabar to evaluate the productivity of Telfaiaria occidentalis (L) as affected by the frequency of foliar application of Nutrient Organic Plus Fertilizer® in a degraded Ultisol of a humid rainforest of Cross River State. The treatments consisted of times of application of Nutrient Organic Plus Fertilizer® (weekly, two weekly, three weekly and four weekly with control of zero application of the foliar nutrient). The treatments were in a randomized complete block design in five replications. Increasing frequency of foliar application of Nutrient Organic Plus Fertilizer® resulted in a significant ($p = 0.05$) increase in all the growth variables of Telfaiaria occidentalis in a humid rainforest of Calabar. A similar pattern was observed on the fresh and dry yield per hectare. These results could have suggested that frequent foliar application of this organic fertilizer could have made nutrient available to this crop to sustain its growth and performance in a humid rainforest of Calabar

1. Introduction

Agricultural productivity in the tropics is mainly under the traditional cropping systems (Rajack-Talley, 2015; AATF, 2018) which are highly dependent on the native soil fertility. However, soils of the humid tropics are fragile and manifest multiple productivity constraints including low nutrient and soil organic matter content, high nutrient immobility, low moisture and nutrient holding capacity, high acidity with aluminum toxicity and low biodiversity (Cardoso & Kuyper, 2006; Kostov, 2016). Such soils degrade rapidly and are often unproductive, making them unsuitable for long-term productivity especially in the low external inputs systems (AATF, 2018; FAO, 2018).

Low quality arable soils are a major contributory factor to low crop productivity which leads to hunger, poverty and malnutrition/diseases particularly in low income households in Africa including Nigeria (IFPRI, 2010). An estimated income of about US$42 billion has been reported lost in Africa through a reduction in crop productivity due to soil-related constraints (AATF, 2018).

The use of foliar organic fertilizers is gaining popularity in crop nutrient management. Foliar fertilization is highly efficient and is often used to address short-term nutrient needs of growing crops resulting in higher yields than soil-applied nutrients (O'Dell, 2004; Lovatt, 2013; Gardenerdy, 2018).

Foliar nutrients are absorbed almost immediately after application and require a repeated application for best results (Fernandez & Brown, 2013). But repeated foliar feeding is time-consuming and expensive and could become wasteful and ineffective if not properly timed. The need to determine the best application frequency for optimum productivity of *Telfaiaria occidentalis* in a humid environment was the objective of this trial.

2. Materials and Methods

Experimental Site

A field experiment was carried out in 2016 at the Teaching and Research Farm, Department of Crop Science, University of Calabar (Latitude 4^{o} 45'30'' and 5^{o} 08' 30'' N; Longitudes 8^{0} 11' 21'' and 8^{0} 27' 00''with altitude of 32 m above sea level). The area receives an average annual rainfall of 2500 mm bimodally distributed with the highest peak in July and the other in September. The area has nine months long raining season which commences from March/April and terminates in October/November. The mean maximum and minimum temperatures are 23 and 32 ^{0}C respectively, while the relative humidity ranges from 78 % in the dry season to 92 % in the rainy season (Akpan-Idiok, 2012).

Land Preparation

The land was cleared manually, fine tilled and seedbeds of 1.5 m x 3.5 m made with the aid of a spade. 1.0 m-wide alleyways separated adjacent plots arranged in three blocks each containing five unit plots of 0.5 m x 1.5 m (0.75 m^2) spaced 1.5 m apart. Tie bunds were constructed at the ends of plots and at intervals between the plots to control water flow from one plot to another and drainage basins/pits were also dug to intercept excess run-off water within the gross experimental area of 14.0 m x 17.5 m (24.5 m^2)

Before tilling, soil samples were collected inthegross plot using a soil augur at 30 cm depth. Samples were bulked together, dried under the shade and grinded to pass through a 2 mm-mesh. Sieved samples were used for routine laboratory analysis using standard procedures (IITA, 1982).

Treatments and Experimental design

The spray regimes were the treatments which were weekly, 2-weekly, 3-weekly, 4-weekly sprays and the zero spray as Control. The treatments were replicated three times and laid out in a randomized complete block design (RCBD).

Sowing of *Telfaiaria*

The crop seeds were sown on 27th July, 2016. Two healthy seeds sun-dried for one day were sown in holes 2 – 3 cm deep and spaced 0.5m x 0.5m, corresponding to 80,000 plants/ha.

Treatment Application

The fertilizer was mixed according to the manufacturer's manual in the ratio of 1:100. Spraying was done between the hours 9.00 am and 11.00 am each time. The fertilizer was applied using hand sprayer in such a way that plants were thoroughly wetted.

Weeding was done manually to maintain weed-free plots. The soil was gathered at the base of plants to cover the roots exposed by rain splash.

Data Collection and Analysis

Data on vine length, branches/plant, leaf area index (LAI) and leaf yield were recorded on the six plants in the net plot and analyzed using analysis of variance (ANOVA) statistical technique and significant means were compared using the Fisher Least Significant Difference (LSD) at 5 % probability level.

3. Results and Discussion

Pre-cropping soil samples at the experimental site had sandy-loam texture and moderate acidity (pH 6.8) with organic carbon (0.86 %), total nitrogen (0.07 %), potassium (0.01cmol/kg), calcium (3.8 cmol/kg), magnesium (2.8 cmol/kg), effective cation exchange capacity (3.25 cmol/kg) and phosphorous content of 32.12 mg/kg which were all below the critical levels except phosphorous, indicating low fertility status (Enwenzor *et al*. 1989).

There was a significant ($P < 0.05$) increase in all the growth variables with increasing frequency of foliar application Nutrient Organic Plus Fertilizer®. A similar pattern was observed on the fresh and dry leaf yield (Table 1). The growth and leaf yield performance of *Telfaiaria occidentalis* was enhanced by applying *Nutrient Organic Plus* Fertilizer®, indicating that the crop benefitted from the nutrient. However, the benefit obtained was more in plots sprayed weekly after which it declined in wider spraying regimes. The optimum vegetative growth and the corresponding best leaf yield obtained in weekly sprays indicates that foliar supply of plant nutrients could be more beneficial if applied more frequently rather than at wider intervals. This observation is in consonant with the report of Fernandez & Brown (2013) that frequent foliar feeding of 5 – 7 days intervals is highly efficient in promoting plant growth and development leading ultimately to higher yield. Similarly, Asumadu *et al* (2012) recorded higher maize yield in frequent foliar applications of one to weeks than in low frequency treatments. This again underscores the benefit of more frequent foliar nutrient application. A 7 – 14 – day cycles of foliar nutrient supply could be adopted to boost *Telfaiaria* growth and productivity in nutrient-poor soil in a humid rain forest of Calabar, Southeastern Nigeria.

Table 1*: Growth and leaf yield of Telfaiaria occidentalis as influenced by time of foliar application of Nutrient Organic Plus Fertilizer® in a humid rainforest of Calabar*

Application frequency	*Vine Length (cm)*		*Branches per plant*	*LAI*	*Leaf wt (t/ha)*
				Fresh	*Dry*
Control	115.2	8.2	8.4	70.2	8.3
Weekly	230.0	18.7	21.6	110.0	20.4
2-Weekly	210.8	18.6	18.8	108.3	20.2
3-Weekly	180.5	13.4	14.2	89.6	12.3
4-Weekly	135.0	10.3	8.2	84.8	12.2
LSD $_{(0.05)}$	15.8	4.2	3.8	18.0	3.5

LAI = Leaf area index; Wt. = Weight

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