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Effect of Irrigation Frequency On The Growth Of Selected Maize *(Zea Mays)* Varieties

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ABSTRACT: the effect of Irrigation frequencies on the growth of three varieties of maize (*Zea Mays*) was investigated. Three different maize varieties (SWAN-1-SR-Y, ART/98/SW4-OB, and ART/98/SW6-OB) were planted in 4 seeds per bucket and later thinned to two seeds after a week of planting at irrigation frequencies 10, 20, 30 and 40 days. Soil samples were air dried, sieved with 2mm sieve and packed into 36 perforated buckets. The data were subjected to statistical analysis and analyzed by a two-way ANOVA (using software package–*MINITAB*) to compare variations and establish if the treatments (water applied) and the maize varieties were significantly different. Results showed that there were significant differences in the four treatments of irrigation frequencies applied while there were no significant differences among the maize varieties at 0.05 levels of significance. It was also observed that daily irrigation has the highest values to be 7.00, 16.50, 22.50 and 27.00 on the stem length of the varieties, which indicates that it has significant effect on the growth of the Maize. The daily irrigation frequency also has significant effect on the leaf area with values of 56.02, 224.18, 313.03 and 388.33 while every other day irrigation frequency was observed to have effect on the stem girth with a noticeable value of 0.4-0.5. The twice a week irrigation frequency was found to have the lowest values in all the three varieties, which makes the effect not to be too much when compared with others. It was deduced that water requirement of plant at different stages of growth and development differ during emergence and vegetative stage. Thus, irrigation should be practised daily during plant emergence, establishment and vegetative stage, while every other day irrigation is recommended for optimum yield of maize crop.

Keywords: maize varieties, irrigation frequency, stem girth, stem length, leaf area.

INTRODUCTION

Irrigation can be described as the artificial application of water to soil for the purpose of agricultural production. It is primarily considered when there are suspected problems with rain-fed crop production. Rainfall may be unreliable in amount and duration of timing. For instance rainfall may vary from year to year, or the onset and cessation of the rains may be uncertain (Gevens, 2007). Meanwhile, there may be period of drought during the rainy season itself. Irrigation systems are considered because they solve the problem of food production and the materials needed or used for the practice are not as scarce as they appear to be. Effective irrigation will

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influence the entire growth and yield process from seedbed preparation, germination, root growth, nutrient utilization, and plant growth and re-growth, and yield and quality (AFF, 2010). Water is essential for irrigation purposes, but its indiscriminate use can lead not only to shortages, but also to the deterioration of crop yields and soils. It is hence vital to ensure that it is applied as effectively as possible in order to reach sustainability. Diouduis *et al.* (2007) reported that maize (*Zea mays*) is a crop cultivated worldwide with irrigation method which requires large quantities of water seasonally if it is to yield large crop. The requirement in irrigation water of maize oscillates from 500 to 800m^3/ha of water for the achievement of maximum seed production. Maize production was increased with a combination of deep tillage together with a good irrigation system.

Maize is one of the most important cereal crop grown principally during the raining season in Nigeria used for both human consumption and poultry feed. The local production of the crop is not sufficient to meet the continuous increase of consumption. Therefore attempts to increase maize production are of great importance which can only be achieved through appropriate irrigation methods (Robertson *et al*., 2003).

Lindsay (2001) had advocated sprinkler method of irrigation wide varieties of crops grown in Nigeria especially where there is relative abundance of water or present of sewage water. In the other hand, Toro (2010) has stated the advantages of drip method to include high water use efficiency, flexible fertilizer utilization, and limited weeds and diseases development. Furrow irrigation also known as gravity techniques is best suited to soils with moderate to low infiltration capacity; it is applied directly to the soil furrow. Deborah *et al*. (2003) compared three methods of irrigations under climatic conditions such as wind and concluded that drip and furrow irrigation methods are preferred to sprinkler. Humphreys (2002) while comparing the same irrigation methods under slope condition submitted that sprinkler and drip irrigation are preferred to furrow irrigation. Whether sprinkler, drip or furrow, a significant effect has been realized on the growth and yield of a crop when a system is properly designed (Franken *et al*., 2006).

Irrigation frequency is the number of days between irrigation periods without rainfall. Crop irrigation requirement is the portion of the water consumptive use of crop, which must be supplied by irrigation to ensure optimal crop growth and development. With the rising human population and resultant increase in daily demand for maize for various uses, it becomes imperative to intensity effort at all year round Maize Production in the country. Also, one of the problems of irrigation in Nigeria is the unavailability of sufficient water for meeting the ever-increasing population needs that will satisfy the irrigation requirement. There is thus the need to establish balance between the demand for water for both irrigation and household use. This work is therefore

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important because of the desirability of supplying appropriate quantities of water at regular interval or frequency to ensure maize production. Hence, the specific objective of this research is to determine the effects and optimum irrigation frequency on the growth and yield of selected varieties of Maize.

MATERIALS AND METHODS

Materials used for this research include: buckets, loamy soil, 2mm sieve, weighing balance, volumetric cylinder and 3 maize varieties (SWAN 1-SR-Y, ART/98/SW4-OB, ART/98/SW6-OB)

Methods

The experiment was conducted in the Greenhouse of Institute of Agricultural Research and Training (IAR&T) Moor Plantation, Ibadan using three different Maize varieties obtained from IAR&T seed store. The maize varieties were planted in 4 seeds per bucket and were later thinned to two seeds at a week after planting. The three varieties of Maize used were SWAN 1-SR-Y, ART/98/SW4-OB, and ART/98/SW6-OB. The soil samples for the experiment were collected within the experimental field of Federal College of Animal Health Production Technology, Moor Plantation, Ibadan. The samples were air dried, sieved with 2mm sieve and packed into 36 perforated buckets. The buckets were perforated to prevent accumulation of water at the bottom and in order to allow air to enter the buckets as a condition for germination of seeds, physical and chemical analyses were carried out on the soil. 5kg of the soil was put in each of the 36 buckets.

The experiment was subjected to four different irrigation frequency systems (daily, twice a week, thrice a week and every other day). 50ml of water was used at the 10 days, at 20 and 30 days after planting, 100ml and 150ml were used respectively. It was later increased to 250ml at 40 days after planting and this was maintained till the harvesting time. The optimum yield of the maize plant was determined, the data sets on plant growth collected at 10 days intervals after planting are: Stem Length (cm), Stem Girth (cm) and Leaf Area (cm^2).

Experimental Layout

The experimental layout adopted was Randomized Completely Block Design (RCBD) replicated thrice as presented in Table 1:

Table 1: Experimental Layout

	V_1	V_2	V_3
T_1	R_1 R_2 R_3	R_1 R_2 R_3	R_1 R_2 R_3
T_2	R_1 R_2 R_3	R_1 R_2 R_3	R_1 R_2 R_3
T_3	R_1 R_2 R_3	R_1 R_2 R_3	R_1 R_2 R_3
T_4	R_1 R_2 R_3	R_1 R_2 R_3	R_1 R_2 R_3

Where: V_1 is SWAN 1-SR-Y, V_2 is ART/98/SW4-OB, V_3 is ART/98/SW6-OB, T_1 is Daily Water Application, T_2 is Twice in a week Water Application, T_3 is Thrice in a week Water Application, T_4 is Every other day Water Application, $R_{1,2,3 \text{ and } 4}$ are replicates 1,2, 3 and 4 respectively.

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Data Analysis

Data obtained were subjected to statistical analysis using a Two-Way Analysis of Variance (2-way ANOVA) to compare variations and establish if the treatments (water applied) and the maize varieties were significantly different.

RESULTS AND DISCUSSION

The results obtained from the study on effect of irrigation frequency on growth of maize is presented below.

i. **Soil Analysis:** The experimental site was slightly acidic and sandy loam in texture (Table 2)

Table 2: Pre-planting Soil Analysis of Experimental Site

Soil Property	Value
Ph	6.7
Organic Carbon (g kg^{-1})	0.68
Organic Matter (g kg^{-1})	1.17
Calcium (cmol kg^{-1})	1.36
Magnesium (cmol kg^{-1})	1.92
Available Phosphorus (mg kg^{-1})	1.35
Total Nitrogen (%)	0.28
Potassium (cmol kg-1)	0.14
Sodium (cmol kg-1)	0.36
ECEC (cmol kg-1)	3.75
Sand (%)	780
Silt (%)	140
Clay (%)	80
Textural Class	Sandy loam

ii. **Effect of Irrigation Frequency on Stem Length:** There are significant differences in the four treatments (water) applied since $F_{Tr} > F_{0.05}$ for 1o, 20, 30 and 40 days irrigation frequencies while there are no significant differences among the three varieties of maize at 10, 20, 30 and 40 days since $F_{Bl} < F_{0.05}$. Figure 1 shows that the irrigation frequency has significant effect on the stem length of the Maize Varieties. SWAN 1-SR-Y had the highest value of 7.00 for stem length after 10 days at every other day irrigation frequency while the least value of 3.00 was obtained for stem length at 10 days at twice a week irrigation frequency. SWAN 1-SR-Y had the highest value of 16.50 for stem length at 20days at daily irrigation frequency while the least value of 10.00 occurred at twice a week irrigation frequency with the variety ART/98/SW6-OB. SWAN 1-SR-Y had the highest value of 22.50 for the stem length after 30 days with daily irrigation frequency and the least value of 12.05 at twice a week irrigation frequency with varieties ART/98/SW4-OB and ART/98/SW6-OB. SWAN 1-SR-Y had the highest value of 27.00 for the stem length after 40 days with the daily irrigation frequency while the lowest value was obtained to be 17.00 at variety ART/98/SW4-OB with twice a week irrigation frequency.

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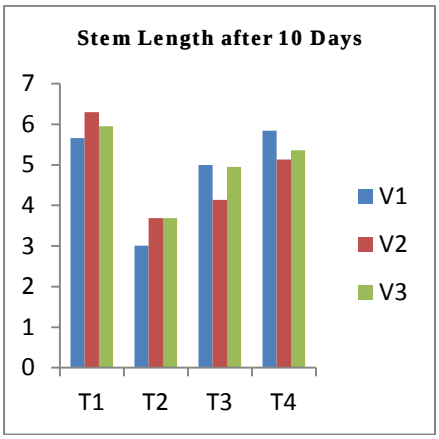

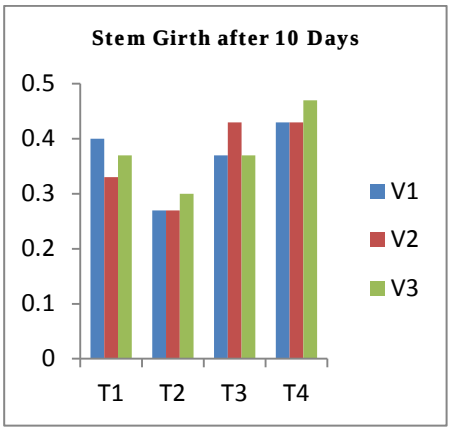

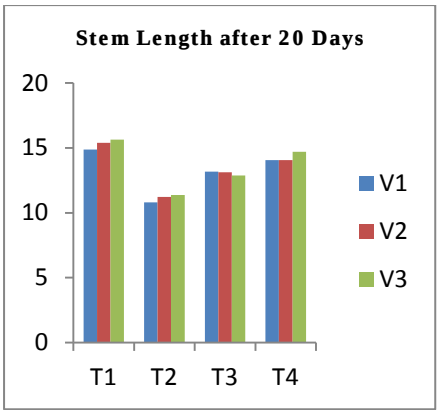

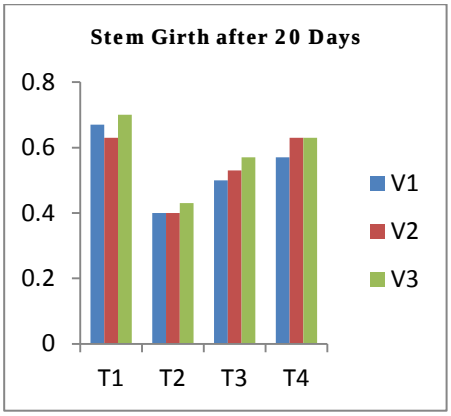

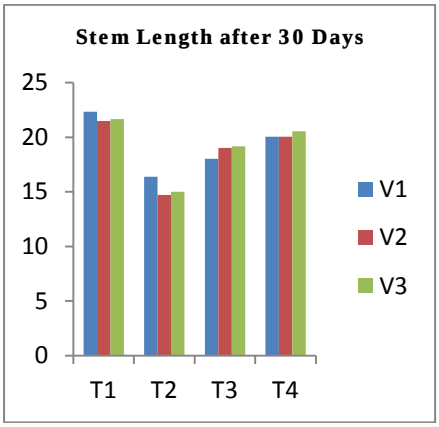

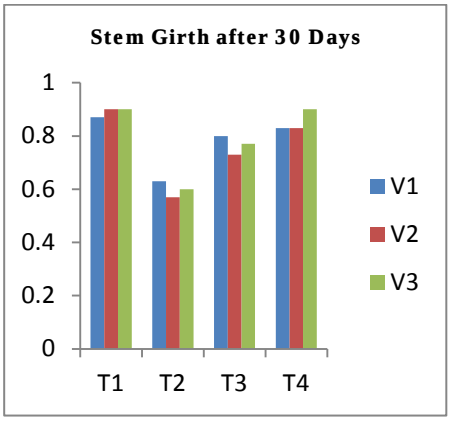

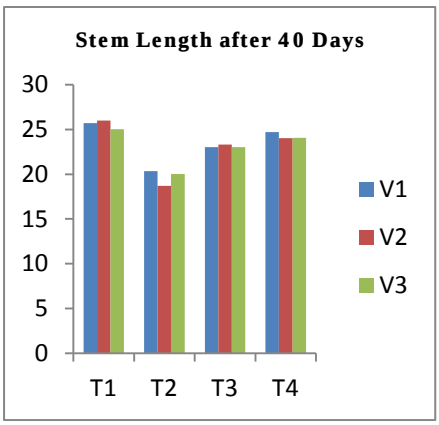

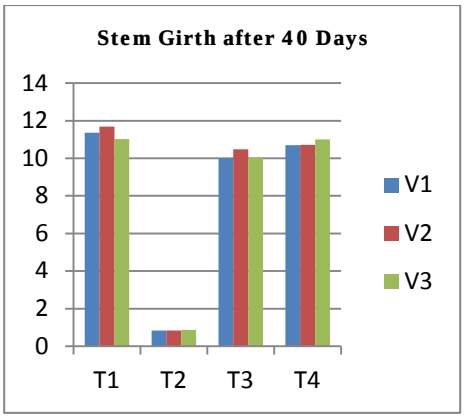

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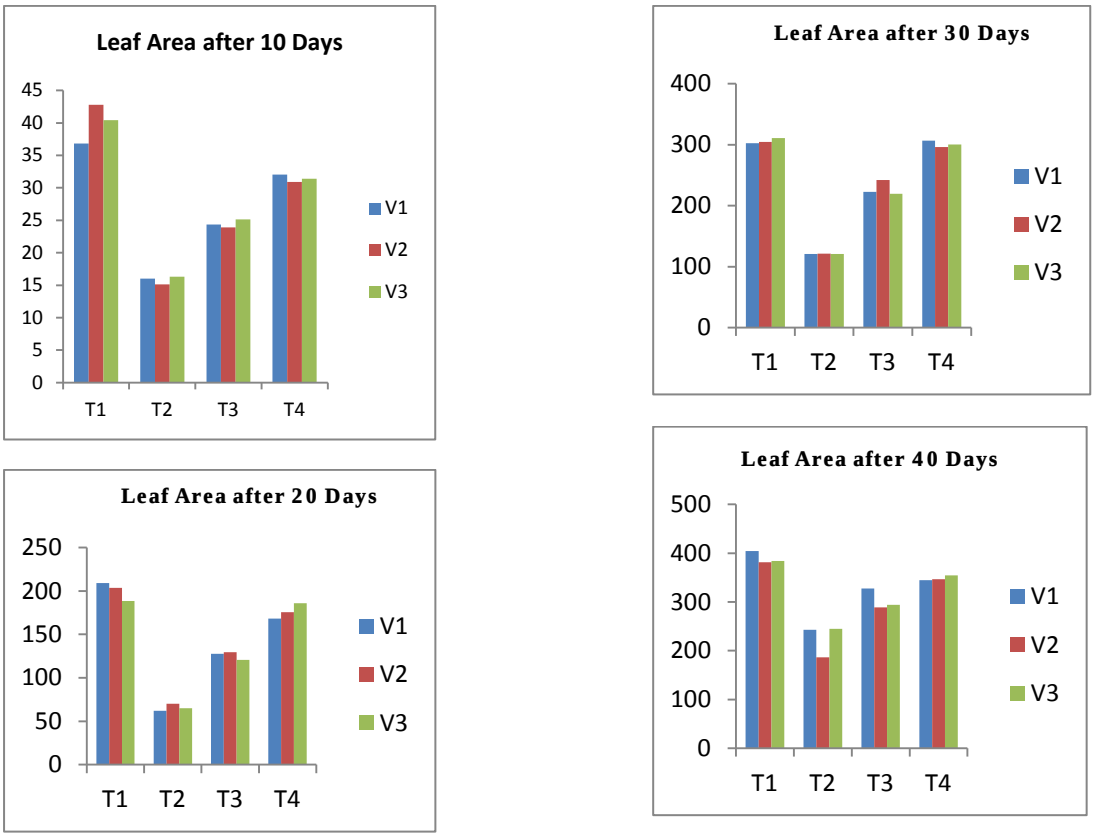

Figure 1: Effect of Irrigation Frequency on Stem Length, Girth and Leaf Area

iii. **Effect of Irrigation Frequency on Stem Girth:** there are differences in the four treatments (water) applied since $F_{Tr} > F_{0.05}$ for 1o, 20, 30 and 40 days irrigation frequencies while for the three maize varieties, there are no significant differences among them at 10, 20, 30 and 40 days since $F_{Bl} < F_{0.05}$. Thus, the null hypothesis must be rejected for the four treatments (water) applied while for the three maize varieties, the null hypothesis cannot be rejected. Stem girth after 10 days with 0.4-0.5 and 0.20 values were obtained as the highest and lowest which cut across almost all the three varieties (SWAN 1-SR-Y, ART/98/SW4-OB and ART/98/SW6-OB) at every other day irrigation frequency and twice a week irrigation frequency respectively. The extreme low values of stem girth (0.80-0.90) were obtained at twice a week irrigation affecting all the three varieties. This may be due to the nature of the soil.

iv. **Effect of Irrigation Frequency on Leaf Area:** there are differences in the four treatments (water) applied since $F_{Tr} > F_{0.05}$ for 10, 20, 30 and 40 days irrigation frequencies while there are no significant differences among the three varieties of maize at 10, 20, 30 and 40 days since $F_{Bl} < F_{0.05}$. Hence, the null hypothesis must be rejected for the four treatments (water) applied while for the three varieties of maize, the null hypothesis cannot be rejected. The highest value for leaf area after 10 days was obtained to be 56.02 at daily irrigation frequency of variety ART/98/SW4-OB while the lowest value was 5.70 at twice a week irrigation frequency of variety ART/98/SW6-OB. The highest value for the leaf area was also recorded to be 224.18 at daily irrigation frequency of

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variety ART/98/SW4-OB while the least value obtained twice week irrigation frequency of variety SWAN 1-SR-Y with the value of 64.77. For leaf area after 30 days, the highest value of 313.03 was obtained also at daily irrigation frequency ART/98/SW6-OB while same variety also put up the lowest value of 92.11 a twice week irrigation frequency. At leaf area of 40 days, variety ART/98/SW4-OB has the highest value of 388.33 at daily irrigation frequency while the least value occurred at twice a week irrigation frequency of variety SWAN 1-SR-Y with the value of 179.95.

Conclusion

Irrigation frequencies have serious effects on the stem length, stem girth and leaf area of the three maize varieties. The daily irrigation frequency was found to have the highest value on the stem length and leaf area while every other day irrigation frequency was also found to be the highest on the stem girth of the varieties. It was also observed from the study that twice a week irrigation frequency has the lowest values so far which cut across all the three varieties of maize. The varieties do not really have much effect on the growth of the maize however the rate of water application varies with the growth of the crop. It is also seen that maize grows best on a rich, well-drained, neutral or alkaline soil because it uses large quantities of nutrients from the soil.

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