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THE INFLUENCE OF METEOROLOGICAL CONDITIONS ON THE GROWTH OF PEARL MILLET (*PENNISETUM GLAUCUM* L. R. BR.) IN JIGAWA STATE, NIGERIA

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Abstract

Study was carried out to assess the influence of some selected meteorological conditions on the growth of pearl millet in three local government areas of Jigawa State. The experiments were conducted over 2016 and 2017 planting seasons at the experimental farm of Federal University, Dutste 11° 42' N, 9° 34' E [FUD], Bilyaminu Usman Polytechnic, Hadejia 12° 48' N, 10° 01' E (BUPH) and College of Education, Gumel 12° 62' 9° 38' E (COEG]) Jigawa State The Experiment was laid on a randomized complete block design (RCBD) and replicated thrice, in each of the 3 locations, the total of 25*18m experimental area were splits into plots size of 5m^2 with 1mtr distance between and within replicate to the study the influence of some selected meteorological conditions viz; rainfall, maximum and minimum air temperatures, relative air humidity and sunshine duration on the yield of pearl millet. Four (4) Pearl millet varieties viz; SOSAT C-88 (LCIC – MV1) and LCICMV4 Jirani (improved varieties), Zango (V_3) and Matsangari (local varieties) obtained from Jigawa State Agricultural and Rural Development Agency (JARDA) and from the local farmers in the study area. Daily weather data on rainfall, maximum and minimum air temperature, relative air humidity as well as sunshine duration were obtained from the meteorological stations of the said locations. Data collected were subjected to multiple regression analysis using 5% significant level. The results revealed that meteorological condition rainfall, number of tillers, relative humidity, spike length and sunshine duration contributed 40%, 45% and 47% to the yield per hectare at Dutse. At Gumel it was revealed that maximum airtemperature contributes about 51% to the number of tillers, relative air humidity 58% to yield per plot and the sunshine duration contributes about 68% to the yield per hectare. However, the results obtained at Hadejiya shows that most of the contribution came from relative air humidity 51% and maximum air temperature 41 and 46% respectively.

Keywords: Agriculture in Nigeria**,** Meteorological Conditions, Growth, Pearl Millet.

INTRODUCTION

Agriculture in Nigeria is heavily dependent on the seasonal characteristics of rainfall. Combine this with diminishing amount and duration of rainfall, as one moves from the south to the north of the country, and its year-to-year variability, is a major deterrent to investments into agriculture. Farming communities have good traditional understanding of weather and climate of their communities though they complained that the weather was less predictable now than in the past. However, they still depended on their traditional understanding to make farm management decisions and those relating to other means of livelihood (Nnoli *et al;* 2006)

Crop growth and development is mainly a function of temperature if water is available to the optimum satisfaction. Although weather and climate had never been constant and they had always experienced changes either positive or negative. Increased temperature will affect the physiological processes necessary for crop growth and development of crops and ultimately crop yields are most likely to drop over the present level. A climatic anomaly plays an important role in increasing the uncertainties in crop production. (Rasul, *et al*, undated).

Agriculture has been the mainstay of livelihood for over 90% of the population of Jigawa State. This livelihood is heavily reliant upon rainfall and the use of traditional implements. Out of the 2.24-million-hectare total land area of the State, about 1.6 million hectares are estimated to be cultivated during the raining season while about 308,000 hectares of the land mass is potential for irrigated cultivation. The major crops in state are the rainy and dry season crops. Rain fed crops include millet, sorghum, cowpea, groundnuts, sesame, rice, maize, sweet potatoes, Bambara nuts, water melon, cassava, cotton, okra, Roselle and water melon. And the dry season farming production include tomatoes, pepper, onions, wheat, sugarcane, carrots, cabbage, lettuce, maize and a host of other leafy vegetables. About 11 years' assessment of crop farming shows that the State largest crop production is millet and sorghum with an average of 491M/Tons and 460M/Tons per year respectively (Jigawa state ministry of agriculture, 2013). However, production levels fluctuate each year. Perhaps due to changes in climate experienced in recent times. Although climatic variables are natural and beyond human manipulations, there are other factors of productions that may compound the problem of crops production, millet in particular.

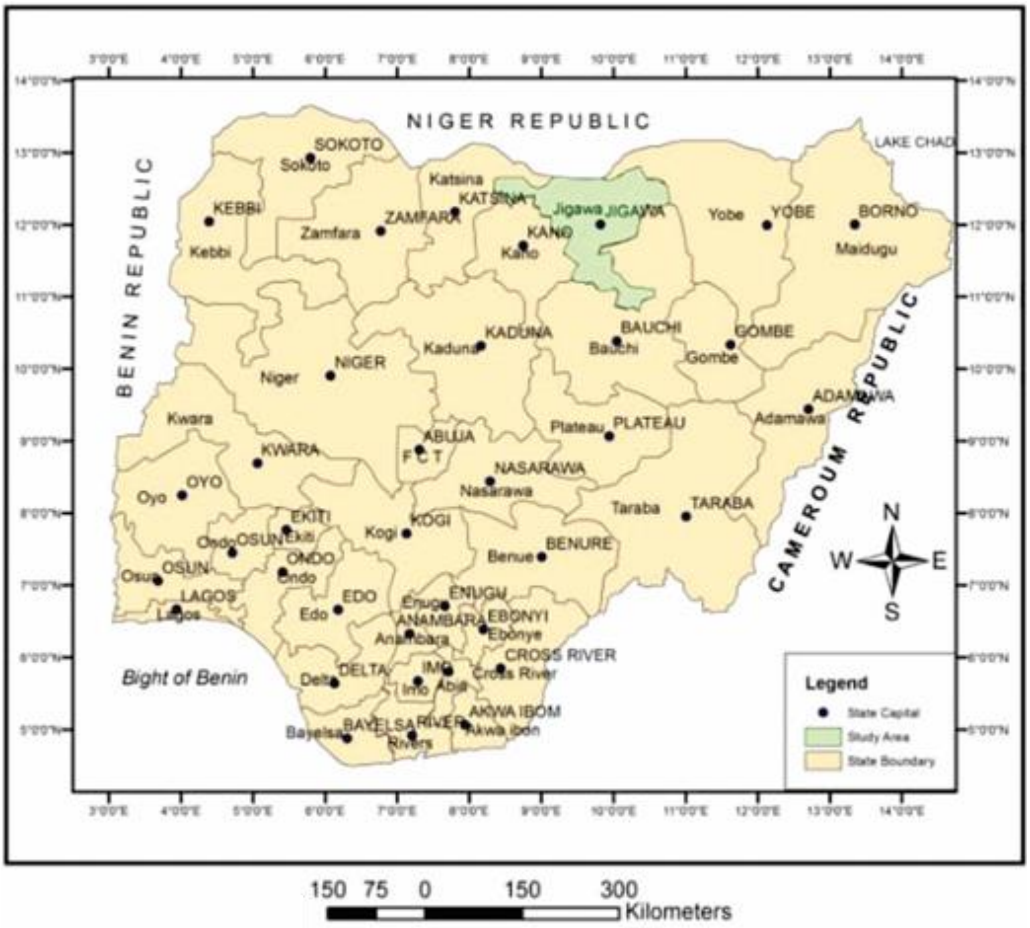

Figure 1 Jigawa State within Nigeria.

Linear regression analysis is one of the most important and commonly used statistical methods that serve three major purposes: (I) description, (2) control, and (3) prediction (Neter, Kutner, Nachtsheim, & Wasserman, 1996, Alejandro, 2008). According to Larsen, regression models are statistical models which describe the variation in one (or more) variable(s) when one or more other variable(s) vary. Inference based on such models is known as regression analysis (Larsen, 2003, Alejandro,2008). Regression takes us one large step further. A regression is a test to see if we can predict one variable's value if we know the value of another variable (or variables). Here, we will limit ourselves to Simple linear regressions, which fit the data to a straight line. Regressions are really Cartesian geometry, the classical formula y = mx+b and the X and Y axis chart; where, the X axis is our independent variable, and the Y axis is our dependent variable. Linear regression analyzes the relationship between two variables, X and Y. For each subject or experimental unit, you know both X and Y and you want to find the best straight line through the data. In some situations, the slope and/or intercept have a scientific meaning. In other cases, you use the linear regression line as a standard curve to find new values of X from Y, or Y from X (Neter, Et. aI, 1996, Alejandro,2008). Linear regression is discussed as a technique that is used to analyze a response variable Y which changes with the value of the intervention variable X Sellam and Poovammal (2016)

MATERIALS AND METHODS

Field experiments were conducted over 2016 and 2017 planting seasons at the experimental farm of Federal University, Dutste 11° 42' N, 9° 34' E [FUD], Bilyaminu Usman Polytechnic, Hadejia 12° 48' N, 10° 01' E (BUPH) and College of Education, Gumel 12° 62' 9° 38' E (COEG]) Jigawa State. Soil samples were collected at 0 -20cm and 20 -50cm depth. The Experiment was laid on a randomized complete block design (RCBD) and replicated thrice, in each of the 3 locations, the total of 25*18m experimental area were splits into plots size of $5m^2$ with 1mtr distance between and within replicate to the study the influence of meteorological conditions on pearl millet in three local government area of Jigawa State viz; Dutse, Gumel and Hadejia. Almost the same farm management practices were employed and applied to the three selected site throughout the two growing seasons under studying. The land was first cleared prior to the commencement of onset of the rain for both the seasons. At the onset of rain, the field was then ploughed, harrowed and ridged.

Agronomic data on millet growth determining parameters were collected on the farms through observation and recording of the pearl millet growth within the two growing seasons of 2016 and 2017. Data on growth parameters such as stem diameter, plant height, and number of leaves were taken from 2 weeks after sowing and continuously at 7 days' interval till harvest. A periodic measurement of 10 consecutively selected plants from the net plots was made. Crop stand count per plot was taken by counting the number of crop stand per plot after it has been established. This was conducted from 2 weeks after sowing and continuously at 7 days' intervals up to the period whereby all tillers are grown out. Ten plants per plot were consecutively selected.

Number of leaves: Number of leaves per plant was taken by counting the leaves on each ten selected plants in the plots. The total number of leaves was divided by 10 to obtain the mean number of leaves per plant.

Plant Height (cm): The plant height was measured by measuring the height of the plants vertically from the ground level to the apex level of the plant using a meter ruler. The total numbers of centimeter obtained from each stand were sum up then divided by 10 and obtained the mean heights per plant.

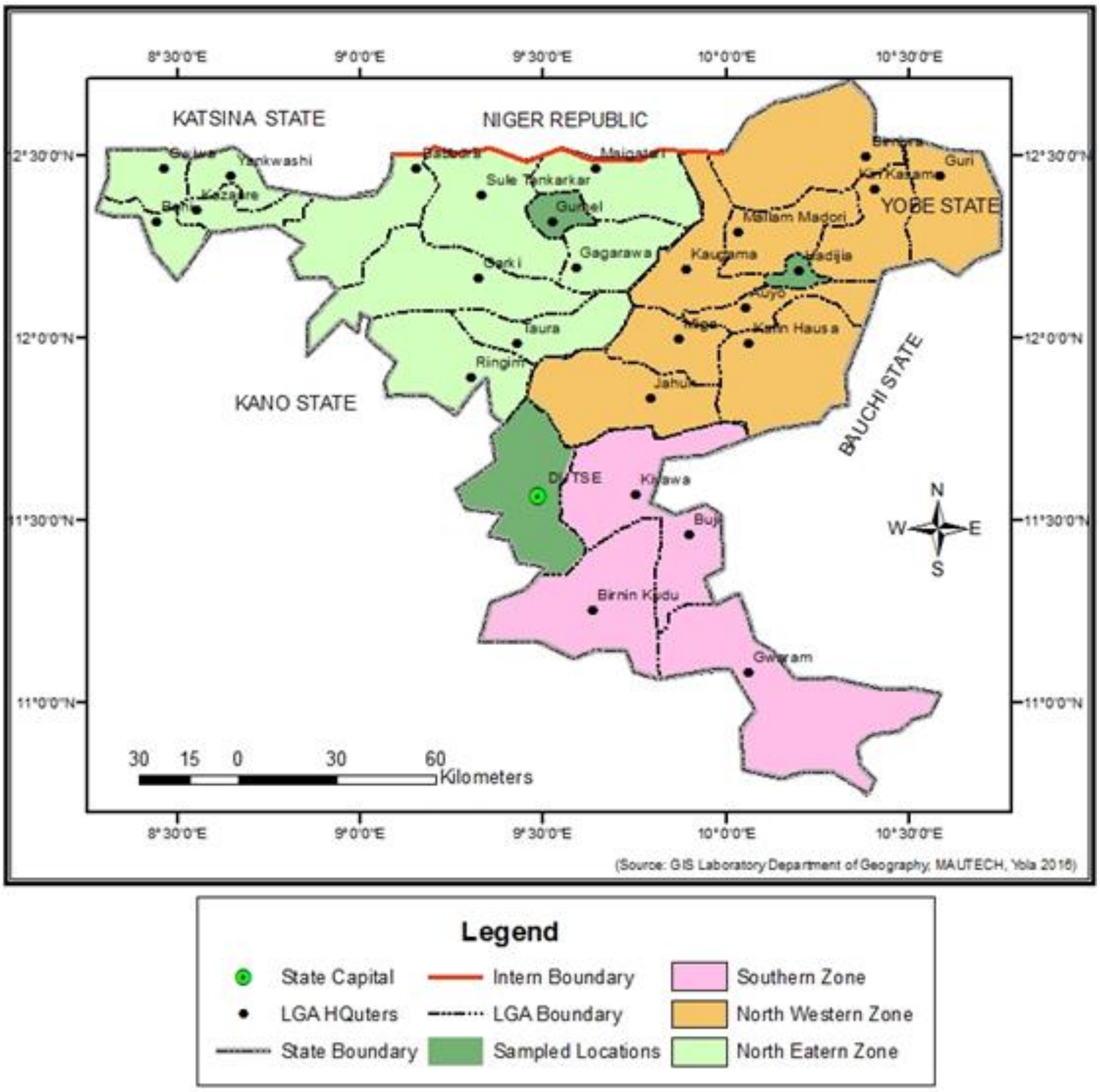

Figure 2 Jigawa State Showing Sampled Locations.

Stem Diameter (cm): This was measured by wounding a thread round the stem of the sampled plant and placed the thread on a graduated meter rural to take the reading and obtained the circumference. These measurements were sum up and divided by the total number of plants measured to obtained the mean in centimeter (cm).

Treatment and Experimental Design

The experiment was laid on a randomized complete block design (RCBD) and replicated thrice (Figure 3), in each of the 3 locations, the total of 25*18m experimental area were splits into plots size of $5m^2$ with 1mtr distance between and within replicate. Each replicate contains four plots with four pearl millet varieties *viz*; SOSAT C-88 (LCIC – MV1) and LCICMV4 Jirani (improved varieties), Zango (V_3) and Matsangari (local varieties). The former was obtained from Jigawa State Agricultural and Rural Development Agency (JARDA) and the latter from the local farmers in the study area.

Data analysis

The data were subjected to Regression Analysis using SAS (2003) to find the contribution of each climatic variable on the growth of pearl millet. Four (4) millet varieties were used to see which is more suitable for the study area.

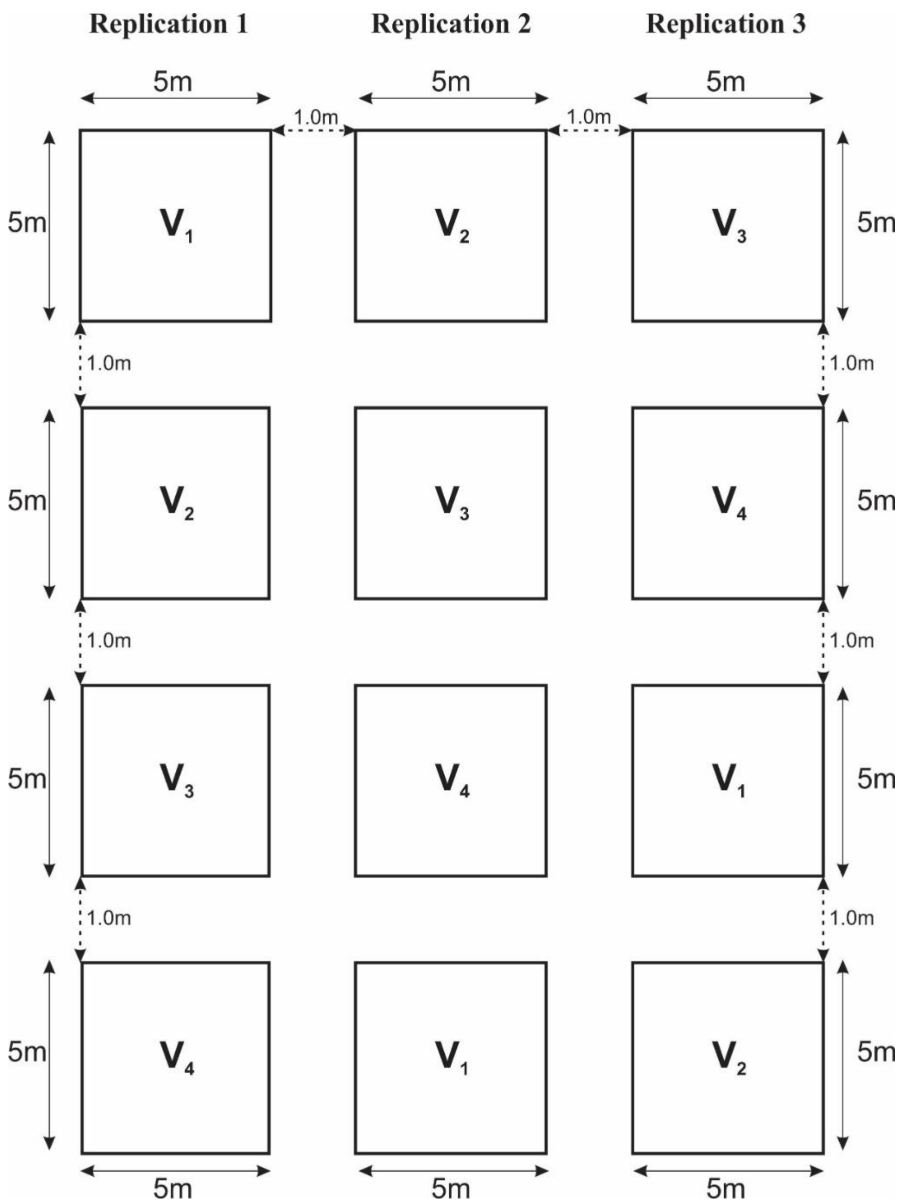

Figure 3 Layout design for the four cultivars of Pearl millet (V_1, V_2, V_3 and V_4) arrange in a Randomized Complete Block Design (RCBD) three replication.

RESULTS AND DISCUSSION

Combined Effects of Meteorological Conditions on Growth Parameters at Dutse location

The results (Table 1) for the combined analysis of multiple regressions of Dutse location in 2016 and 2017 showed that minimum air temperature, relative air humidity and maximum air temperature are independent variable that have influenced plant height and accounted for about 74%. As presented, the regression equation revealed that minimum air temperature contributes positively to the development or increase in the height of pearl millet. This implies that a unit increase in minimum air temperature will bring about 24 cm increases in plant height. Similarly, relative air humidity and maximum air temperature have negative influence on pearl millet plant height. This explains that a percentage increase in relative air humidity and maximum air temperature will decrease plant height of pearl millet varieties with about 4.8cm and 82 cm respectively. The finding connoted with the report by Nguyen, (2006). The report shows that productivity in rice and other tropical crops decreased with increased temperatures as a result of global warming. High temperature for just 1 to 2 h at anthesis (about 9 days before and at heading) causes large percentage of grain sterility in rice (Nguyen, 2006).

Table 1. Regression Summary of Effects of Meteorological Conditions on Growth Parameters at Dutse

Growth Parameter	Regression Equation	R^2
Plant Height (Y)	$Y= 2561.38+24.15X_1 – 4.82X_2 – 82.90X_4$ (-12.25) ** (7.69) ** (-3.71) **	0.74
Stem diameter	$Y= 4.867 + 0.374X_1+0.050X_2 - 1.913X_3$ (4.335) ** (1.984) * (-10.034) **	0.50
Number of leaves	$Y= 16.031+ 0.196 X_2 - 3.435X_3$ (3.272) ** (-7.638) **	0.42

Where, X_1 = Minimum Air Temperature (^{O}C), X_2 = Relative Air Humidity (%), X_3 = Sunshine Duration (hrs.), X_4= Maximum Air Temperature (^{O}C), X_5 = Rainfall (mm)
** Significant at 0.01, * Significant at 0.05
R^2 = coefficient of Determination
Values in Parenthesis = T Value

The combined effect of the different meteorological conditions on the growth stem diameter of pearl of millet at Dutse location was also analyzed using the multiple regression technique. Only the climatic variables which are significantly correlated with growth of stem diameter of pearl millet were included in the multiple regression analysis. Meteorological conditions that showed a strong influence on stem diameter of pearl millet includes; minimum air temperature, relative air humidity and sunshine duration and have accounted for about 50% of variance of stem diameter (Table 1). As shown, minimum air temperature and relative air humidity have influenced the stem diameter positively, meaning that the higher the minimum air temperature and percentage relative air humidity the higher the increase in stem diameter of pearl millet. Furthermore, sunshine duration had negative effect on stem diameter. Contrary to this finding, Hassan *et al.* (2014), reported variation in stem diameter and attributed it to differences in heredities of the varieties

Relative air humidity had positive influence on number of leaves of pearl millet (Table 1), meaning that as percentage relative air humidity increases the number of leaves also increases. Furthermore, sunshine duration had negative effect on number of leaves of pearl millet. Meaning that further a unit increase in sunshine duration will bring about three (3) decrease in pearl millet leaves. The inverse relation could be linked to high temperature and low rain fall experienced in the in area during the period of the study. Two independent variables identified to have influenced on the number of leaves are relative air humidity and sunshine duration and accounted for only 42% variance in number of leaves. Others could be explained by other factors such as soil, pearl millet variety, fertilizer, farm practices among others.

Combined Effects of Meteorological Conditions on Growth Parameters at Gumel location

The multiple regression analysis computed for the growth parameters at Gumel revealed that plant height, stem diameter and number of leaves have coefficient of determination of 0.83, 0.72 and 0.66 respectively. This implies that 83, 72 and 66% of the variance in plant height, stem diameter and number of leaves can be explained by meteorological conditions (Table 2) The result of the regression analysis showed that minimum and maximum air temperature, relative air humidity and rainfall have positive significant influenced in plant height (Table 2). However, sunshine duration had negative effect on plant height. The implication is that the higher the sunshine the shorter the pearl millet plant. Similarly, minimum and maximum air temperature, relative air humidity, rainfall and sunshine duration have significant influence in pearl millet stem diameter. The regression equation in Table 2 shows that climatic variables minimum and maximum air temperature, relative air humidity and rainfall have positive influenced in pearl millet stem diameter. Thus, a unit increase in any of these meteorological conditions will certainly increase the stem diameter of pearl millet. However, sunshine duration had negative influence in stem diameter. By implication an hour increase in sunshine will reduce stem diameter by 0.3 cm. This is in line with what Sajjad *et al.*, (2017) who stated that plants directly depend on sunshine for their healthy growth and development, completion of their life cycle, and most importantly, food preparation. In contrast, excessive sunshine has similar negative effects on crops.

Table 2. Regression Summary of Effects of Meteorological Conditions on Growth Parameters at Gumel

Growth Parameter	Regression Equation	R^2
Plant Height (Y)	$Y= 42.00 +9.915X_1+6.530 X_2 -32.011X_3 -14.926X_4 +0.544X_5$ (5.1005)** (13.198)** (-13.978)** (-6.057)** (6.339)**	0.83
Stem diameter	$Y= -30.51+0.618X_1 +0.373X_2 -1.173X_3 +0.027X_5$ (5.421)** (-8.826)** (12.602)** (5.360)**	0.72
Number of leaves	$Y = -18.44+0.44X_2-1.214X_3+0.030X_5$ (11.873)** (-7.012)** (4.925)**	0.66

Where, X_1 = Minimum Air Temperature (^OC), X_2 = Relative Air Humidity (%), X_3 = Sunshine Duration (hrs.), X_4= Maximum Air Temperature (^OC), X_5 = Rainfall (mm)
** Significant at 0.01, * Significant at 0.05,
R^2 = coefficient of Determination
Values in Parenthesis = t value

Relative air humidity, sunshine duration and rainfall are three meteorological conditions that altogether accounted for about 66 % in the variance of number of leaves. The remaining 34% may be attributed to others factors apart from these three. Plants need sufficient humidity for their balanced growth. Humidity that is too low or too high is not beneficial for higher crop yield. When humidity is sufficient, plants can absorb nutrients from the soil and can provide a high yield. Plant–water relationship is directly controlled by humidity and indirectly by other factors. Furthermore, dryness in the atmosphere can seriously threaten dry matter production by controlling stomatal leaf water potential Ali *et al.*, (2017). The combined regression results for Gumel location shows that relative humidity and rainfall had positive influenced on the number of leaves. The reason is that the higher the percentage relative humidity and rainfall the higher the number of leaves of pearl millet. By implication, an increasing 1unit total rainfall resulted in an increase in 1number of leave. Positive relation could be explained in relation to the nature of rainfall, farm location among others. Furthermore, sunshine duration had negative effect on the number of leaves. The implication is that higher sunshine exerted on pearl millet will in return reduces the number of leaves of pearl millet in the study area. The inverse relation could be explained in relation to the high sunshine (i.e., extreme temperatures) of the area. This is in line with what Ruhul *et al,* (2015) whom reported that plants are dependent on solar radiation to generate food, complete their life cycle and ease healthy growth and development. They further stated that, excessive sunshine shows similar negative effects on crops, like higher temperature stress.

Effects of Meteorological Conditions on Growth Parameters at Hadejiya location

The regression analyses of meteorological conditions and growth parameters of pearl millet in Hadejiya location gained the development of three, four and five variable equations (Table 3). The regression result shows that minimum and maximum air temperatures, relative air humidity, sunshine duration and rainfall were significant. The first four meteorological conditions have negative influence on the plant height. The adjusted R^2 value indicated that about 75% of the variation in the pearl millet plant height is explained by meteorological conditions. Furthermore, the regression analysis was also used to obtain the contribution of meteorological conditions to the development of stem diameter of pearl millet. The result also shows that sunshine duration, maximum air temperature and rainfall were significant but negative influenced the development of stem diameter (Table 3). Relative air humidity positively influences the growth of stem diameter. All together contributed about 52% in the variation in stem diameter. However, minimum temperature, relative humidity and sunshine hour were the significant meteorological conditions that influenced number of leaves of pearl millet and have accounted for about 71% in the variation in the number of leaves. This is in line with Igwe, *et al* (2013) who opined that millet production in Nigeria is temperature dependent. Increases in annual temperature enables millet to fruit and mature and for the grains to be stored at moderate humidity content.

Table 3. Regression Summary of Effects of Meteorological Conditions on Growth Parameters at Hadejiya

Growth Parameter	Regression Equation	R^2
Plant Height (Y)	$Y = 1584.769 - (25.59 X_1 + 1.887 X_2 + 70.65X_3 + 10.52X_4) + 0.559 X_5$ (-5.803)** (-2.501)* (-13.493)** (-2.334)* (4.620)**	0.75
Stem diameter	$Y = 19.78 + 0.044X_2 - 1.210X_3 - 0.318X_4 - 0.014X_5$ (2.398)* (-7.396)** (-2.807)** (-3.139) **	0.52
Number of leaves	$Y = 56.40 - 1.033X_1 - 0.078 X_2 - 3.025 X_3$ (7.745)** (3.026)** (14.660)**	0.71

Where, X_1 = Minimum Air Temperature (^OC), X_2 = Relative Air Humidity (%), X_3 = Sunshine Duration (hrs.), X_4= Maximum Air Temperature (^OC), X_5 = Rainfall (mm)
** Significant at 0.01, * Significant at 0.05,
R^2 = coefficient of Determination
Values in Parenthesis = T Value

Combined Effects of Meteorological Conditions on Growth Parameters

Plant Height (cm)

Multiple regressions were used to determine the relationship between the independent variables (Minimum temperature, Relative humidity, Maximum temperature and rainfall) and the dependent variable (Plant height, Stem diameter and Number of leaves). The result of the regression analysis is as shown on Table 4. The result showed that minimum temperature, relative humidity, maximum temperature and rainfall were significantly influence plant height. As presented, as minimum temperature increases plant height decreases. This implies that the more minimum temperature increases the higher the tendency for pearl millet not increase in height. The increase in minimum temperature also means that nighttime temperatures are increasing. According to some experimental records, high nighttime temperature decreases crop production by decreasing photosynthetic function and sugar and starch content, increasing respiration rate, suppressing floral development and hastening crop maturity (Jones 1992, Abrol & Ingram 1996, Seyni *et al.,* 2015). This finding is also similar to a report by Nguyen, (2006) who reported that productivity in rice and other tropical crops decreased with increased temperatures as a result of global warming. Similarly, decrease in relative humidity and rainfall have a negative influence on plant height. Implying that relative humidity and rainfall decreases the lower the tendencies of pearl millet to decrease in height. However, the analysis shows that maximum temperature had positive influence on plant height of pearl millet. Implying that the higher the maximum temperature the higher the plant. Ruhul *et al* (2015) opined that solar radiation (sunshine) directly affects crop growth and flowering by inducing photosynthesis. Plants are dependent on solar radiation to generate food, complete their life cycle and ease healthy growth and development. In contrast, excessive sunshine shows similar negative effects on crops, like higher temperature stress. Furthermore, rainfall had positive influence on plant height of pearl millet. The implication is that the more the rainfall increases the higher the plant height. This is similar to what (Smith 1903, 1914; Davis and Pallesen 1940; Runge and Odell 1958; Runge 1968; Allmaras et al. 1964; Voss et al. 1970; Hill et al. 1979; Chang 1981; Hazell 1984; Garcia et al. 1987; Qi, 2003) who reported that growing-season climate conditions (e.g., rainfall and temperature) affect the growth of corn (*Zea mays* L.). Understanding the climate effect has been a continuous endeavor toward improving farming technology and management strategy to reduce the negative impacts of climate and to increase corn yield.

Table 4. Regression Summary of Combined effects of Meteorological Conditions on Growth Parameters

Growth Parameter	Regression Equation	R^2
Plant Height (Y)	$Y = 30.77 - 0.224X_1 - 0.107X_2 + 0.475X_4 - 0.016X_5$ (-4.22)** (-20.55)** (17.82)** (-20.57)**	0.97
Stem diameter	$Y = 9.559 + 0.409X_1 - 0.821X_3 - 0.553X_4 - 0.052X_5$ (2.02)** (3.51)** (-3.55)* (-9.21)**	0.69
Number of leaves	$Y = 30.01 - 0.674X_4 - 0.026X_5$ (-4.64)** (-6.70)**	0.48

Where, X_1 = Minimum Air Temperature (^{O}C), X_2 = Relative Air Humidity (%), X_3 = Sunshine Duration (hrs.), X_4= Maximum Air Temperature (^{O}C), X_5 = Rainfall (mm)
** Significant at 0.01, * Significant at 0.05,
R^2 = coefficient of Determination
Values in Parenthesis = t Value

Stem Diameter(cm)

Multiple regressions procedure identified minimum air temperature, relative air humidity, sunshine duration and maximum air temperature have strong influence on stem diameter of pearl millet. These variables include; minimum air temperature, sunshine duration, maximum air temperature and rainfall accounted for about 69% of variance of stem diameter (Table 4). As shown, minimum air temperature had positive influenced on stem diameter, meaning that a unit increase in minimum air temperature (°C) will increase in stem diameter of pearl millet by 1unit on the average. However, sunshine hours, maximum air temperature and rainfall had significant ($p < 0.05$) negative effect on stem diameter. This is in line with Igwe *et a.,* (2013) who opined that, rice yields more with increase in rainfall while the growth rate of maize, millet, sorghum and wheat was affected by increase in rainfall intensity- showing that, increase in rainfall might not be favorable to maize, millet, sorghum and wheat growth and yield. The inverse relation could be attributed to meteorological conditions of the area as well as pearl millet variety itself. Hassan *et al.* (2014), reported that variation in stem diameter may be due to difference in heredities of the varieties. Therefore, there is need for farmers in the area to look for a variety that can withstand higher sunshine duration and less rainfall in order to attain higher yield at harvest.

Number of Leaves

The result of the regression analysis shows that maximum air temperature and rainfall had negative influence on pearl millet number of leaves (Table 4). Implying that the higher the maximum air temperature and rainfall the lower the number of leaves of pearl millet. This result is consistent with the findings of (Ismaila *et al*., 2010) who reported that temperature affects cereal production by controlling the rate of physio-chemical reaction and rate of evaporation of water from crops and soil surface. Productivity in rice and other tropical crops will decrease with increase in temperatures as a result of global warming, Igwe *et al.,* (2013). Similarly, rainfall had positive influence on pearl millet number of leaves. This is similar to the findings of Igwe *et al.*, (2013)

Summary of Multiple Regression of Climatic Variables in Growth Parameters in Dutse, Gumel and Hadejiya.

Owing to the fact that plant being exposed to the minimum air temperature, relative air humidity, solar radiation, rainfall in Dutse respectively, there is clear indication that plant height in Dutse and Gumel due experience similar tropic levels than in Hadejiya with a remarkable spatial variation in SS and RF. Stem diameter is a measure at which a plant shows readiness in maturity. In Dutse, MNT, RH and SS have positive influence on its thickness than in Gumel with one more element MNT, RH, SS and RF while in Hadejiya, MNT, RH, SS, MXT and RF have a greater significant effect on plant height. Foliage development gives plants more strength on evapotranspiration with balances gaseous exchange level and autotropic development of any plant. This result shows (Table 5) that RH and SS are the major determinant of leaves development in Dutse area but in Gumel, RH, SS and RF are the major factors while MNT, RH and SS are the major factors in Hadejiya respectively. In conclusion Dutse shows a feature sieve dune of an uplift that favors solar radiation intensity that give rise plant growth and development because it a depositional plane region compared to Gumel while Hedejiya is Fadama region. These variations result in high retention capacity of water and low evapotranspiration.

Table 5. Summary of the Effects of Meteorological Conditions on Growth Parameters in Dutse, Gumel and Hadejiya

Growth Parameters	LOCATION		
	DUTSE	GUMEL	HADEJIA
Plant Height (cm)	MNT, RH and MXT	MNT, RH, SS, MXT and RF	MNT, RH, SS, MXT and RF
Stem diameter (cm)	MNT, RH and SS	MNT, RH, SS, and RF	RH, SS, MXT and RF
Number of leaves	RH and SS	RH, SS and RF	MNT, RH and SS

Note: MNT = Minimum Air Temperature (^{O}C), RH = Relative Air Humidity (%), SS = Sunshine Duration (hrs.), MXT= Maximum Air Temperature (^{O}C), RF = Rainfall (mm)

CONCLUSION

Meteorological Conditions (minimum air temperature, relative air humidity, maximum air temperature and sunshine duration) have significant influenced on the development of plant height (i.e. Pearl millet plant height). Similarly, minimum air temperature, relative air humidity, sunshine duration and rainfall contributed for about 70% of variance of stem diameter. The regression analysis however, discovered that maximum air temperature had negative influence on pearl millet number of leaves.

At Dutse multiple regression revealed that minimum air temperature, relative air humidity and sunshine duration are independent variable that have influence on plant height and accounted for about 74%. Stem diameter of pearl millet in Dutse was strongly influenced by the minimum air temperature, relative air humidity and sunshine duration. Two independent variables identified to have influenced on the number of leaves are relative air humidity and sunshine duration accounted for only 42% variance in number of leaves. The multiple regression analysis computed for the growth parameters at Gumel revealed that plant height, stem diameter and number of leaves discovered that minimum and maximum air temperature, relative air humidity and rainfall have positively influenced the growth of pearl millet plant height and stem diameter. Relative humidity, sunshine duration and rainfall were discovered o exhibit to have positive influenced on the number of leaves in same Gumel. The influence of Meteorological Conditions on Growth Parameters at Hadejiya location, it is discovered that maximum air temperature, relative air humidity, sunshine duration and rainfall were found to have positive and significant influence on plant height. Additionally, sunshine duration, maximum air temperature and rainfall were significant meteorological conditions that influenced the development of stem diameter. However, minimum air temperature, relative air humidity and sunshine hour were the significant meteorological conditions that influenced number of leaves of pearl millet and have accounted for about 71% in the variation in the number of leaves. Based on the current study, it is suggested that northwestern part of the Jigawa state is good for growing Pearl millet but need additional inputs, finance and frequent extension services to sensitize the farmers in the area on up-to-date weather prediction prior to onset of rain for better preparation, management and productivity.

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