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Full Length Research Paper

Effect of Different Spacing intervals on the Growth and Yield of Maize (*Zea mays L.*) in Mubi, Adamawa State

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Improved white maize is one of the important cereal crops in Nigeria. There is little information on the optimum spacing intervals of improved white maize for optimum growth and yield in Nigeria. Field experiment was conducted at thestudents' practical farm, of the Department of Agriculture Technology, Federal Polytechnic Mubi in during the 2013 cropping season, to assess the effects of different spacing intervals on growth and yield of maize). The field design was a randomized complete block design (RCBD) replicated three (3) times. Treatments consisted of three (3) different spacing intervals viz: 60 × 30cm, 60 × 40cm and 60 × 50cm. Data were collected on the growth and yield parameter arewere analyzed. The result indicated a significant effect (P≤ 0.05) of spacing on plant height at eight weeks after sowing (8 WAS), stem diameter at 2WAS, days to first tasselling and number of cobs per plot. There was no effect of spacing o the yield of maize. Yield increase with increase in spacing, Spacing interval measuring 60× 50cm recorded a yield of 4, 622 kg ha^{-1}, while the spacing intervals 60×30 and 60×40 recorded yields of 3,688 kg ha^{-1} and 4177 kg ha^{-1} respectively. Despite non-significant difference in yield, the spacing 60×50 cm is recommended for adoption by farmers of maizein the study area.

Keywords: Spacing, Population, Growth, Yield, Maize,

INTRODUCTION

Population of cereal crops on a given pieces of land is always seen to influences the yield in practical terms based on different management practices adopted. Maize belongs to the grass family (Gramineae). It isa most important and useful cereals grain in the world providing nutrient for humans and animals, serving as a basic raw materials for the production of starch, oil, protein, alcoholic beverages, food sweetener and more recently, fuel (FAO,1992). The green plant, made into silage had been used with much success in the dairy and beef industries. In spite of the economic importance and high demand for maize in Nigeria, rapid reduction in soil fertility, failure to identify high yielding varieties and negligence on the use of soil amendment materials have interplayed to decrease yield to as low as 1 t/ha. (Romney et al., 2003; Rehn and Espig, 1991; Mabasa et al., 1995). Plant spacing varies with the growth of plants and the growing environments (Zhao et.al., 1997). To date, diverse planting patterns, such as narrow spacing (Widdicombe & Thelen, 2002; Sharratt & Mcwilliams, 2005), wide–narrow rows (Gozubenli *et al,* 2004; Xue, et al, 2002; Andrade et al., 2002) and multiple-plant hill plots (Xu et al., 2008) have been developed in

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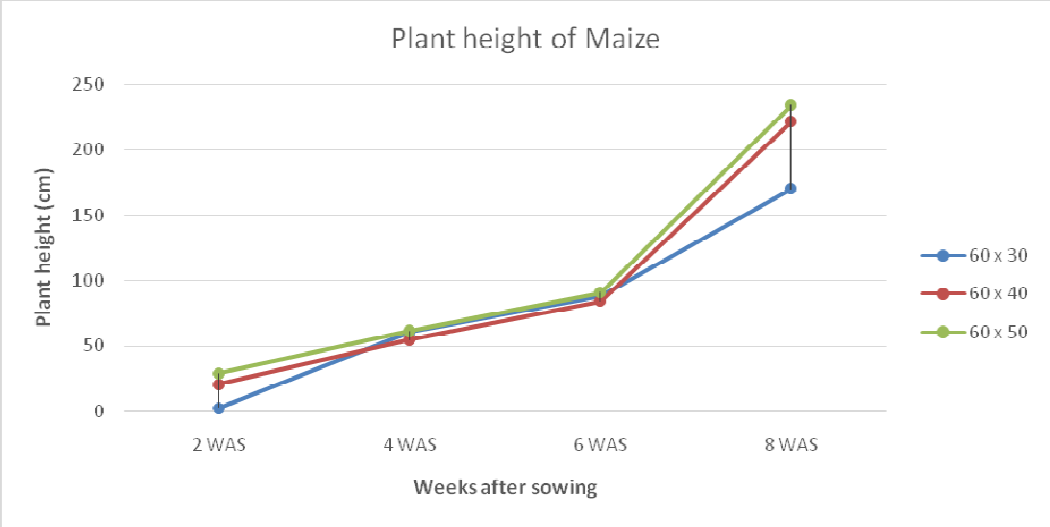

Figure 1: Effect of different spacing interval on plant height of Maize during the 2013 cropping season

maize (Zea mays L.) in pursuit of highgrain yields under different growing conditions.Some farmers sow their maize crop without recourse to the specifics of distance between plant and this ultimately lead to poor growth of plant, difficulties in management of inputs, as well as reduced yield as the case may be. The planting space for local farmers vary from 90 cm x 30 cm, 90 cm x 20 cm, 90 cm x 50 cm or 75 cm x 50 cm and this do not translate into the expected high yield as revealed by previous study in the area, hence the need to optimize the intra row spacing in maize in the study area for better productivity. Therefore, the aim of this study is todetermine the effects of different spacing on the growth and yield of improved white maize and recommend the correct spacing required for optimum growth and yield in the study area.

MATERIAL AND METHOD

The study area

The research was conducted in Northern part of Mubi town in the student's practical farm of the department of Agricultural Technology of the Federal Polytechnic, Mubi. Mubi is located in the Northeastern part of Adamawa State between latitude 9^{o} 26' and $10^{o}10'$ N and longitudes 13^{o} 1' and 13^{o} 44' E. It has a land area of 506.40km^2 (Adebayo, 2004), at an altitude of 696m above sea level (Encarta, 2007). The climate is characterized by alternating dry and wet season. The rains last from April to October with a mean annual rainfall from 700mm to 1050 mm (Udo, 1970; Adebayo, 2004). The land use types are mainly arable farming and livestock production (Tekwa and Usman, 2006).

Experimental design

The experiment was laid out using the randomized complete block design (RCBD) replicated three (3) times. Treatments consisted of three spacing regimes namely: 60cm × 30cm, 60cm × 40cm, and 60cm × 50cm. The total site was measured to about. (67.5 m^2) while each plot covered 7.5m^2. The interval between one plots to another was 0.5m while an alley of 1 m was allowed between replications. The research was carried out between the months of July and October during the rainy season of 2013

Statistical analysis

The data collected were subjected to the statistical analysis of variance. The treatment means wereseparated using the least significant difference (LSD) at 5% levels of probability.

RESULTS

The mean value showing the effect of different spacing on plant height is presented in Figure 1. Increase in spacing between plants significantly increase the height of maize at 8WAS. However, at 2WAS and 4WAS there was no significant increase in height of Maize in all the spacing treatments. The tallest plant at 8WAS was with spacing 60 x 50 which recorded 233cm while spacing 60 x 30 cm was shorter at 8WAS with 169 cm. Figure 2 also describes the number of leaves of maize. There was no significant effect of spacing on the number of leaves of maize from 2WAS to 6WAS. Numberof leaves was taken at interval of two weeks during the production period. The number of leaves

Figure 2: Effect of different spacing interval on number of leaves of Maize during the 2013 cropping season

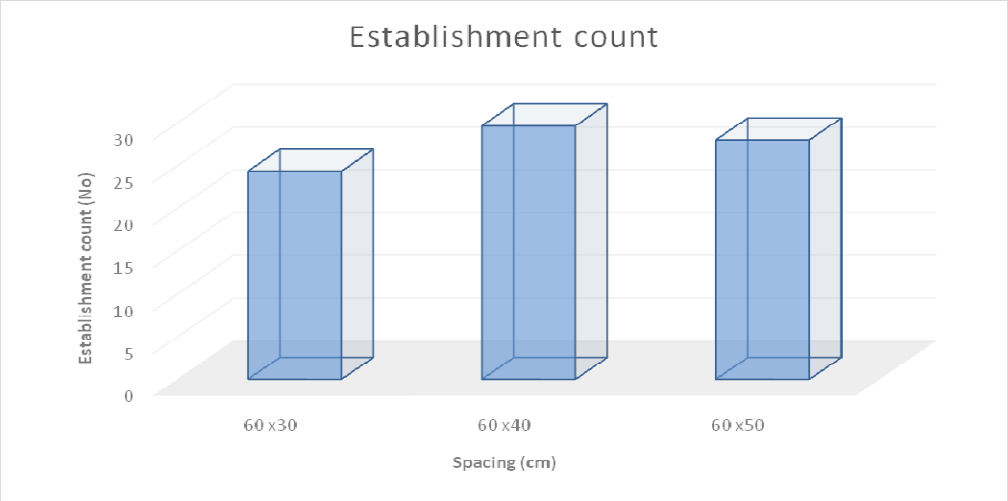

Figure 3: Effect of different spacing interval on the establishment of Maize during the 2013 cropping season

numerically showed that 60 x30 < 60 x40 < 60 x50 but were all not statistically different. Moreleaves were produced when maize was space at 60 x 40 cm at 8WAS.Also, establishment count was taken at 14 days after planting, and the result is presented in Figure 3. Maize plant with spacing interval of 60 x40 has the highest ($P \leq 0.05$) number of established crops to 29.6, while 60 x30 has 24.33 and 60 x 50 had 28.0 plants established respectively.

The effect of different spacing interval on the thickness of Maizestem is presented in Table 1.

Stem diameter was measured from 2WAS up to 8WAS at intervals of two weeks. Result indicates at 2WAS, increased spacing significantly ($P > 0.05$) increase the thickness of stem. However, spacing of maize at 60 x 40 cm significantly lower the stem thickness compared to both 60 x30 cm and 60 x 50 cm spacing. At 4WAS up to 8 WAS, there was no significant ($P<0.05$) effect of spacing on the thickness of maize stems (Table 1).

The mean showing the effect of different spacing on the number of cobs per plot ofmaize is presented in Figure 4.

Number of cobs per plot was counted at six weeks after sowing (6WAS). Wider spacing intervals significantly increased the number of cobs per plot with 60 x 40 cm recording a significantly higher number of cobs compared to 60 x30 cm but is not significantly different from 60 x 50 cm spacing (Figure 4).

In Table 2 is presented the effect of different spacing interval on days to first tasselling and yield of maize.

There was no significant effect of spacing intervals on both the days to first tasselling of maize as well as the yield per hectare of maize. However, numerical values (not statistically different) indicates that as the spacing gets wider, the yield tends to increase. The higher yield of

Table 1: The effect of different spacing intervals on stem diameter of Maize

Treatment	Stem Diameter 2weeks	4weeks	6weeks	8weeks
60x30 cm	6.07a	19.55	21.24	23.08
60x40 cm	5.34b	18.93	21.54	32.65
60x50 cm	7.05a	17.92	21.85	23.40
LSD (0.05)	0.56	1.90	2.61	2.16
CV (%)	15.51	22.74	21.19	15.52
SE	0.141	0.422	0.553	0.454
P>F	0.045	0.542	0.9406	0.1707

All the means with the same along same column are not significantly different (P≤0.05)

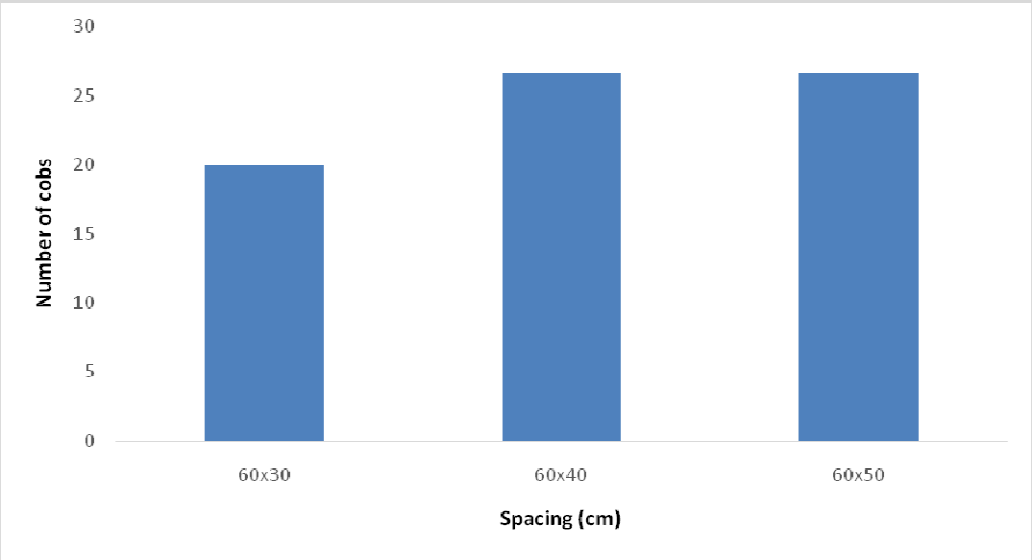

Figure 4: Effect of different spacing interval on number of cobs per plant of Maize during the 2013 cropping season

Table 2: Effects of different spacing intervals on days to first tasselling and yield of maize during the 2013 cropping season

Treatment	Days to first tasselling	Yield (Kg ha^{-1})
60x30 cm	68.33	3,688.8
60x40 cm	65.33	4,177.8
60x50 cm	65.33	4,622.2
LSD(0.05)	6.13	945.3
CV (%)	4.08	10.16
SE	1.587	262.69
P>F	0.3841	0.1205

All means the same letters among same columns are not significantly different (P≤0.05)

Note: DTFT=Days to First Tasselling, NOCPP = Number of Cobs per Plant, YPP = Yield per Plot, YPH = Yield per Hectare

4,622.2 kg ha^{-1} was recorded with spacing 60 x 50 cm while the lower yield was recorded with spacing 60 x 30 cm (3,688.8 kg ha^{-1}).

DISCUSSION

Most maize varieties attain their maximum vegetative growth from 6-8 WAS. The pattern of increase in the height in maize due to the effect of spacing at 8 WAS was not unconnected with the ability of the maize crop to make maximum utilization of growth resources since wider spacing reduces both intra and inter crop competition. This behavior in the morphological development in the height of maize is also reflected with the number of leaves produced by maize under different spacing's in this study. Young plants are at high tendency to behave differently due to their varying ability to respond to the environment. Stem diameter however was not influenced by these environmental factors from 4-8 WAS of the maize growth period. Jigtap and Abama (2003*)* viewed environmental factors as well as agronomic practices during early crop development stage as key to successful plant performanceand ultimately related toplant growth, root development and fruiting of maize. Close spacing interferes with normal plant development and increase competition resulting in yield reduction, while too wide spacing may result in excessive vegetative growth of plant and abundant weed population due to more feeding area available (Alford et al., 2004, 1985). Maize crop is known to be a heavy feeder and poor competitor in terms of resources. Wide spacing tends to edge out competitive tendencies in maize environments. This could be one of the reasons for its better performance with 60 x 50 cm spacing. Morachan (1986) maintained that closer spacing interval reduces yield of individual plants while wider spacing reduces the total yield because of lesser population. Hussein et al (2008) also reported that plants density plays an important role in the competitive growth of maize.This tends to confirm the response of improved maize in this study to different spacing.

CONCLUSION AND RECOMMENDATIONS

Although the spacing 60 x 50cm was not statistically different in terms of yield, this study howeverfound that the growth performance such as plant height, stem diameter, number of leaves and establishment count under the spacing 60 x 50 cm was generally better compared to both 60 x 40 cm and 60 x30 cm.It is therefore recommending the sole cropping of maize in Mubi area, using a spacing of 60 x 50cm for optimum growth and yield of the improved white maize variety.

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