Effect of Spacing on the Performance of Extra Early Yellow Maize *(Zea mays L.)* Variety TZESR - Y in Mubi, Adamawa State Nigeria

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Abstract: The study examined the effect of spacing on extra early yellow maize variety TZESR —Y in Mubi Adamawa state with the objective of finding the most appropriate spacing for optimum yield. The effect of four spacing viz: 75cm x 25cm, 75cm x 20cm, 75cm x 15cm and 75cm x 10cm respectively were evaluated. The experiment was laid in a randomized complete block design (RCBD) replicated three times. Data were taken on nine parameters viz: plant height, plant leaves, length of cob, diameter of cob, stem girth, 1000 seed weight, days to 50% tasseling, days to physiological maturity and yield per plot. Results were obtained after subjecting the data to analysis of variance (ANOVA). Results shows that spacing has great significance on the performance of maize. S1 (75cm x 25cm) gave the highest number of days to 50% tasseling (48), length of cob (12.13), diameter of cob (13.27), stem girth (13.02), 1000 seed weight (1000 g) and yield per plot (1900 kg/ha) respectively. It was observed also that these values were significantly (p=0.05) different with other means. [Journal of American Science 2010; 6(9):708-712]. (ISSN: 1545-1003).

Key Words: Zea mays,spacing,performance,variety,physiological maturity.

Introduction

Maize (*Zea mays L.*) is an important cereal crop in the world and ranks second, following wheat in the world's cereal crops production. It accounts for about 11.2% of grain produced in Nigeria (Lajide, 1998; Emeasor, 2002).Maize forms a major part of the cereal crops consumed by man and serves as a source of dietary carbohydrate (Asawalam and Adesiyan, 2001). Maize has a wide range of tolerance to environmental conditions and also larger number of varieties with different maturity periods (Rehn and Espig, 1991). Increase in the use of maize has led farmers to reduce spacing among plants thus, population density is increased with attendant increased quantity of maize grain produced. Tropical maize yields an average of 1.2 to 2.0 t/ha under sole cropping with a varying population density (Rehn and Espig, 1991; Jennifer, 1996). When crops are grown sole, spacing and planting pattern differ from when intercropped. Ogunbodede and Olakojo (2001) recommended that maize should be sown at 75cm x 75cm at two seeds per hill or 50cm x 50cm at one seed per hill in sole cropping.

For good maize yield, adequate spacing is an important factor. Rowland (1993) viewed that widely spaced maize tends to have excessive vegetative growth during early stage which may result in severe competition for water. He further observed that spacing and plant population can be determined after considering a number of factors like variety, amount of water expected to be available during the growing season and its distribution through time, soil fertility especially nitrogen availability, planting, pest and disease considerations etc. Wider spacing encourages growth of weed and thus, more labour and increase cost of production. Whiteman (1981) opined that there may be interaction between pest, damage and spacing in maize. Hay and Walker (1992) observed the influence of plant population density on maize dry matter yield where an increase up to plateau value to moderate densities were seen and significant reduction only at very high densities. Grain yield therefore tends to respond to population densities of maize and spacing. At high plant densities and close spacing, the low yield is as a result of decreasing plant size. Harper (1999) showed the relationship between final from yield of crop. Plant population can either be asymptotic or parabolic. In the asymptotic relation, yields increase linearly with increase population over the lower range of population. However, in parabolic the total yield decline at higher population and there is an identifiable optimum value. Closer spacing results in a progressive decline in the number of seed per cob because the cobs are smaller but sometimes produce no cobs. Adetola (2004) reported that variety that mature early have the potential for drought tolerance with production value very superior to the general average. Raemaekers (2001) reported that the optimal plant density should be adjusted to the local condition and the type of varieties to be grown. Generally maize is grown on low densities in Africa with a density of 15, 00 — 35,000 plant per hectare. In view of the rapidly expanding population in Nigeria and the general acceptability of corn as a popular staple food among small scale farmers and the desert encroachment in the North, there is the need to increase production through the use of correct spacing and appropriate variety to ensure optimal productivity.

This study therefore sought to evaluate the appropriate spacing that will ensure optimal production of maize in northern guinea savanna.

Materials and Methods

The experiment was conducted at the Research and Teaching farm of Department of Crop Science Faculty of Agriculture Adamawa State University Mubi during the 2008 cropping season during rain fed conditions. Mubi lies within latitude of 10 o8’ N and 10 30’ N and longitude 13° 10’ E and 13° 25’ E at 696m above sea level . Mubi is located in the northern guinea savanna zone of Nigeria with annual rainfall ranges of 700mm — 1000mm with peaks in July to September. Soil in the trial site is Typic Ustisapment (Rayar, 1986). The physio—chemical characteristics of the experimental area are shown in Table 1.

Table 1. Physio—Chemical Characteristics of the Soil from the Experimental Site.

Chemical analysis	
PH in water	6.80
Organic Carbon (%)	0.65
Carbon to Nitrogen ratio (C:N ratio)	1: 40
Available Nitrogen (%)	0.40
Available Phosphorus (PPM)	6.60
Available Calcium (Me/100g)	4.20
Available Sodium (Me/100g)	0.35
Available Potassium (Me/100g)	0.49
Particle Size Analysis	
Clay (%)	3.00
Sand (%)	56.50
Silt (%)	40.50
Soil Texture	Sandy Loam
Maximum Water Holding Capacity (%)	39.7

The result from chemical analysis shows that the soil was slightly acidic. Although the organic carbon (0.65%) and available nitrogen (0.40%) values were low, there was a high concentration of available phosphorus 6.6 (ppm). The particle size analysis show that, the soil type of the experimental area was sandy loam with a high proportion of sand (56.5%) and silt (40.5%) and less clay (3.0%). The soil had a high water — holding capacity with a maximum of (39.7%).

The maize variety TZESR — Y used for the experiment was purchased from Tropical Agro Center Yola. The experimental design consists of four different spacing viz: 75cm x 25cm, 75cm x 20cm, 75cm x 15cm, and 75cm xl0cm respectively which was replicated three times. The experiment was laid in a Randomized Complete Block Design (RCBD) on a 1 7m x 1 5m land area. Three seeds were planted per hole by dibbling method, and later thinned to two, two weeks after sowing (WAS). Sowing was done after the experimental site was ploughed, harrowed then leveled. Maize seeds were dressed with Apron — plus 50DS (Metalaxyl) at the rate of 3kg of seed per sachet of l0g of the seed dressing chemical before sowing in order to control soil — borne diseases and seedling pests. Each plot measured 3m x 4m (12m2) with 0.5m between each plot and in between replicates. All plots were weeded two times manually with a hand hoe at 3 and 6 WAS.

Records were taken from 10 randomly chosen plants from three central rows of each plot. Data were collected on plant height, number of leaves, and number of days to physiological maturity, diameter of cob, length of cob, 1000 seed weight and yield. Data collected were subjected to Analysis of Variance (ANOVA) to evaluate treatment effects using the procedure outlined by Gomez and Gomez (1984) for randomized complete block design. Mean separation was based on the least significant differences (LSD) at the 3% probability level.

Results

Results obtained from the study on the effect of spacing on plant height at 4 WAS and 8 WAS, days to 50% tasseling and days to physiological maturity of maize variety TZESR — Y is presented in table 2 whereas the effect of spacing on length of cob, diameter of cob, stem girth, 1000 seed weight and yield is presented in table 3, the study reveals that plant height at 4WAS and 8WAS were significantly (P=0.05) influenced. The t allest height of 40.67 cm was recorded with S4 — 75cm x 10cm at 4WAS. Similarly at 8WAS the tallest height of 160.33cm was recorded with S4.

Table 2: Effect of Spacing on Plant Height at 4 WAS and 8 WAS, Number of Leaves at 4WAS and ,8WAS, Days to Tasseling and Days to Physiological Maturity on Extra Early Yellow Maize Variety TZESR — Y in Mubi.

Spacing (cm)	*Plant Height (cm)*		*Number of Leaves*		*Days to 50% Tasseling*	*Days to Physiological Maturity*
	4 WAS	8 WAS	4 WAS	8 WAS		
S1=75x25	35.87	143.07	7.67	11.0	48	70
S2=75x20	33.93	147.87	8.33	10.67	43	75
S3=75x 15	38.40	156.80	8.34	10.67	50	69
S4=75 x 10	40.67	160.33	7.68	11.33	45	67
LSD (P=0.05)	3.37	8.63	NS	NS	2.06	4.03

The mean number of leaves at 4 WAS and 8 WAS shows that there was no significant effect among all treatments. However S3 (75cm x 15cm) at 4 WAS and S4 (75cm x 10cm) at 8 WAS recorded the highest number of leaves of 8.34 and 11.33 respectively. Significant effect (P 0.05) for days to 50% tasseling and days to physiological maturity as influenced by different spacing was recommended.

Result on the effect of spacing on the length of cob as shown Table 3 below indicates no significant (P = 0.05) difference though S1 (75cm x 25cm) recorded the longest cob (12.13cm) while S3 (75cm x 15cm) recording the least (9.01cm). The diameter of cob shows significant (P = 0.05) difference where S1 (75cm x 25cm) recorded the largest cob (13.27cm) whereas S3 (75cm x 15cm) gave the least (9.13 cm). The effect of spacing on stem girth, 1000 seed weight and yield gave a significant (P = 0.05) difference statistically. However S1 (75cm x 25cm) recorded the highest 1000 seed weight (1100g) and yield per plot (1,900kg) respectively.

Table 3. Effect of Spacing on Length of Cob (cm), Diameter of Cob (cm), Stem Girth, 1000 Seed Weight/Plot, Yield/Plot (kg/ha) on Extra Early Yellow maize Variety TZESR — Y in Mubi.

Spacing (cm)	*Length of Cob (cm)*	*Diameter of Cob (cm)*	*Stem Girth (cm)*	*1000 Seed Weight*	*Yield/Plot (kg/ha)*
S1=75x25	12.13	13.27	13.02	1100.00	1,900.00
S2=75x20	10.53	12.20	9.56	930.00	1,650.00
S3=75x15	9.01	9.13	10.17	970.00	1,590.00
S4=75x10	10.53	11.10	9.10	1000.00	1,800.00
LSD (P = 0.05)	NS	1.56	1.42	16.25	38.75

Discussion

The positive effects observed in the yield and yield determining parameters (Tables 2 and 3) under score the idea that spacing plays a key role in maize production. The growth recorded supports the findings of Schuthesis (2007) who observed that even distribution of rainfall enhance early uniform emergence and good growth of corn. The marked effect observed on growth could be due to rainfall distribution but not intensity. Plant height was evaluated to determine the vegetative growth of maize in line with the findings of Pfeiffer and Harris (1990) who observed and suggested that plant measurement are used as an indicator of vegetative growth. The performance of maize variety TZESR — Y was enhanced vegetatively at S4 (75 cm x 10cm) which gave clear lead of plant height. The low density had greater canopy light interception than the high density. The greater closeness encourages greater etiolation which resulted in taller plants. The wider spacing enjoyed a temporal difference which helped in reducing competition for the growth factor such as light. Weak stems that encouraged lodging was observed during this research which might be due to closer spacing that might lead to etiolation. Other factors like crop variables, amount of water expected during growing season and distribution may also be responsible. The findings from this study corroborates that of Rowland (1993) who found that narrow spacing in maize encourages plant growth with weak stems and also encourages lodging. Characters that determine the overall performance of the crop were used to evaluate the yield. This is necessary because yield is a quantitative character and therefore influenced by a number of traits acting singly or interacting with each other. Positive effect was observed in the yield and yield determining parameters. S1 (75cm x 25cm) gave the highest 1000 seed weight (1100g) and yield of (1900kg/ha) respectively. This study is in total agreement with Rehn and Espig, (1991) and Jenniffer (1996) who found that tropical maize yield an average of 1.2 to 2.0 **t/** ha under sole cropping with a varying population density. However, S1 (75cm x25cm) that gave the highest yield of 1900kg/ha in this study is contrary to the findings of Ogunbodede and Olakojo (2001) who recommended that maize should be sown at 75cm x75cm at 2 seeds per hill or 50cm x 50cm at one per hill in sole cropping.

Conclusion

From the results of this study, it could be concluded that spacing has varied effect on the growth and development of maize. The maize variety TZESR — Y performed better in terms of growth and yield at S1 (75cm x25cm) with a yield of 1900kg/ha whereas S1 (75cm x 25cm) recorded the lowest yield of 1590kg/ha. This study has provided useful information on the effect of varied spacing on maize that increases its growth potential for commercial production in Mubi. Based on the results obtained from the study, S1 (75cm x 25cm) gave the highest yield of 1900kg/ha and is therefore recommended for optimum production of maize in Mubi. Further comparative study on the effect of spacing on maize variety TZESR — Y research is suggested.

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