EFFECT OF TILLAGE AND WEED CONTROL METHODS ON THE GROWTH AND YIELD OF MAIZE (*Zea mays* L)

Adesina, O. A.[1*] A.P. Ajakpovi [2]. H.A Ibrahim[3]

[1] Crop Production Department, Federal University of Technology Minna.
[2] Department of Agricultural Economics and Extension Services, Federal University Oye- Ekiti.
3 Crop Production Department, Federal University of Technology Minna

*Corresponding Author's Email: adolwak@gmail.com. GSM: 07033160767

ABSTRACT

A field experiment was conducted during the 2007 raining season at the research farm of Institute of Agricultural Research and Training (IAR&T) Moor Plantation Ibadan to determine the effects of tillage and cultural weed control method on growth and yield of three maize varieties. The tillage methods evaluated are ploughed twice (T_1), ploughed twice, harrowed once (T_2), ploughed twice harrowed once and ridged (T_3) and zero tillage (T_4). The cultural weed control adopted was hoe weeding and the three maize varieties used are Suwan– ISR – Y (Suwan I Striga Resistance- Yellow) (V_1), TZPBSR – W (Tropical Zea mays Population Borer and Streak Resistant - White) (V_2) and DMR – LSR – Y (Downey Mildew Resistant, Late maturing Streak Resistant, Yellow) (V_3). Results showed that T_1 favours the highest response of all the three varieties for vegetative growth and yield under cultural weed control method. All the 3 varieties had high yield value under T_1 (Suwan–ISR–Y = 4755.6Kg/ha, TZPBSR–W = 7555.6Kg/ha and DMR–LSR–Y = 4311.1Kg/ha). The highest yield (7555.6Kg/ha) was obtained with TZPBSR–W. All varieties had their least yield under T_4. The T_1 was recommended for maize cultivation especially under cultural weed control method.

KEYWORDS: *Cultural, growth, tillage, weed, yield.*

INTRODUCTION

Maize belongs to the family graminae and is one of the most important food crop worldwide with a remarkable production potential (Jennifer and Gregory, 1997; Komolafe, 2007unpublished; Nuss and Tanumihardjo, 2010). The origin of maize has been a matter of controversy but the most common opinion is that maize originated through domestication of wild grass Teosinte (*Zea mexicana*) which is native to Mexico, Guatemala and Honduras. Maize is one of the crops that are produced in greater quantities than other crops (Jennifer and Gregory, 1997). In Africa, Nigeria in particular, maize is one of the crops used by many families to ameliorate poverty by using it to replace other costlier foods. Maize brings people and culture together and help them realise their dependence on one another (Iwuafor, 1986, unpublished; Nuss and Tanumihardjo, 2010).

According to Oguntoyinbo (1987), Maize performs best on well drained, aerated, warm, deep and soft loam having adequate organic matter content and rich in nutrient. Different tillage operations are usually carried out before maize is planted based on how much money the farmer is having to spend or the time available in the growing season for land preparation. Decisions on tillage practices by farmers' are usually made not in relation to intended weed control method, be it chemical (herbicides) or cultural (hoe weeding) due to knowledge gap and lack of awareness by famers. Osunbiten *et al*., (2005) indicated that soil bulk density decreases with the degree of soil manipulation during tillage practices with no tillage having the highest and ploughed harrowed having the least. They stated further that effects of the degree of soil manipulation on hydraulic conductivity, soil bulk density, soil strength and penetration consequently affects crop productivity (Kayode and Ademiluyi, 2004; Ressia *et al*, 2003). To this extent, Douglas (1995) stated that care must be taken in soil manipulation since tropical soils are physically fragile, generally low in fertility and easily eroded when cleared of natural vegetation.

Weeds on the other hand are unwanted plants that struggle for existence in competition with crops. Several researchers (Steiner and Twomlow, 2003; Lehoczky and Reinsinger, 2003) have reported a yields reduction of up to one tonne per hectare in maize as a result of weed invasion, and that to boost maize production, the effect of weeds should be reduced. Weeds can be controlled culturally and chemically among other methods (Parish, 1990).

The economic importance of maize necessitates the study of factors that will improve its growth and yield. Thus there is need to determine what the impact of these land preparation methods in combination with cultural weed control method will have on maize yield. Hence, the objective of this study was to determine the effect of different tillage practices and cultural weed control method on the growth and yield of maize.

METHODOLOGY

Experimental Site

The experiment was carried out at research farm of Institute of Agricultural Research and Training (IAR&T) Moor Plantation Ibadan.

Treatment and experimental design

The treatment comprised of factorial combination of four tillage practices (ploughed twice-T_1, ploughed twice and harrowed one- T_2, ploughed twice and harrowed once and ridged T_3 and zero tillage-T_4), one weed control method (Cultural weed control: hoe weeding) and three maize varieties (Suwan-ISR-Y, TZPB-SR-W and DMR-LSR-Y) arranged and laid out in a randomized complete block design and replicated three times. Plot size for each treatment was 6.5m by 6.5m.

Planting and Crop Maintenance

Three varieties of maize were used as test crops. Three seeds were planted per hole and thinned to one plant per stand after two weeks. Hoe weeding was used as cultural weed control method. It was regularly done at three weeks interval and weeded three times before terminating the experiment.

Data collection

Crops growth data which includes stem girth (cm), number of leave and plant heights (cm) were measured at four, six and eight weeks after planting (WAP). Crops yields data collected including kilogram weight per hectare for fresh weight and at 10 % moisture content.

Data Analysis

The data collected were subjected to Analysis of Variance (ANOVA). Where there is significant difference among the treatments, the Duncan Multiple Range Test (DMRT) at 5% significant level was used for mean separation.

RESULTS AND DISCUSSION

Table 1 shows the result of physical and chemical analysis carried out on soil sample obtained from the experimental site. The textural class of the soil used for the experiment is sandy-loamy. The pH is slightly acidic

This soil structure and texture is suitable for maize cultivation according to AIC, (2004) which states that maize is well adapted to a well-drained sandy loam to silt loam soils.

The effects of tillage on growth parameters of maize varieties under cultural weed control method

Table 02 shows the mean value for stem girth of maize plants at 4, 6 and 8WAP under cultural weed control method. The highest stem girth size was obtained in DMR-ISR-Y under ploughed twice at 4WAP. TZPB-SR-W was significantly different ($p \leq 0.05$) at 6WAP and 8WAP under ploughed twice. The least value was obtained in Suwan-ISR-Y under zero tillage at 6WAP and 8WAP.

In Table 03, the highest numbers leaf was obtained in TZPB-SR-W at 8WAP for ploughed twice followed by TZPB-SR-W and DMR-LSR-Y with same leaf numbers each in ploughed twice and harrowed once. The number of leaf was the same for ploughed twice, ploughed twice and harrowed once and ridged at 4WAP. The least number of leaves at 8WAP is consistent with ploughed twice and harrowed once, ploughed twice harrowed once and ridged and zero tillage.

The effects of tillage on growth parameters of maize varieties under cultural weed control method for plant height are shown in Table 04. The highest value was obtained in DMR-LSR-Y under ploughed twice and harrowed once at 4WAP and 6 WAP. DMR-LSR-Y had the highest value at 8WAP under ploughed twice. The least value was consistent under zero tillage at 4, 6, and 8 WAP. The difference in height was more significant in DMR-LSR-Y at 4WAP in ploughed twice harrowed once.

Poor responses was obtained under zero tillage in almost all the growth parameters under cultural weed control method and this is an indication for poor growth and yield. Also, the highest value gotten in ploughed twice in most of the growth parameters under cultural weed control method is a pointer to good conformation and high yield. This is because there was adequate room for photosynthesis, proper nutrient and water utilization and the ability of the plant to bear maize cob at a proper level above the ground without lodging, thereby preventing rodents, disease and insect attacks. This best performance

under ploughed twice also agrees with the recommendation of Agribusiness Information Centre, (2004) that "there is no need of excessive soil manipulation for maize production."

Effects of Tillage and Cultural weed control on the yield (kg/ha) of Maize Varieties (Fresh weight and at 10% Moisture Content)

Table 06 showed the mean yield of three maize varieties for Fresh weight and at 10% moisture content (MC) under cultural weed control method. TZPB-SR-W had the highest yield for Fresh weight in ploughed twice while the least yield was gotten in DMSR-MSR-Y at 70 MC under zero tillage. It was also followed by TZPB-SR-W under ploughed twice harrowed once. At 10% MC Suwan-ISR-Y was significantly higher than the rest under T_1, followed by TZPB-SR-W also under T_1. DMR-LSR-Y had lowest yield in zero tillage under cultural control method for Fresh weight and 10% MC.

CONCLUSION AND RECOMMENDATIONS

With the result obtained from growth and yield performances of the three varieties of maize under different tillage and cultural weed control method, it can be concluded that ploughed twice is the best tillage method as it best favours growth and yield of maize. It is hereby recommended that ploughed twice should be used for maize cultivation especially under cultural weed control method.

ACKNOWLEDGEMENTS

My gratitude goes to my supervisor, Dr O.B Adetayo and Mr Wale Adetayo for their immense contribution towards the completion of this study.

Table 1.The soil physical and chemical properties of the site prior to planting.

Parameters	Values
Ph	5.79
Ca (cmol/kg)	0.86
Mg(cmol/kg)	0.72
K(cmol/kg)	0.13
Na(cmol/kg)	0.52
H^+	0.12
Av. P(cmol/kg)	4.30
Zn(cmol/kg)	8.00
C.E.C(cmol/kg)	2.35
% Organic Carbon	0.68
% Organic Matter	1.17
% N	0.07
% Sand	76.8
% Silt	13.00
% Clay	10.02

Table 2: The Effects of Tillage and Cultural weed control on the Stem Girth (cm) of maize varieties

VxT	4WAP	6WAP	8WAP
V_1T_1	2.73	5.23^{b}	4.57^{b}
V_1T_2	2.76	4.63^{b}	4.83^{b}
V_1T_3	2.46	4.20^{b}	4.73^{b}
V_1T_4	2.58	3.43^{bc}	4.13^{b}
V_2T_1	2.86	6.50^{a}	7.47^{a}
V_2T_2	2.43	5.23^{b}	5.86^{b}
V_2T_3	2.60	5.33^{b}	5.96^{b}
V_2T_4	2.70	4.20^{b}	4.17^{b}
V_3T_1	2.86	5.16^{b}	5.33^{b}
V_3T_2	3.20	4.70^{b}	5.03^{b}
V_3T_3	2.83	4.66^{b}	4.87^{b}
V_3T_4	2.70	4.76^{b}	4.23^{b}
CV%	13.77	15.68	15.65
S.E.M	0.38	0.76	0.80

Means with the same letter are not significantly different (at 5% level of significance) according to Duncan Multiple Range Test.
KEY: V_1=Suwan-ISR-Y; V_2= TZPB-SR-W; V_3= DMR-LSR-Y.
T_1= Ploughed Twice T_2= Ploughed Twice, Harrowed Once T_3= Ploughed Twice Harrowed Once and Ridged T_4= Zero Tillage
WAP= Week After Planting

Table 3: Effects of Tillage and Cultural weed control on the Number of Leaves for Maize varieties

VxT	4WAP	6WAP	8WAP
V_1T_1	6[b]	8	11
V_1T_2	6[b]	9	9
V_1T_3	6[b]	7	9
V_1T_4	6[b]	7	10
V_2T_1	6[b]	9	12
V_2T_2	7[a]	8	12
V_2T_3	7[a]	8	11
V_2T_4	6[b]	8	9
V_3T_1	7[a]	8	10
V_3T_2	6[b]	8	11
V_3T_3	6[b]	8	10
V_3T_4	6[b]	8	9
CV (%)	10.33	17.96	10.96
S.E.M	0.66	1.43	1.06

Means with the same letter are not significantly different (at 5% level of significance) according to Duncan Multiple Range Test.

Table 4: Effects of Tillage and Cultural weed control on the Plant Height (cm) of maize varieties.

VxT	4WAP	6WAP	8WAP
V_1T_1	19.70 [b]	45.60 [a]	106.26
V_1T_2	16.36 [b]	43.30 [a]	88.76
V_1T_3	16.53 [b]	32.03 [b]	83.03
V_1T_4	16.20 [b]	28.33 [b]	68.77
V_2T_1	21.46 [b]	45.37 [a]	71.10
V_2T_2	16.40 [b]	42.56 [a]	100.03
V_2T_3	18.03 [b]	40.07 [a]	66.63
V_2T_4	17.87 [b]	31.03 [b]	51.86
V_3T_1	21.86 [b]	51.53 [a]	108.70
V_3T_2	30.46 [a]	52.10 [a]	104.33
V_3T_3	17.60 [b]	46.50 [a]	92.60
V_3T_4	22.17 [b]	42.20 [a]	84.63
CV%	31.25	17.75	30.65
S.E.M	6.11	7.40	26.22

Means with the same letter are not significantly different (at 5% level of significance) according to Duncan Multiple Range Test

Table 5: Effects of Tillage and Cultural weed control on the yield (kg/ha) of Maize Varieties (Fresh Weight and at 10% Moisture Content (MC)

VxT
V_1T_1
V_1T_2
V_1T_3
V_1T_4
V_2T_1
V_2T_2
V_2T_3
V_2T_4
V_3T_1
V_3T_2
V_3T_3
V_3T_4
CV%
S.E.M

REFERENCES

Agribusiness Information Centre (2004). Production Guidelines for Maize. Agribusiness Information Centre. Federation of Indian Chamber of Commerce and Industry (FICC). 4th Floor Federation House Tansen Marg. New Delhi. , pp. 1-7

Bolarinwa Senjobi, (2007). The effects of Tillage Practices on soil properties under a maize cultivation in South Western Nigeria . 2007. Olabisi Onabanjo Universiry, Ogun state, Ayetoro, Nigeria.

Douglas, C. Couper (1995). No Till farming in the humid and sub-humid. Tropics Africa. IITA Research Guide 3, 2nd Edition. Training programme IITA, Ibadan, Nigeria. Pg. 5-8

Iwuafor, E.N.O, (1998). The effects of Tillage and crop residue management practices on soil properties and crop performance in the southern Guinea Savanah zone of Nigeria. Unpublished Ph,D Thesis Ahmadu Bello University Zaria. Pp 254-255

Jennifer G kling and Gregory E, (1997). Morphology and Growth of Maize, IITA/CIMMYT Research Guide 9, 2nd Edition. P 36.

Kayode J and Ademiluyi B (2004). Effect of Tillage Methods on Weed Control and Maize performance in Southwestern Nigeria. Journal of Sustainable Agriculture, (2004). Vol 23(No 3) pg. 39-45doi.org/10.1300/J064v23n03_05

Komolafe R.F. (2007). Comparative effects of Organo-mineral Fertilizer and Poultry Dung on the growth of Maize. Unpublished student research work Federal College of Agriculture, Moor Plantation, Ibadan. Pg 1-8.

Nuss, E. T., and Tanumihardjo, S. A. (2010). Maize: a paramount staple crop in the context of global nutrition. *Comprehensive reviews in food science and food safety*, *9*(4), 417-436.

Steiner, K.G. and Twomlow, S. (2003).Weed management in conservation tillage systems. *African Conservation Tillage Network. Information Series, 8 (Retrieved from* http://www.act-africa.org/file/newsletters/promotional_materials/bulletins/Weed%20Management%20in%20Conservation%20Tillage%20Systems.pdf)

Lehoczky E, Reisinger P, (2003). Study on the Weed-Crop Competition for Nutrients in Maize. Applied Biology Sciences 2003. Georgiken Faculty of Agriculture Science Keszthely, Veszprein University H -8360 Keszthety, Deak F.U. 16, Hungary. Pg 378-80(*Retrieved from* https://www.researchgate.net/profile/Eva_Lehoczky/publication/8557341_Study_on_the_weed-crop_competition_for_nutrients_in_maize/links/58e634d4a6fdcc6800b44c30/Study-on-the-weed-crop-competition-for-nutrients-in-maize.pdf)

Oguntoyinbo S.S, (1987). Climatic Variability and Food Crop Production in West Africa Geo Journal 5(2), Pg 139-149(*Retrieved from* https://link.springer.com/content/pdf/10.1007/BF02582047.pdf)

Osunbitan J.A, Oyedele D.J., Adelaku K.O. (2005).Tillage Effects on Bulk Density, Hydraulic Conductivity and Strength of a Loamy Sand Soil in Southwestern Nigeria. Soil and Tillage Research, Vol. 82 No. 1. Pg 57-64doi.org/10.1016/j.still.2004.05.007

Parish S, (1990). A review of Non-Chemical Weed Control Techniques. The West Scotland College, Auchin Cruive, Ayr KA6 5HW, Scotland. Academia publishers Printed in Great Britain. Vol. 7 pp 117-137doi.org/10.1080/01448765.1990.9754540

Ressia J. Mendivila, Balbuena R, Pablo M. de, (2003). Corn Hybrid Emergence under the Tillage Systems. Agro-Ciencia, 2003 (vol. 19) (No. 2) 115-119