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CROP EMERGENCE AND FIELD PERFORMANCE OF *ZEA MAYS* AS INFLUENCED BY TILLAGE PRACTICES AND SEEDING DEPTH IN ULTISOL OF SOUTHEASTERN NIGERIA.

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ABSTRACT: The two trials were carried out independently at the Teaching and Research Farms of Federal University of Technology Owerri, (2006) and Imo State Polytechnic (2007), Imo state, Nigeria to assess the seeding emergence and field performance of *Zea mays* (Maize) as affected by Tillage Practices and seedling depth in an Ultisol. A 2x3 split-plot treatment arrangement fitted into Randomized Complete Block Design (RCBD) with 3 replications was used for the trial. Planting in the tilled plots gave 12% in 2006 and 6% in 2007 more seedling emergence than planting on the no till plots. Stands grown on the tilled plots(mounds) were significantly (P>0.05) greater in height, leaf area, and root density, number of ears per plant, cob length, number of grains per cob and seed yield than those grown in no- till plots. Highest seed yield was obtained at 3cm seedling depth. Therefore growing maize on mounds and at the depth of 3cm is recommended for maximum seed yield.

KEY WORDS: Nickel toxicity, Percentage survival, New Calabar River, Mixed culture, Biological activities,

INTRODUCTION

It has been reported by Anyaegbu et al (2009) that one of the physiological problems facing out people is hunger. Anyawale (2008) in Rome indicated that more than 500 million people would suffer from hunger and malnutrition in 2005. Currently, about 862 million people are suffering from hunger and malnourishment (Anyanwale 2008). The hunger problem has been attributed by food and Agriculture Organization (FAO) to "global warming", a natural agent of degradation of land for farming which lead to desertification, ozone layer thinning, flooding, erosion etc, all of which led to crop failures and therefore the current global food crises.

Zea mays (maize) is one of the staple food crops affected by the global warming. In most part of the country particularly in the Eastern Nigeria, the average seed yield of maize has gone as low as 1.2 t /ha as against 4 to 4.5 t /ha under normal circumstances.

United States of America has been the largest supplier of corn to developing countries including Nigeria but unfortunately because of its interest in bio-fuel for ethanol, it has presently concentrated on the production of non-edible variety of *Zea mays* for ethanol production, *Anyaegbu et al (2009*). The above situation has led to shortage of edible corn in developing countries.

Emphasis therefore is to find a system for improved production of maize to make for the short fall from the supplies of the USA to feed the ever increasing human population without significant damage to production resources, soil and water and the aerial environment.

This study, therefore, is aimed at evaluating the effect of tillage practices and seeding depth on the crop emergence and root proliferation of *Zea mays* in an ultisol in South Eastern Nigeria.

MATERIALS AND METHODS

The first trial was conducted at the Research farm of Federal University of Technology, Owerri, Imo state (Latitude 05^0 27$^/$N Longitude 07^o 24$^/$E) in 2006 while the second trial took place at Imo State Polytechnic, Imo state (Latitude 07^{o}00E, Longitude 07^{o}07$^/$E) in 2007. Both locations are in the Rainforest zone with an average annual rainfall of 1600mm. The soil of both sites is characterized by deep porous red soils derived from sandy deposits in the coastal plains which are highly weathered, low in mineral reserve and natural fertility, hence farmers in the area practice bush fallowing as a means of improving soil fertility *(Ononoiwu 1990*).

The tillage techniques used were 0.3m tillage and no tillage while the planting depths were 3cm, 5cm and 7cm respectively. Thus, a 2 x 3 split plot treatment arrangement fitted into a randomized complete block design (RCBD) with 3 replications was used in the trials. The experimental layout was 20m x 11.0m (220m^2). Each block (2.5m x 20m each) contained 6 plots. A plot measured 3.0m x 2.5m (7.50m^2) and was separated from each other by 1m alley or access path.

In the 0.3m tilled plots, hand-held hoes were manually used to prepare the soil to specified depths. The *Zea mays* variety used was Oba Super II hybrid. Planting was done at the same day. The *Zea mays* seeds were manually planted at 0.25 x 0.75m spacing and at three different planting depths in the tilled and no till plots, giving a population of 50 plants per plot and 53,333.3 plants/ha. Originally, the maize seeds were planted two per hole and were thinned down to one seed per hole, one week after emergence. Weeding was done manually using hoe, 3 weeks after planting (WAP) and N.P.K. (15:15:15) fertilizer applied in all plots manually using band application method at 0.15m radius, at the rate of 90kg ha^{-1}. Each of the experiments lasted for 60 days after planting (DAP).

Data collected include: seedling emergence per treatment from the 6th to 14th DAP, height per plant at 60 DAP, using meter rule, Leaf Area at 60 DAP as recommended by *Francis et al (1969*), Leaf Area Index (LAI), Dry root density and bulk density by core method, *(Blake and Hartge, 1986*) and seed yield. The data collected were analyzed using analyses of variance test. Means were separated with F-LSD at P>0.05 using SAS software.

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Table 1: Metrological conditions in Owerri in the two years of trial

TOTAL RAINFALL 2006 **MONTHS**

	JAN	FEB	MAR	APRIL	MAY	JUN	JUL	AUG	SEP	OCT	MEAN
Total Rainfall (mm)	0	20	115	220	205	265	305	415	306	285	237
No. of rain days	0	4	8	13	15	15	18	21	18	18	142
Max. Temp (O^0c)	36	36	35	34	32.3	30	28	30	27	33	32
Min. Temp (^oC)	30	29	28.1	27.5	25	23	24	22	24	24.8	26

2007

TOTAL RAINFALL 2007 **MONTHS**

	JAN	FEB	MAR	APRIL	MAY	JUN	JUL	AUG	SEP	OCT	MEAN
Total Rainfall (mm)	0	11	116	105	110	315	408	110	385	395	217
No. of rain days	0	2	7	7	10	17	21	8	20	15	12
Max. Temp (O^0c)	36	36	34	34	30	30	28	30	30	30	32
Min. Temp (^oC)	31	30	30	26	26	24	21	20	20	18	20

RESULTS AND DISCUSSION

Although the year, 2006 was more rainy than 2007, the two years (of the trial) were indeed rainy years in owerri considering the 10 years (1995-2005) average of 172m per month. The rains commenced early and the second modal rains were in torrent (Table 1). The good performance of the crops in these two years was directly related to the good rainfall distribution and temperature.

Table 2 shows the effect of tillage practices and seeding depth on vegetative characters of maize. Seedling emergence of maize planted on tilled soil and on flat (no till) differed significantly (P>0.05). At 14 days after planting (DAP), maize seedlings in tilled plots emerged 12% in 2006 and 16% in 2007 more than those planted in no tilled plots. The basic principles of tillage operation is to effect changes in the structure of the soil, the cause a better aeration, increase the oxidation of chemicals and possible nutrients absorption by plants. Consequently favorable conditions are provided for the germination and emergence and subsequent establishment. Hence the significant emergence of the seedlings in the tilled plots in both locations over those in no tilled plots may be attributed to the above stated conditions. *Theodore et al (1998)* reported that differences in soil surface characteristics and disturbance patterns, tilled and non tilled production systems influenced seed survival and dominance and as well as the timing and magnitude of emergence.

Differences in seeding depths also significantly (P>0.05) affected seedling emergence of maize. Irrespective of tillage practices, maize seeds planted at the depth of 3cm recorded more percent emergence (P>0.05) than others, followed by those planted at 5cm depth. Lowest seedling emergence 66% in 2006 and 51% in 2007 was recorded from seeds planted at 7cm deep. The above result on seedling emergence as influenced by depth of plant is in line with the report of *Gupta et al 1988* who reported that shallower planting allowed earlier emergence owing to higher soil temperature and less resistance adding that under field conditions if no rain follows planting, the soil moisture content decreases over time and the decrease is greater at the shallower depths. *Lindstorm et al (1976)* observed faster emergence of wheat seedlings for decreasing depths of seedling under a uniform soil moisture distribution with depth. Generally, seedling emergence is affected by some physical properties including soil temperature among others, thus shallower planting allowed earlier emergence owing to higher soil temperature and less resistance. The trend of seedling emergence of maize as influenced by tillage and seeding depth was directly related to the root density of the crops. Hence, the earlier a seedling emerge, the earlier it starts photosynthesizing and the earlier the root development commences. Thus, stands grown on tilled plots produced more roots than those on no tilled plots.

Osuji (1978) indicated that low root density of maize in sub soil horizon on no tilled plots may be attributed to variations in gravel concentration in some soils. In another trial, *Barber (1999)* reported that root response to tillage is mediated through tillage effect on mechanical impedance, noting that roots are generally restricted to shallow layers in directly sown (no till) crops rather than in those sown after tillage because of higher bulk density and greater soil strength of surface layers in no till soils as compared to tilled soils.

The maize stands established on the flat and mound differed significantly (P>0.05) in plant height (Table 1). The height advantage of maize planted on mounds over those on the flat (no till) is attributable to better utilization of soil nutrients made readily available in the pulverized mounds. Significant interactions existed between tillage practices and seedling depths. Results on plant height showed similar trend to that of leaf area of maize.
For the two years of the trial, bulk density was higher in the no till plots than in the tilled plots. *Varsa et al (1998)* found that tillage reduced bulk density by loosening the soil particle, thus increasing root proliferation and hence crop yield. Irrespective of tillage systems, bulk density was not significantly influenced by differences in the seedling depth used in this trial. *Chaudhary et al (1985)* reported in their work that there was higher bulk density at different depths in the no till compared with conventionally tilled plots.

The yield components of maize assessed in this trial were found to be significantly (P>0.05) influenced by tillage and seeding depths, (Table 4). Stands of maize in the tilled plots produced more ears per stand , longer cobs and more grains per cob (P>0.05) than those grown in no tilled plots. However, irrespective of tillage practices, maize stands established from 3cm soil depth, significantly (P>0.05) produced more number of ears, longer cobs and number of grains per cob than other stands planted at the depth of 5cm and 7cm respectively. Performance of stands grown at 7cm soil depth was relatively poor. The trends of the yield components as affected by tillage and seeding depth were similar to the absolute seed yield of the crops. Thus in the two years of the trial, highest seed yield of maize (P>0.05) was recorded from stands grown in tilled plots. This is an indication that favorable environmental conditions are provided by tillage. Hence, *Okaka et al (2009)* in their cassava trial, reported that cassava plants grown on mounds promptly initiated and commenced tuberization earlier than those planted on the plot that were still burdened with penetrating intact soil. Mounding thus is an advanced tillage method and according to *Chokor et al (2008)* tillage has one of its main objective to stimulate root re-growth.

Table 2 Vegetative characters of maize as influenced by tillage and seeding depth

Tillage	**Depth** Cm	**Characters** Seedling emergence		Plant height (m)		Leaf Area per plant (m)		% Root Density per plant (60 DAP)	
		2006	2007	2006	2007	2006	2007	2006	2007
	3	95	87	2.76	2.94	0.61	0.68	18.6	17.5
Till	5	91	68	2.12	2.07	0.52	0.67	15.9	14.6
	7	60	53	0.94	1.81	0.35	0.49	8.70	6.8
Mean		82	69	1.94	2.27	0.49	0.61	14.4	12.97
No till	3	71	72	1.06	2.28	0.52	0.48	4.8	3.9
	5	72	60	0.98	22.0	0.49	0.41	4.76	3.6
	7	60	51	0.70	1.69	0.21	0.21	2.01	1.84
Mean		68	61	0.91	2.05	0.41	0.37	3.85	3.11
FLSD(p>0.05)		5.63	4.38	0.26	0.471	0.21	0.14	1.51	1.32

Table 3: Effects of Tillage and Seeding depth (cm) on Bulk density (Mg^{m-3})

Tillage	**Seeding Depth**	**DAYS AFTER PLANTING (DAP)**		
	3	1.04	0.82	1.25
Till	5	1.04	1.02	1.25
	7	1.09	1.04	1.23
Mean		1.06	0.96	1.24
	3	1.41	1.44	1.66
No till	5	1.41	1.45	1.66
	7	1.41	1.45	1.67
Mean		1.41	1.44	1.66
LSD P>0.05		0.081	0.051	0.056

Table 4: Yield components of maize as influenced by Tillage and Seeding depth

Tillage	**Seeding Depth**	**DAYS AFTER PLANTING (DAP)**					
		No. of ears/Plants		Length/Cob (cm)		No. of grains/ Cob	
		2006	2007	2006	2007	2006	2007
Till	3	2.5	2	22	26	341	361
	5	2	2	21	23	311	232
Mean		1.9	1.7	18.5	21.3	260	254
No till	3	1.6	1	14.5	18.5	138	141
	5	1	1	15	18.0	127	138
	7	1	1	9.8	13.2	106	111
Mean		1.2	1	13.1	16.6	123.7	130
LSD (P>0.05)		0.14	0.03	2.63	3.24	8.51	26.61

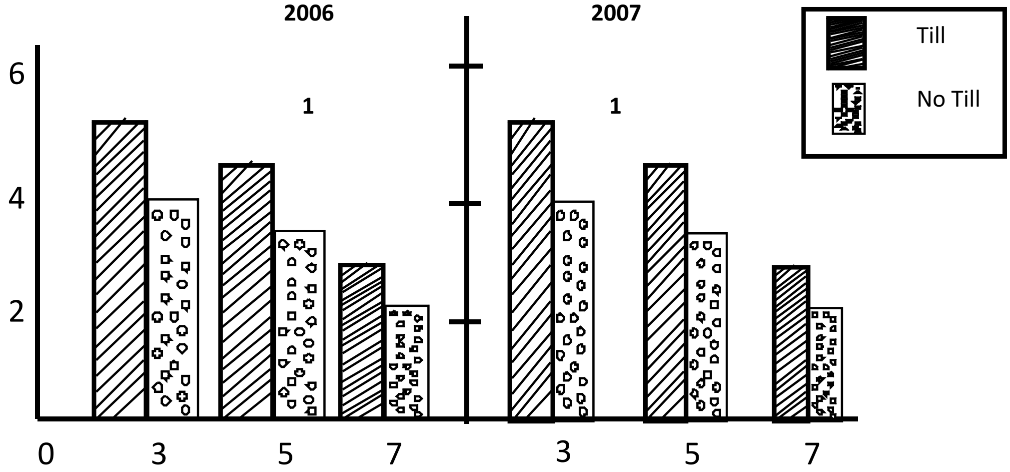

Fig. 1: Seed yield of maize as influenced by seedling emergence and Tillage.

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