Effect of Direct Seeding and Transplanting on the Performance of Maize (*Zea may* L.) in South-Western Nigeria

[1]*Adesina J. M., [2]Afolabi. L. A., [3]Aderibigbe, A. T. B. and [4]Sanni, K. O.

[1-3]Department of Crop, Soil & Pest Management Technology, Rufus Giwa Polytechnic, P. M. B 1019, Owo, Ondo state, Nigeria. Department of Crop Production and Horticulture, Lagos State Polytechnic, P. M. B. 1007, Ikorodu, Lagos State, Nigeria.
* moboladesina@yahoo.com. Tel: +2348037110905

Abstract: The experiment was conducted to find out the effects of direct seeding and transplant age on the growth and performance of maize. TZSR-Y-1 and TZESR-Y maize seeds were planted directly and seedlings were transplanted at 9, 14, 19, and 24 days after planting (DAP). Results from the study revealed that there were significant differences between the treatment in terms of leaf area and total dry matter at 25 days after transplanting. Seedling transplanted at 14 DAP had a significantly higher leaf area than the other transplants and direct seeded crops. Direct seeded crops had a significantly higher dry matter than the seedlings transplanted at 19 DAP. From the studies, it may be concluded that seedlings of maize can be transplanted at 14 DAS without serious retardation at the vegetative growth stage.

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Introduction

Maize (*Zea mays* L.) is relatively a short duration crop and capable of utilizing inputs more efficiently and is potentially capable of producing large quantity of food grains per unit area. It can successfully be cultivated twice a year [1] Maize is an important cereal crop that provides staple food to large number of human population in world. In developing countries maize is a major source of income to many farmers [2]. It is the top most ranking cereal in terms of higher grain yield and holds third position in respect of total production following wheat and rice in the world. It is nutritionally superior to most other cereals as it contains 72% carbohydrate, 9.0% protein, 3.4% fat, 1.7% ash, 4.8% oil, 1.0% starch fibre, 3% sugar, 0.30% thiamine, 0.08% riboflavin and 1.9% niacin [3]. Iken and Amusa [4] reported that Western Nigeria generally produced about 50% of Nigeria green maize while the remaining 50% being split between the North and the East. It is the third most important cereal after sorghum and millet [5].

Transplanting involves carefully moving seedlings at appropriate times from the nursery to the field (e.g. 2-3 weeks for tomatoes, 6-8 weeks for tobacco, and 6-7 months for cocoa [6]. Transplanting is commonly used in rice cultivation and in the production of vegetable crops. In areas of Africa and Asia, transplanting is also a traditional practice in sorghum and millet cultivation, either to fill gap after crop emergence and thinning, or to compensate for a growth period that is too short for a complete crop cycle. The advantages of this practice are more uniform fields, better control of crop density, and higher yield [7]. Khehra *et al* [8] reported that maize can be successfully transplanted during winter in India. He ascertained that the successful cultivation of transplanted maize could reduce crop rotation in the main field and provide new and more economical crop rotations. Sharma *et al*,[9] observed that maize transplanted at 10 day old after planting yielded equally good as direct seeded compared to seedling transplanted at 20 days-older after transplanting gave very poor grain yield. Maize transplanting in Nigeria is very uncommon, probably because of lack of appropriate technique and lack of irrigation to control moisture at the time of transplanting. Therefore, this study was conducted to evaluate the effects of different planting techniques on the performances of maize in order to improve crop stand in South-western Nigeria

Materials And Methods

The experiment was conducted in the screen house of Teaching and Research Farm of Rufus Giwa Polytechnic, Owo, Ondo state, Nigeria (latitude 5^0 12' N and longitude 5^0 36' E), in the year 2010. Seeds of TZSR-Y-1 (V1) and TZESR-Y (V2) maize varieties (used for the study were obtained from the Ondo State Agricultural Development Programme, Akure. The experiment was laid out on a Complete Randomised Design with three replications. The treatments were direct seeded, transplanting at 9, 14, 19 and 24 days after planting (DAP). TZSR-Y-1 (V1) and TZESR-Y

(V2) maize varieties were sown into nursery polythene bags. The plants were watered frequently to avoid wilting. Seedlings were uprooted in the evening from 0.08 0.1m deep with the aid of table fork and transplanted same day into 10 polythene bags per treatments. Transplanted maize plants were watered immediately after transplanting while the second watering was done 5 days later to facilitate establishment of seedling. Rouging of weeds were carried out at when due to avoid undue competition with the seedlings.

Determination of Growth Parameters

Five plants were randomly selected and tagged per treatment to evaluate growth variables such as such as plant height, number of leaves, leaf area, and root length at 5 days interval and dry matter accumulation. Plant height was determined with a meter rule at the distance from soil level to the terminal bud; number of leaves was determined by visual counting of the leaves, leaf area was measured by using leaf area meter model AAM- 5[10], root length was determined by carefully using razor to cut the polybag and thereafter dissolved the ball of earth in a bucket of water to remove the plant without damaging the roots, the root length was thereafter taken with meter rule from the root tip to the plant base. Dry matter accumulation was determined by harvesting the plant at 25 DAT rinsed with deionized water, put in an envelope and oven dry at 65^0C for 48 h until a constant weight was obtained.

Statistical Analysis

The data collected were subjected to linear regression analysis to determine the rate of growth of plant height, root length, leaf area and dry matter and regression coefficient (b) was used for the Analysis of variance (ANOVA). Treatment means were compared using LSD at $P<0.5$.

Results And Discussion

Plant Height Growth Rate

Plant heights were significantly influenced by the age of transplants (Table 1). The rate was faster in seedling transplanted at 19 DAP (Table 2). Plant height was not significantly influenced by transplanting at 25 DAT (Table 4). Similar height was observed between the direct seeded and other seedlings transplanted at 19 and 14 DAP in V2 (Table 5). Seedlings transplanted at 24 DAP recorded 100% mortality before 25 DAT. Mckee [11] reported that root disturbance in transplanted seedlings caused changes in physiological process and decreased growth on transplants. However, difference in height was not observed in this study between the surviving transplants, which indicates that transplanting was tolerated even at 19 DAP.

Leaf area development

Leaf area development was significantly influenced by variety treatment and their interactions (Table 1). Leaf area was larger in TZSR-Y-1 (V1) than TZESR-Y. Among the treatments, seedlings transplanted at 14 DAP had significantly higher leaf area than the other treatments including the direct seeded. Leaf areas of various treatments responded differently with varieties. V2 had higher leaf area than V1 in To T1 and T4 but lesser value than T2 (Table 2). At 25 DAT, leaf area was significantly different between varieties and treatment (Table 4 and 5). This result showed that earlier transplanted seedlings had higher leaf area. This confirmed earlier studies that early transplanting encourages higher leaf area over late transplanting [12, 9, 13] .

Root Length Development

Rate of growth in roots was significantly influenced by treatments and interaction between treatment and varieties (Table 1). Root length development was faster at 14 DAP and it was higher than other treatments except seedlings transplanted at 24 DAP in V2 (Table 3). At 25 DAT, direct seeded crop has statistically similar root length with other treatments (Table 4 and 6). The result supports the findings of Tanjuro et al [14, 15, 12]

Dry Matter Yield

The rate of dry matter yield was significantly influenced by variety, treatment and their interactions (Table 1). Dry matter growth rate was higher in V2 than V1. Among the treatments, 9 DAP transplants had significantly higher dry matter yield rate than the other treatments in V2 and direct seeded had higher rate than other treatments in V1 (Table 3). At 25 DAT, direct seeded crops had a significantly higher dry matter than T3 transplants (Table 4 and 6). The marked differences in total dry matter production among transplanting dates were probably caused by differences in their leaf area development values. Schinir *et al*. [17] reported that in transplanted rice, total matter accumulation increased steadily after crop establishment until maturity and responded positively to early transplanting. Generally, early transplanting contributed to increased vegetative growth and thus greater biomass production. The result from this study also with conforms with Adelana [12, 16, 18] that early transplanting greatly influenced dry matter accumulation in transplanted tomato, sorghum and rice respectively.

Conclusion

The study revealed that among the methods of planting evaluated, 9 DAP shows higher growth rate in terms of plant height, leaf area, root length and total dry matter yield at 25 DAT which implies that maize cultivation can be achieved with 9 DAP seedlings.

Table 1. Anova showing Mean square of growth rates in height, leaf area, Root length and Dry matter in transplanted maize seedling.

Source of Variation	Degree of Freedom	Plant height (cm)	Leaf Area (cm^2)	Root length (cm)	Dry matter (g/plant)
Variety	1	10.96	0.012*	0.031	71.95***
Treatment	4	16.62***	0.013***	1.37**	34.20***
Interaction	4	6.76	0.006*	3.69***	36.66***
S. Error	39	3.03	0.002	0.29	5.22
C. V (%)		5.52	1.96	18.45	4.96

Table 2. Transformed mean values (√x+5) of growth rates in height and Leaf area in transplanted maize varieties.

Plant height (cm/plant)	V1	V2	Treatment mean	Leaf Area (cm^2/plant)	V1	V2	Treatment mean
To	3.09	2.28	2.68	T0	2.25	2.32	2.28
T1	2.42	2.33	2.38	T1	2.25	2.32	2.28
T2	2.44	2.29	2.37	T2	2.40	2.34	2.37
T3	7.86	3.58	5.72	T3	2.26	2.30	2.28
T4	2.57	2.67	2.62	T4	2.25	3.30	2.27
Variety Mean		3.68	2.63			2.28	2.31
LSD Variety			NS				0.02
LSD Treatment			1.47				0.04
LSD Interaction			NS				0.05

NB V1 = TZSR-Y V2 = TZESR-Y
T0 = Direct seeded T1 = 9 days after planting
T2 = 14 days after planting T3 = 19 days after planting
T4 = 24 days after planting DAT= Days after transplanting NS = Non significant

Table 3. Transformed mean values (√x+5) of growth rates in height and Leaf area in transplanted maize varieties

Plant height (cm/plant)	V1	V2	Treatment Mean	Leaf Area (cm^2/plant)	V1	V2	Treatment Mean
To	2.33	2.54	2.44	T0	3.72	7.34	5.53
T1	2.55	2.86	2.70	T1	2.94	12.72	7.83
T2	4.56	2.42	3.49	T2	2.89	3.40	3.14
T3	2.63	2.98	2.83	T3	3.40	3.09	3.24
T4	2.39	4.00	3.20	T4	3.20	3.34	3.24
Variety Mean		2.90	2.96			3.25	5.94
LSD Variety			NS				1.22
LSD Treatment			0.45				1.92
LSD Interaction			0.64				3.00

Table 4. Anova showing Mean square of plant height, Leaf area, root length and Dry matter at 25 DAT in transplanted maize varieties

Source of Variation	Degree of Freedom	Plant height (cm)	Leaf Area (cm^2)	Root length (cm)	Dry matter (g/plant)
Variety	1	62.18	134.56**	75.09	4.90*
Treatment	4	81.52	0.013***	27.24**	4.72***
Interaction	4	4.72	0.006*	5.02	0.44
S. Error	39	33.13	0.002	4.68	0.77
C. V (%)		8.02	1.96	10.98	15.05

Table 5. Transformed mean values (√x+5) of growth rates in height and Leaf area in transplanted maize varieties at 25 DAT

Plant height (cm/plant)	V1	V2	Treatment Mean	Leaf Area (cm^2/plant)	V1	V2	Treatment Mean
To	72.65	74.75	20.81	T0	149.49	142.15	145.02
T1	73.07	74.77	20.78	T1	159.66	149.88	154.76
T2	69.76	74.82	20.22	T2	150.54	158.77	154.66
T3	65.94	68.23	16.95	T3	125.52	146.68	136.11
Variety Mean	70.35	73.14			149.37	146.31	
LSD Variety			NS				3.70
LSD Treatment			1.47				2.30
LSD Interaction			NS				NS

Table 6: Transformed mean values (√x+5) of growth rates in root length and Dry matter in transplanted maize varieties at 25 DAT

Root length (cm/plant)	V1	V2	Treatment Mean	Dry matter (g/plant)	V1	V2	Treatment Mean
To	18.35	23.27	20.81	T0	3.56	3.66	3.61
T1	18.98	22.58	20.70	T1	2.44	3.50	2.97
T2	19.16	21.49	20.22	T2	2.11	3.25	2.86
T3	14.08	19.83	16.95	T3	1.34	2.18	1.76
Variety Mean		21.74	17.64			2.36	3.15
LSD Variety			NS				NS
LSD Treatment			NS				1.12
LSD Interaction			NS				1.15

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