Effect of Transplanting Age on Vegetative and Root Development of Maize (*Zea may* l.) in South Western Nigeria

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Abstract: An experiment was carried out to study the effects of transplanting age on the vegetative and root development of two maize varieties. (DMR-ESR-Y and DMR-LSR-Y). Maize seeds were planted directly and some were transplanted at 9 days after emergence (DAE), 14 DAE, 19 DAE and 24 DAE. The parameter studies were plant height, leaf area, root length and dry matter yield. The results showed that there were significant difference between the treatment in terms of leaf area and total dry matter at 25 days after transplanting. Seedling transplanted at 14 DAE 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 seedling transplanted at 19 DAE. From the studies, seedlings of maize can be transplanted at 14 DAE without serious retardation at the vegetative stage.

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Introduction

Maize (*Zea may*) or corn is a member of the grass family *poaceae* (formerly *Graminae*) and one of the most important grains crops after wheat and rice. Geographically, it is the most widely planted cereal. In Nigeria, it is the country's third most important cereal following sorghum and millet respectively [8].

Maize is a multi-purpose crop plant that can be utilized as food, livestock feed and fuel, and for manufacturing starch, flakes, alcohol, salad oil, soap, varnish paint, painting and similar products [3] [5]. The demand for maize is rapidly increasing day by day worldwide. It is expected to be increased further with the establishment of maize-based food industries, poultry, dairy and fish farms. This may lead to an enormous increase in maize import, which may result in depleting the hard-earned foreign currency [4]. Maize production in Nigeria is low with farmers yield of < 1.0t/ha [6]. Due to the importance of this crop attempts should be made to increase total production not only through increased land area but also by the use of appropriate cultural practices.

The effect of transplanting age on yield is an issue often broached by the growers of horticultural and agronomic crops in an effort to maximise production potentials [19]. Appropriate age of transplant has been reported to improve crop growth, yield and quality [10] [16] [13]. Despite general interest in this area, the literature is surprisingly sparse. Though, agronomic interest in transplanting age is most prominent in vegetables and rice [7] [14] [12]. However, Khehra et al [11] reported that about 4-leaf stage is the optimum stage for transplanting maize to obtain good seedling establishment and agronomic performance. Grain yield was significantly reduced when seedling of 20 day- old or older were used. While, Sudipta *et al* [17] stated that transplanting of 21 day-old maize seedlings had poorer vegetative growth, earlier flowering and maturation than direct-seeded crop, Biswas [4] observed that maize transplanted at 14 and 21 days-old produced statistically similar grain yields.

The investigation on transplanting age of maize is far from being complete as evident in conflicting results in the literature. This is likely due to the different environmental and cultural practices that the plants were exposed to in the greenhouse and in the field. This study is therefore aimed at assessing the responses of maize varieties to transplanting shock and determining the appropriate transplanting age for maize in south western Nigeria.

Materials And Methods

The experiment was carried out in the screen house of Rufus Giwa Polytechnic, Teaching and Research Farm, Owo, Ondo State South western Nigeria with longitude 7^0 6' N and latitude 5^0 36' E. Seeds of maize varieties (DMR-ESR-Y and DMR-LSR-Y) were obtained from the seed store of Institute of Agricultural Research and Training, Moor Plantation, Ibadan, Oyo State, Nigeria.

The experimental design was Complete Randomised Design (CRD). There were 5 methods of planting: direct seeded, transplanting at 9, 14, 19 and 24 days after emergence (DAE). DMR-ESR-Y (V1) and DMR-LSR-Y (V2) maize seeds were sown in polythene bags as nursery and later transplanted at various ages into twenty 2- litre-size polythene bags.

The soil in the polythene bags was loam-sandy and slightly acidic and the soil was pre-heated to ensure sterilization. Frequent light watering was applied in nursery to escape wilting damage. Seedlings were uprooted using table fork. Transplanted treatments were watered immediately after transplanting, followed by a second watering 5-7 days later to facilitate the establishment of seedlings. At sowing, direct seeded pots had adequate moisture for germination. The plant height, root length, leaf area and total dry matter were measured at 5 days interval with 5 plants taken randomly per treatments. The data collected were subjected to linear regression analysis to determine rate of growth of plant height, leaf area, root length and dry matter, while regression co-efficient (b) was used for the ANOVA. Treatment means were compared using LSD at $P < 0.5$.

Result And Discussion

Growth rates in plant heights were significantly influenced by the age of transplants (Table 1). The rate was faster in seedling transplanted at 19 DAE (Figure 1). Plant height was not significantly influenced by transplanting at 25 DATP (Table 2). Similar height was observed between the direct seeded and other seedlings transplanted at 19 and 14 DAE in V2 (Figure 1). At 25 DAT seedlings transplanted at 9 DAE recorded the highest height (73.07) and least height in 19 DAE, while seedlings transplanted at 24 DAE recorded 100% mortality before 25 DATP. However, difference in height was not observed in this study between the surviving transplants, which implies that transplanting was tolerated even at 19 DAE.

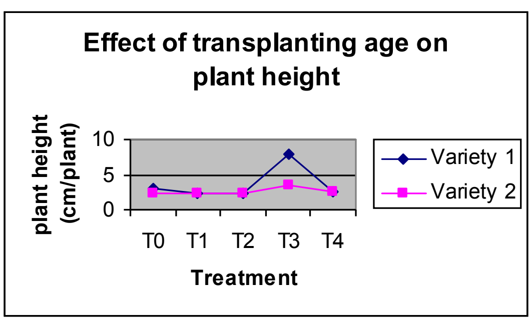

Figure 1: Effect of transplanting age on plant height

Rate of leaf area development was significantly influenced by variety treatment and their interactions (Table 1). Leaf area was larger in DMS-LSR-Y (V2) than DMS-ESR-Y (V1). Among the treatments, seedlings transplanted at 14 DAE 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 (Figure 2). At 25 DATP, leaf area was significantly different between varieties and treatment (Table 2). The leaf area was larger in maize plant transplanted 9 and 14 DAE compared to direct seeded and 19 DAE transplants (Figure 5). This result showed that earlier transplanted seedlings had higher leaf area. This confirmed earlier studies [1] [13] that early transplanting encourages higher leaf area development.

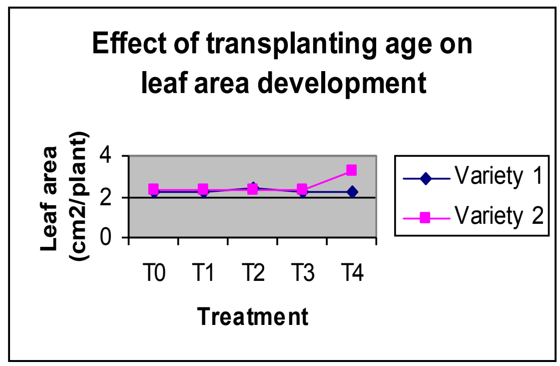

Figure 2: Effect of transplanting age on leaf area development

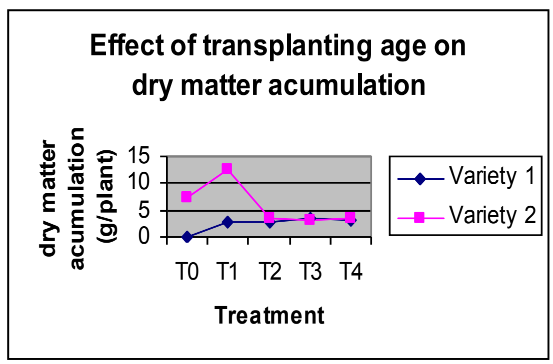

Figure 3: Effect of transplanting age on dry matter accumulation

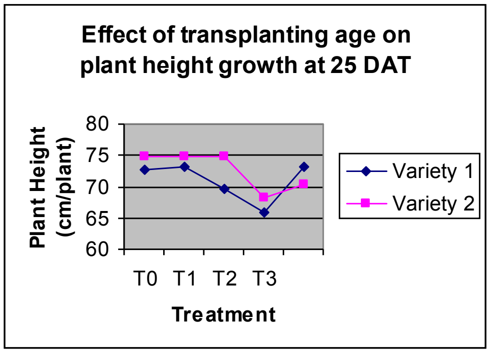

Figure 4: Effect of transplanting age on plant height growth at 25 Days after transplanting

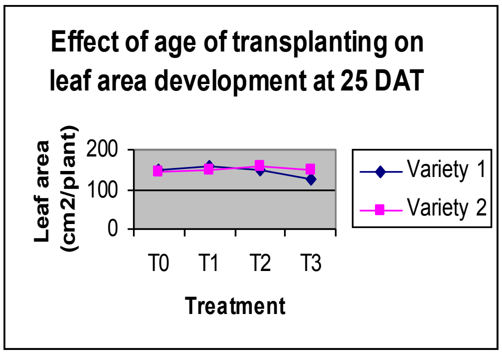

Figure 5: Effect of transplanting age on leaf area development at 25 days after transplanting

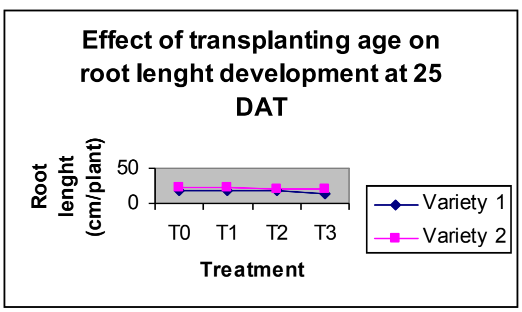

Figure 6: Effect of transplanting age on root lenght development at 25 days after transplanting

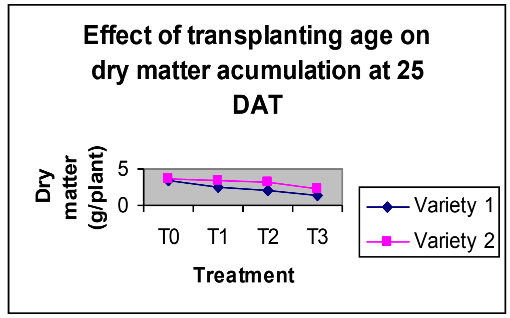

Figure 7: Effect of transplanting age on dry matter acumulation at 25 days after transplanting

Rate of growth in roots was significantly influenced by treatment and interaction between treatment and variety (Table 1). Root length development was faster at 14 DAE and it was higher than other treatments except seedlings transplanted at 24 DAE in V2 (Figure 3). At 25 DATP direct seeded crop has statistically similar root length with other treatments (Figure 6). The results support the findings of previous workers 18] [15] [13].

The rate of dry matter accumulation was significantly influenced by variety, treatment and their interaction (Table 1). Dry matter accumulation rate was higher in V2 than V1. Among the treatments, 9 DAE transplants had significantly higher dry matter accumulation rate than the other treatment in V2 and direct seeded had higher rate than other treatments in V1 (Figure 3). At 25 DATP, direct seeded crops had a significantly higher dry matter than T3 transplants only (Table 2.). Among the varieties direct seedlings had the grater dry matter accumulation (3.56 for V1 and 3.66 for V2). In all V2 accumulate dry matter than V1 (Figure 7). The marked difference in total dry matter production among the treatments were probably caused by differences in their leaf area development This result conforms to Agbaje [2] that dry matter progressively decreases with delayed transplanting time. Also Iqbal *et al*, [9] reported that in transplanted rice, total dry matter increased steadily after crop establishment until maturity and responded positively to early transplanting.

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 (cm)	Degree of Freedom	Plant height (cm)	Leaf Area (cm^2)	Root length	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	6.79	0.006*	3.69***	36.66***	
Error	39	3.03	0.0002	18.45	5.22
C. V (%)	5.52	1.96	18.45	4.96	

** Highly significant
* Significant

Table 2: **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	3	81.52	27.24**	629.96	4.72**
Interaction	3	4.72	5.02	418.30	0.44
Error	24	33.13	4.68	988.50	0.77
C. V (%)		8.02	10.98	21.26	15.05

** Highly significant
* Significant

Conclusion

This experiment indicated that maize cultivation by transplanting can be tolerated up to 14 DAE because this has total dry matter similar to that of direct seeded. Among the methods of planting evaluated, 9 DAE shows appreciable higher growth rate in terms of plant height, leaf area, root length and total dry matter at 25 DATP. Generally, early transplanting and contributed to increased vegetative growth and thus greater biomass production. Therefore, it is recommended that optimum plant population can be achieved with 9 DAE transplanting of maize in south western Nigeria where birds and lizards pick dibbled grains and emerging cotyledons.

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