



Effects of Different Planting Dates On The Growth And Yield Of Tomato (*Lycopersicon esculentum*) In Rainforest Agro ecological Zone of Nigeria

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Abstract

This study investigated effects of different planting dates – June, July and August on the growth and yield of two hybrid tomato varieties (*N'dara* and *Benito*) and a local variety called *N'teje* local was used as a check. The experimental design was a split plot, having three replicates each. Growth and yield parameters such as plant height, number of branches, days to flowering, number of fruit, fruit weight and fruits per plant were significantly ($P > 0.05$) increased by the various planting dates used. August planting date had comparably better yields of 297.1g/plant compared with that of the plantings done in June and July of 215.6g/plant and 37.1g/plant respectively. There were also significant differences among the varieties. *N'dara* was first to flower, produced the highest number of flowers and also had the highest fruit yield of 203.9g/plant *Benito* was first to set fruit while *N'teje* local was first to mature. This implies that August is the best planting date for growing tomato in Anwai, as a result of the high fruit yield and growth performance.

Keywords: tomato, planting dates, , hybrid, variety, performance.

Introduction

Tomato, *Lycopersicon esculentum* Mill, belong to the genus *Lycopersicon* and family solanaceae (Cox, 2000). Is a widely grown crop, and is one of the most important and popular fruit vegetable in the world (Bao, 1999). It is a native of central and South America but today it is widely grown all over the world (Saidu, 1998).

Tomato is an important condiment in most diets and a very cheap source of vitamin and minerals (Odeleye and Odeleye, 2001). The fruit may be eaten raw, cooked or processed into juice, sauces, ketchup, paste and puree which are used for cooking in soup and stew (Saidu, 1998). Apart from its characteristic flavour and aroma, it is also a good source of vitamins (A and C) and minerals (Kaur *et al*, 1999; Akanbi and Oludemi, 2003). It also functions as an antioxidant and helps in lowering DNA damage, malignant transformation and other parameters of cell damage and reduces cancer risk.

Tomatoes are also high in lycopene, the major carotenoid contained in tomatoes that is responsible for the deep red colour (Cox, 2000) and numerous studies have confirmed that people who consume increased amount of tomato products experience marked reductions in cancer risk (Giovanucci, *et al*, 1995). Fayemi (1999) also reported that the juice contains relatively large quantities of vitamin C, moderate quantities of soluble sugars, several organic acids and mineral salts.

Tomato has firmly implanted itself as a major player in diets of many nationalities. In the tropics, the great economic importance of tomato makes it one of the most popular and widely grown vegetable crops. It provides a ready source of income to the farmer, rich source of minerals and vitamins A and C, used for making soup, salads, and Suit drinks (Babatola and Olaniyi, 1998). It is currently the most important commercial vegetable grown in Nigeria (Ibrahim, *et al*. 2000). It is becoming an increasingly important crop in delta state because of its

diverse uses and its relatively high productivity under condition in which many other crops may fail (Akparobi and Ilondu, 2002).

Weather factors greatly influence crop yield, and time of planting varies within the different agro ecological zones as a result of differences in climatic factors. Planting in March with the early rains was found to be the best for the crop in South-western Nigeria (Adelana, 1977). While in the Northern plain is usually between June to August and November to December (Agrawal, 1995). Infact, tomatoes can be transplanted almost through the year in Northern Savanna zone (Quinn, 1974). In the Hills, tomato is also planted during May and June.

The importance of tomatoes as a dietary staple vegetable in Nigeria and its high income potentials has made the need for increased production very necessary, in other to meet all year round food demand, in and out of season. Consequently, the effect of planting date on tomatoes have been seen in the degree of pest and disease incidence, low fruit setting and poor yield performance of the crop (tomato) which constitute one of the major limiting factors to production in this area. Hence the study was under taken to identify the best planting date suitable for growing tomato in Anwai, Delta State.

Materials and Methods

Description of Study Area

The Experiment was conducted at the Teaching and Research farm of Delta State University Asaba Campus, Delta State. Asaba is located at latitude 06⁰14'N and longitude 06⁰49'E at the Equator with a hot humid climate, mixed vegetation of forest interspersed with shrubs and grasses. The rainfall pattern is bimodal with peaks in July- September, and an annual rainfall amount of 1121mm; a mean temperature of 26.3-30.5⁰C and relative humidity varies from 61-89%. The rainfall pattern of Anwai is bimodal like that of rainforest zone with distinct dry and wet season. The dry season runs from early November to the end of March, while the rainy/wet seasons runs between mid - March to mid-November. There are usually two rainfall peaks in this study area and these are July and September (NIMET, 2013).

Experimental design

The materials used for this experiment are: Two Hybrid seeds of tomato namely N'dara, Benito from NIHORT, Ibadan and local variety known as N'teje local.

Three varieties of tomatoes; N'dara, Benito and N'teje local were evaluated using split plot design with three replicate. A split plot design was used, having a main and sub plot. The main plot comprises of the planting dates June, July and August while the sub plot is made up of the tomato varieties. The tomato seeds were planted at Three (3) different planting dates (each having 4 weeks' intervals each). The weeks of planting include: 1st week, 5th week, 9th week. The plantings were done in 3rd June, 1st July and 2nd of August. The tomato seeds were first sown on nursery beds for intensive care before transplanting.

Nursery Management

The seedlings were raised in open seedbeds on the 8 of May, 9th of June and 11th of July, 2007. The sizes of the seedbeds were 5m by 5m long. The beds received basal dressing of organic manure two days before the sowing operation. The seeds were sown in rows at spacing of 5 cm by 5 cm and depth of about 1.5mm in the soil.

The seedbeds were shaded to protect them from sun scorching, heavy rains and winds and excessive drying. The seedbeds were mulched and watered every morning with a fine spray from

a watering can. During germination, the shade was gradually removed to harden the seedlings.

After the third week in the nursery vigorous disease free seedling were transplanted to the main field. The seedlings were transplanted in the late afternoon and watered till they were well established.

Data Collected

Data collected was based on the effect of planting date on the yield performance of tomato cultivars are as follows: 5 plants per plot were selected for data collection.

- i. Number of leaves; by counting representative sample.
- ii. Number of branches; by counting representative sample.
- iii. Plant height; with the aid a meter rule.
- iv. Days to 50% flowering; by observing when 50% of the plant population that flowers first.
- v. Day to 50% fruiting; by observing when 50% of the plant population that set fruits first.
- vi. Total number of fruit per plant; by counting the number of fruit per plant.
- vii. Yield of fruit (fresh weight); by measuring with a triple beam balance.
- viii. No of flower per plant; by counting the number of flower per plant

Data Analysis

Data relating to the above aspects were combined and treatment means was subjected to analysis of variance using SAS (2001) and means separation was done using Least Significance Difference (LSD) at 5% level of probability.

Results

Effects of Planting Dates on Plant Height of Tomato

The effect of planting dates on tomato plant height indicated that there were gradual increases in the plant height with age. Significant differences ($P < 0.05$) were observed in plant height among the planting dates. The highest mean values of 32.6, 43.9, 51.5 and 85.60cm were recorded for August planting while the lowest were recorded for July planting of 17.4, 19.9, 31.4 and 43.4cm at 2, 4, 6, and 8WAT respectively (Table 1).

The effect of varieties on plant height also shows that there were gradual increases in plant height with plant age among the three varieties. Significant differences ($P < 0.05$) were observed at 2 and 6 WAT. The highest mean values of 24.7, 30.3, 43.3 and 62.3cm were recorded for N'dara at 2, 4, 6 and 8WAT, while the lowest mean values of 21.1, 28.5, 39.3 and 61.9 were observed for Benito at 2, 4, 6, and 8 WAT respectively. There were no significant differences in plant height at 4 and 8 WAT (Table 2).

Effect of Planting Dates on Number of Branches of Tomato.

The effect of planting dates on the number of branches showed that there were gradual increases in the number of branches with age. Significant differences ($P < 0.05$) at all the stages of growth. The highest mean values of 12.4, 13.4, 21.1, and 24.1 were recorded for August planting while the lowest mean values of 10.0, 10.8, 14.4, and 15.8 were observed for July planting at 2, 4, 6, 8 WAT (Table 3).

The effect of the varieties on number of branches indicated gradual increase in the number of

branches among varieties with age throughout the sampling period.

There were no significant differences ($P < 0.05$) among the three varieties at 2, 4, 6 and 8 WAT. The highest mean value of number of branches of 11.6, 13.3, 17.2 and 19.1 was recorded for N'teje local at 2, 4, 6 and 8WAT while the lowest mean value of number 11.0, 12.6, and 18.4 were observed for N'dara at 2, 4, 6, 8 WAT respectively (Table 4).

Table 1: Effect of planting dates on plant height

Date of Planting	WEEKS AFTER PLANTING			
	2	4	6	8
June	17.0	25.5	45.4	57.2
July	17.4	19.9	31.4	43.4
August	32.6	43.9	51.5	85.6
LSD(0.05)	2.4	2.1	1.0	7.3

Table 2: Effect on the variety on plant height

Varieties	WEEKS AFTER TRANSPLANTING			
	2	4	6	8
N'dara	24.7	30.3	43.3	62.3
Benito	22.1	28.5	39.3	61.9
N'teje local	20.3	30.5	44.9	62.1
LSD(0.05)	2.4	3.0	5.2	7.3

Table 3: Effect of Planting Dates on Number of Branches/Plant

Date of Planting	WEEKS AFTER TRANSPLANTING			
	2	4	6	8
June	11.8	15.3	15.4	16.4
July	10.0	10.8	14.4	15.8
August	12.4	3.4	21.1	24.1
LSD(0.05)	1.2	2.0	6.1	1.3

Table 4: Effect of variety on number of branches/plant

Varieties	WEEKS AFTER TRANSPLANTING			
	2	4	6	8
N'dara	11.0	12.6	16.5	18.4
Benito	11.6	13.4	16.7	18.8
N'teje local	11.6	13.3	17.2	19.1
LSD(0.05)	1.1	2.0	2.0	1.3

Effect of Planting Dates on Number of Leaves of Tomato

The effect of planting dates on the number of leaves showed that there was gradual increase in the number of leaves with age. Significant difference at ($P < 0.05$) was noticed in the number of leaf among the three planting dates throughout the sampling period. The highest mean values of 45.2, 49.1 and 53.7 were recorded in August planting while the lowest mean values of 35.4, 40.6 and 41.6 were observed for July at 4, 6 and 8WAT (Table 5) respectively.

The effect of the varieties on number of leaves of tomato also indicates that they were gradual increase in the number of leaf among the three varieties. Significant difference ($P < 0.05$) was observed only at 2 WAT. The highest mean values of 38.7, 42.9, 45.9 and 48.1 were recorded for Benito at 2, 4, 6 and 8WAT, while the least mean values of 35.0, 40.8, 44.7 and 47.3 were observed for N'teje local at 2, 4, 6, 8 respectively (Table 6).

Table 5: Effect of Planting Dates on Number of Leaves/Plant

Date of Planting	WEEKS AFTER TRANSPLANTING			
	2	4	6	8
June	41.8	44.7	46.1	47.8
July	33.0	35.4	40.6	41.6
August	34.6	45.2	49.1	53.7
LSD(0.05)	3.1	2.2	7.2	3.4

Table 6: Effect of Variety on Number of Leaves/Plant

Varieties	WEEKS AFTER TRANSPLANTING			
	2	4	6	8
N'dara	35.9	41.6	44.7	47.8
Benito	38.7	42.9	45.9	48.1
N'teje local	35.0	40.8	44.7	47.3
LSD(0.05)	3.1	2.2	1.8	3.4

Effect of Planting Dates on Days to 50% Flowering Days to 50% Fruiting

The result indicates that the tomato plants performed better in August than in June and July, in days to 50% flowering and days to 50% fruiting. N'dara was first to flowering took an average time of 48 days to flower followed by N'teje local which took 50 days then for Benito 56 days in August planting date. While for July planting date, N'teje local was first to flowering took an average time of 55 days to flower followed by N'dara which took 58 days then for Benito 62 days. Then for June planting date also N'teje local was first to flowering took an average time of 52 days to flower followed by N'dara which took 55 days then for Benito 56 days. (Fig. 1).

At 50% fruiting, the maximum time taken to set fruit in August planting was by Benito which was 64 days followed by N'teje local (58days) then N'dara which took 52days while for July planting date was by Benito which took 70 days followed by N'dara 65 days, while N'teje local recorded 50 days to fruiting. Then for June planting date, N'teje local was first to fruit setting with an average of 52 days, followed by N'dara (55days), then Benito 56 days. (Fig.2).

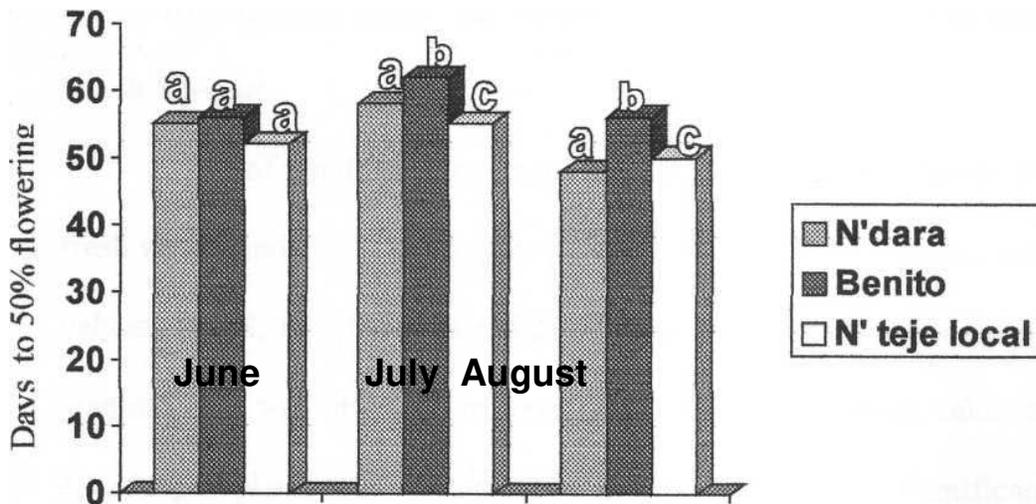


Fig. 1: - Average number of days to flowering. Means with the same letter are not significantly different at (P<0.05) at the same month.

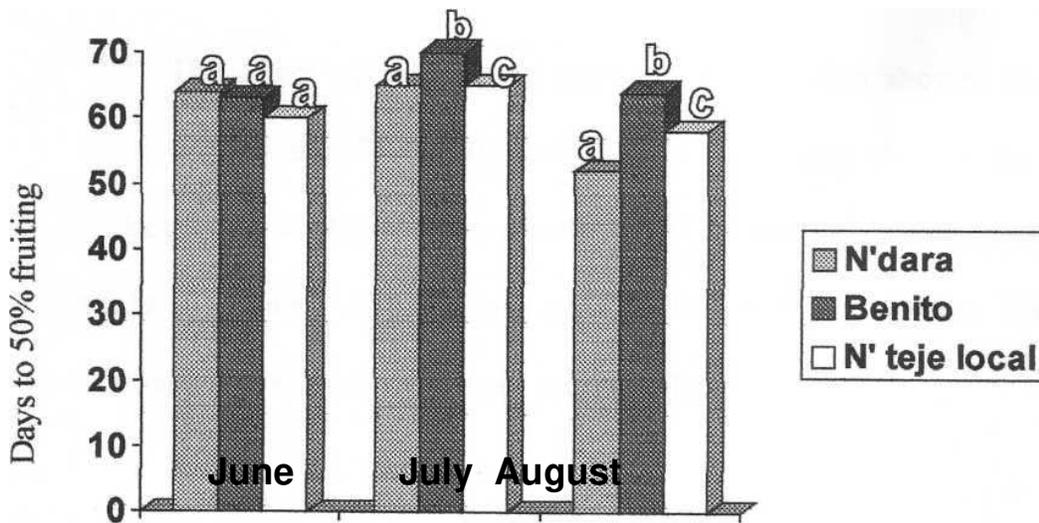


Fig. 2: - Average number of days to fruiting. Means with the same letter are not significantly different at ($P < 0.05$) at the same month.

Effect of Planting Dates on Number of Truss, Fruit Yield and Fresh Weight.

Effect of planting dates on number of truss, number of fruit and fresh weight indicates that August planting date have the highest mean values of 11.8, 12.2 per plant and 297.7g/plant respectively. While July planting date was observed to have the lowest, with a mean value of 3.5, 6.4 per plant and 37.1g/plant respectively (Table 7). Significant differences ($P < 0.05$) were observed in fresh weight and member of fruit among the three planting dates. There were also no significant differences observed throughout the sampling period in the number of truss.

The effect of varieties on number of fruits also showed that there was no significant difference ($P < 0.05$) among the varieties. N'dara have the highest mean value of 9.3, 10.6 and 203.9g/plant while the lowest mean values of 8.0, 9.2 and 167.9g/plant was observed for N'teje local respectively (Table 8).

Table 7: Effect of Planting Dates on Number of Truss, Number of Fruit and Fresh Weight

Date of planting	Number of truss	Number of fruit	Fresh weight g/plant
June	10.1	10.6	215.6
July	3.5	6.4	37.1
August	11.8	12.2	297.1
LSD (0.05)	5.4	6.0	117.3

Table 8: Effect of Planting Dates on Number of Truss, Number of Fruit and Fresh Weight.

Varieties	Number of truss	Number of fruit	Fresh weight g/plant
N'dara	9.3	10.6	203.9
Benito	8.2	9.3	178.5
N'teje local	8.0	9.2	167.9
LSD (0.05)	5.4	6.0	117.3

Discussion

Effects of planting dates on plant growth.

The results clearly indicate that there were gradual increase in the growth characters such as plant height, number of branches, number of leaves and leaf area with plant age as displayed by the varieties. Planting in August at 8 WAT showed that plant height ranged from 43.4cm to 85.6cm, number of branches 15.8 to 24.1, number of leaf 41.6 to 53.7 and leaf area from 184.9.0cm² to 364.5cm². August had the highest plant height, number of branches, number of leaves and leaf area as 85.6cm, 24.1, 53.7 and 364.5cm² respectively, while the least was in July planting with 43.4cm, 15.8, 41.6 and 253.0cm² respectively. The variety N'dara also had a higher plant height compared to N'teje local and Benito 2002 (62.3cm, 62.1cm and 61.9cm) at 8WAT. The increase in these growth characters could be attributed to genetic factors of the varieties. The result obtained here also agrees with earlier work done by Ibrahim *et al.*, (2002) who reported that differential in growth indices of crop is normally attributed to their genetic make-up.

The plant height at maturity of all the varieties was significantly different ($P < 0.05$). N'dara and Benito exhibited an erect and bushy growth pattern. N'dara was significantly taller than the other varieties having a height of 62.3cm and the least plant height was observed in Benito as 61.9cm. These results agreed with the report by Adedeji (2004) who reported minimum and maximum plant height of 45cm and 80cm respectively.

Effects of planting dates on flowering and fruiting behaviour.

Significant differences in flowering and fruiting characters were observed among the tomato varieties in the different planting dates. Days to first flower ranged from 48 to 64days. Kokalis *et al.*,(2002) reported flowering period ranging from 45-55 days in different cultivars, the differences may be attributed to genetic factors. July planting had the poorest fruit yield as a result of the infection of the plant with diseases. Tomato is a crop that requires just a moderate climate to thrive well, a not too hot weather and moderate rainfall, and this experiment commenced in the month of June when the rains have started increasing and in July, the rains was at its peak thereby enhancing the spread of the diseases (Batu, 2003).

Observations from the result also indicates that number of truss ranged from 41.38 to 128.28, fruit set ranged 52 to 70 days after transplanting (DAT). This result is in accordance with earlier work done by Syed and Kholo (2001), which showed that days to fruiting ranged from 55 days to 68 days in different cultivars. The differential in the number of truss produced and the fruit set among some cultivars is because most of the flowers fell off and did not produce any fruit due to abortion resulting from high rainfall, disease and some physiological defects.

Bodunde (1998) reported that low fruit set was not as a result of non formation of flower but was due to the inability of the flowers formed to develop into fruit due to the possible incidence of floral abnormalities such as pollen production reduction, stigma extortion, ovary weight reduction in pollen germination, slow pollen tube growth and poor overall development of the microspores.

Effects of planting dates on fruit yield

The best yield was obtained in August planting compared to that of June and July planting. The fruit yield ranged from 167.9-203.9 per plant. These differentials in fruit yield could be varietal, high rainfall, relative humidity and high incidence of disease and insect pest dependent among other factors. Batu (2003) reported that another added factor for the reduced yield is the

time of planting. Also it was observed that some of the fruits aborted before maturity thus leading to the low number of fruit (yield) per plant Fruit weight (g/plant) also ranged from 37.1g to 297.7g. This finding is also in consonance with the view of Adebayo and Ekpo (2001) and Nwanguma *et al.*, (1998) in the studies on the use of organic amendments in the control of tomato wilt disease.

The results obtained were in accordance with those of Nono Wondim *et al.*, (2001) who also observed yield in various tomato cultivars. Syed and Khalio (2001) also reported that foreign hybrid tomato cultivars showed higher variation of fruit yield, good adaptability, high yield potential and good quality compared to common (non-hybrid) cultivars.

Conclusion and Recommendations

The combined effect of planting dates on three cultivars of tomatoes; N'dara, Benito and N'teje local, was carried out in Anwai, Asaba Delta State. The three cultivars were all subjected to the same treatment and cultivation practices on a four-week interval basis, starting from June, then July and August. The result showed outstanding variation and significant differences ($P < 0.05$) based on growth parameters, days to flowering, days to maturity, number of fruit, number of truss and fresh weight of fruit per plant among the planting dates. August planting had comparably better yields of 297.1g/plant compared with that of the plantings done in June and July of 215.6g/plant and 37.1g/plant respectively. The result showed that it is to plant tomato in August in this location.

There were also significant differences among the varieties. N'dara was first to flower, produced the highest number of flowers and also had the highest fruit yield of 203.9g/plant Benito was first to set fruit while N'teje local was first to mature. This implies that August is the best planting date for growing tomato in Anwai, as a result of the high fruit yield and growth performance.

Conclusion

From this investigation, the following conclusion can be drawn.

1. The study has established the best planting date with respect to their level of high yield performance.
2. The study had equally established varietal differences and superiority in yield and fruit characters of the tested varieties.
3. It has been established equally that August is the best planting date for growing tomato in Nigeria.

Recommendation

Planting tomato in August is hereby recommended to farmer in this region for growing of tomato in order to achieve high fruit yield and growth performance.

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