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EFFECT OF TRANSPLANTING METHODS, NP- FERTILIZER RATES ON LEAF LENGTH OF FEMALE DATE PALM (PHOENIX DACTYLIFERA L.) OFFSHOOT

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ABSTRACT
Effect of transplanting methods and NP – fertilizer rates on leaf length of a female date palm offshoot was conducted over a period of 25 months (September, 2017 – September 2019). The objectives of the study are to evaluate the effects of direct and indirect transplanting methods and NP – fertilizer rates on leaf length and to determine a suitable combination that will provide longer leaves. The trial was sited at the Date Palm Research Sub – station/ Federal University Dutse (11o50'N, 09o25'E) in the Sudan Savanna ecological zone of Nigeria. The location has mean annual rainfall of about 600 mm spread over five months and average minimum and maximum temperatures of 23 and 25oC respectively. The treatments consisted of two transplanting methods (Direct: detachment of offshoot from the parent palm and directly transplanting into the field, and Indirect: detachment of offshoot from the parent palm and keeping in the nursery for 3 months before transplanting) and five NP fertilizer rates Control (0g N + 0g P), 80g N + 40g P, 160g N + 80g P, 240g N +120g P and 320g N + 160g P) arranged in a randomized complete block design with three replications. Leaf length was measured and recorded on a sample of three to five photosynthetic active leaves/plant using measuring ruler at three months' interval starting from September, 2017 to September 2019. Indirect transplanting of date palm proved more effective as it produces statistically longer leaves, an indication for better chances of crop survival and establishment.

Keywords: Date palm offshoot, direct transplanting and indirect transplanting

INTRODUCTION

Date palm, (Phoenix dactylifera L.) is a monocotyledon of the family Palmae or Arecaceae. Date palm fruits are berry containing a single seed, enclosed by fibrous parchment like – endocarp (Al-alawi, 2020). It is a dioecious tree plant, with a male and female flower on a separate plant. There is no certain way to determine at an early stage the sex of the progeny, or the fruit and pollen quality prior to the flowering, which does not occur until seven or more years from the time of seedling transplanting (FAO, 1982, Bekheet et al., 2006). Offshoot propagation produce offspring that are true to type with the parent palm, thus ensuring reliability and profitability of production. Information and research work on the response of offshoot to transplanting methods and NP – fertilizer treatment that are vital for successful offshoot establishment are lacking. Leaf length is associated with increased photosynthesis capacity of a crop and is a good measure for offshoot establishment. The longer the leaves, the more it receives solar radiation for active photosynthesis and the more photosynthetic materials are produced by the crop (Hodder and Stoughton, 1991). Zaid and Dewet (2005) established that, growth of date palm offshoot is proportional to its leaf area which is influenced by leaf length. Information and research work on NP – fertilizer requirements for transplanted date palm offshoot is also lacking, however, Klain and Zaid (2000) recommended the use of 262g N equivalent to 570g Urea 46% N, 138g P equivalent to767g Single super phosphate fertilizer (18% P2O5) for palm younger than four years. Fertilizer is applied according to the age and size of the palm in a ratio 2: 1: 3: 1 of N: P: K: Mg respectively (Williams et al., 2005). The amount of nitrogen according to the above ratio for young palm up to 18 months is 0.3kg N/palm/annum equivalent to 0.652kg Urea 46% N, small palms, 0.5 – 1.0kg N/palm/annum equivalent to 1.087 – 2.174kg Urea 46% N, medium palms, 1.5 – 2.0 kg N/palm/annum equivalent to 1.956 – 4.348 kg Urea 46% N and big palms 2.5 – 3.5kg N/tree/annum equivalent to 5.435 – 7.608kg Urea 46% N (Williams et al., 2005), hence both N and P are important plant nutrients for crop establishment. P supports root establishment and N favors biomass production (Hodder and Stoughton, 1999). The interaction between N and P will provide an indication of the best combination of N and P rates that will optimally support offshoot establishment The objective of this research is therefore:

to evaluate the effect of direct and indirect transplanting methods and NP fertilizer rates on leaf length of a female date palm offshoot, and also established a suitable combination of NP fertilizer rates and transplanting method that would produce longer leaves in female date palm offshoot.

MATERIALS AND METHODS

A field experiment was conducted to study the effect of transplanting methods and NP fertilizer rates on leaf length of a female date palm offshoot over a period of 25 months (September 2017 – September 2019). The trial was sited at the Date Palm Research Substation/ Federal University Dutse (11o50'N, 09o25'E) in the Sudan Savanna ecological zone of Nigeria. The location has mean annual rainfall of about 600mm spread over five months and average minimum and maximum temperatures of 23 and 25oC respectively. Soils of the experimental area are generally sandy loam.

The treatments consisted of two transplanting methods (Direct: detachment of offshoot from the parent palm and directly transplanting into the field, and Indirect: detachment of offshoot from the parent palm and keeping in the nursery for 3 months before transplanting into the field) and five NP fertilizer rates Control (0g N + 0g P), 80g N + 40g P, 160g N + 80g P, 240g N +120g P and 320g N + 160g P) arranged in a randomized complete block design with three replications. Two plants per experimental plot were sampled for growth measurements given a total of 60 offshoots. NP – fertilizer rates were derived from Urea (46% N) and Single superphosphate (18% P2O5) fertilizers as sources for N and P respectively. The equivalent amount of these fertilizers were determined and bulked.

Thirty offshoots that are situated at the base of the parent palm of between three to four years old, weighing about 10kg each of the Deglet Noor variety were carefully detached in March 2016 with the help of chisel, shovel, hoe, cutlass and knife and kept in the nursery. In June 2016, another thirty offshoots were also detached using the same procedure. The field was cleared, ploughed and marked out with planting positions spaced at a 7m X 7m triangular arrangement (197 palm ha1) using surveying tools: calibrated chain, ranging poles and peg and transplanting holes were dug for transplanting. Carbofuran was mixed with the soil at a rate of 0.02kg per hole. All the sixty offshoots were transplanted into the field according to the experimental design in June, 2016. Five kilograms of farmyard manure/plant were applied at transplanting and at the beginning of every raining season as a uniform requirement during the period of the study. The NP – fertilizers were applied in basins in three split doses in June, July and August each year. The experimental field was kept free of weeds by manual hoeing three times each year during the period of the study. No incidence of pest and diseases was observed and plants were mainly sustained by rainfall and irrigated with 10 liters of water every day for 5 days in a week during the dry seasons starting from December to May each year.

Data on leaf length was measured and recorded at three months' interval starting from September, 2017 to September 2019.

Leaf length: This refers to the length of photosynthetic active leaf from the apex to the apparent point of the attachment on the stem. This was measured on a sample of three to five photosynthetic active leaves/plant using measuring ruler. The average length of the leaves was recorded.

DATA ANALYSIS

Data collected was subjected to analysis of variance for randomized complete block design, to test the significance of treatment effects using Genstat 17th edition, the treatment means were separated using Duncans Multiple Range test (Duncan, 1965).

RESULTS

Table 1: Effect of transplanting methods and NP- fertilizer rates on leaf length of female date palm offshoot between September 2017 to September 2019.

	2017			2018				2019	
Treatments	Sept	Dec	March	June	Sept	Dec	March	June	Sept
Transplanting methods									
Direct transplanting	0.40b	0.54b	0.66NS	0.76NS	0.92NS	1.03b	1.10b	1.20NS	1.34b
Indirect transplanting	0.49a	0.62a	0.71NS	0.82NS	1.00NS	1.17a	1.22a	1.28NS	1.53a
SE±	0.027	0.029	0.034	0.041	0.045	0.050	0.051	0.045	0.057
Fertilizer rates (g/plant/year)									
Control	0.34b	0.40bc	0.53b	0.60bc	0.75bc	0.92b	0.99b	1.06b	1.29c
80g N +40g P	0.29b	0.32c	0.42c	0.50c	0.67c	0.72c	0.76c	0.80c	0.99d
160g N +80g P	0.31b	0.46b	0.056b	0.67b	0.78b	0.88b	0.94b	1.05b	1.19c
240g N +120g P	0.63a	0.86a	0.95a	1.09a	1.26a	1.43a	1.50a	1.59b	1.75b
320g N +160g P	0.68a	0.085a	0.94a	1.10a	1.33a	1.53a	1.61a	1.70a	1.97a
SE±	0.043	0.046	0.053	0.064	0.071	0.079	0.081	0.071	0.091
Interaction									
PM × F	*	*	**	**	**	**	**	**	**

Means followed by the same letter(s) are not statistically different at 5% level of significant using DMRT

Table 1 shows effect of transplanting methods and NP- fertilizer rates on leaf length of female date palm offshoot between September 2017 and September 2019. The effect of transplanting methods on the leaf length was statistically significant at the beginning (September and December, 2017), and towards the ends of the sampling periods (December, 2018, March and September, 2019), with the indirect transplanting method maintaining statistically longer leaves. There was however no statistical difference between March and September, 2018 and June 2019. NP-fertilizer rate 320g N +160g P produced statistically longer leaves which are at par with 240g N +120g P throughout the sampling periods except in June and September, 2019, when rate320g N +160g P produced statistically longer leaves than all other rates followed by rate 240g N +120g P. The interaction between transplanting methods and NP-fertilizer rates on leaf length was highly significant from March, 2018 to September, 2019.

Table 2. Transplanting methods and NP- fertilizer rates interactions on leaf length of female date palm offshoot March, 2018.

Transplanting methods	1	2	3	4	5
Direct transplanting	0.31e	0.51d	0.75c	0.87ac	0.85c
Indirect transplanting	0.75c	0.33e	0.40de	1.03a	1.03a
SE±			**0.075**		

Means followed by the same letter(s) are not statistically different at 5% level of significant using DMRT

Table 2 shows interaction between transplanting methods and NP – fertilizer rates on leaf length in March, 2018. The interaction between indirect transplanting method and rates 240g N +120g P and 320g N +160g P produced statistically longer leaves (1.03a), while a combination of direct transplanting method with the control produced the shortest leaves (0.31e).

Table 3. Transplanting methods and NP- fertilizer rates interactions on leaf length of female date palm offshoot June, 2018.

	Fertilizer rates				
Transplanting methods	1	2	3	4	5
Direct transplanting	0.34e	0.60d	0.87c	0.99c	1.00c
Indirect transplanting	0.86c	0.40de	0.46de	2.00a	1.20b
SE±			**0.091**		

Means followed by the same letter(s) are not statistically different at 5% level of significant using DMRT

Table 3 shows interaction between transplanting methods and NP – fertilizer rates on leaf length in June, 2018. The interaction between indirect transplanting method and rate 240g N +120g P produced statistically longer leaves (2.00a) followed by indirect transplanting method and rate 320g N +160g P (1.20b), while a combination of direct transplanting method with the control produced the shortest leaves (0.34e).

Table 4. Transplanting methods and NP- fertilizer rates interactions on leaf length of female date palm offshoot September, 2018.

	Fertilizer rates				
Transplanting methods	1	2	3	4	5
Direct transplanting	0.51e	0.84d	0.95cd	1.07bc	1.21b
Indirect transplanting	0.99cd	0.49e	0.62e	1.44a	1.45a
SE±			**0.101**		

Means followed by the same letter(s) are not statistically different at 5% level of significant using DMRT

Table 4 shows interaction between transplanting methods and NP – fertilizer rates on leaf length of female date palm offshoot September, 2018. The interaction between indirect transplanting method with rate 320g N +160g P produced statistically longer leaves (1.45a) which are at par with indirect transplanting method and rate 240g N +120g P (1.44a). Interaction between indirect transplanting method and rate 80g N +40g P produced statistically shortest leaves (0.49e) which are at par with direct and indirect transplanting methods with control(0.51e) and rate 160g N +80g P (0.62e) respectively.

Table 5. Transplanting methods and NP- fertilizer rates interactions on length of leaf of female date palm offshoot December, 2018.

	Fertilizer rates				
Transplanting methods	1	2	3	4	5
Direct transplanting	0.60e	0.87d	0.99d	1.25c	1.40bc
Indirect transplanting	1.24c	0.56e	0.78de	1.61ab	1.67a
SE±			**0.112**		

Means followed by the same letter(s) are not statistically different at 5% level of significant using DMRT

Table 5 shows interaction between transplanting methods and NP – fertilizer rates on leaf length of female date palm offshoot December, 2018. The interaction between indirect transplanting method with rate 320g N +160g P produced statistically longer leaves (1.67a) which are at par with indirect transplanting method and rate 240g N +120g P (1.61ab). Interaction between indirect transplanting method and rate 80g N +40g P produced statistically shortest leaves (0.59e) which are at par with direct and indirect transplanting methods with control(0.60e) and rate 160g N +80g P (0.78de) respectively.

Table 6. Transplanting methods and NP- fertilizer rates interactions on length of leaf of female date palm offshoot March, 2019.

	Fertilizer rates				
Transplanting methods	1	2	3	4	5
Direct transplanting	0.71ef	0.92de	1.08d	1.32bc	1.48ab
Indirect transplanting	1.26bc	0.61f	0.81ef	1.68a	1.73a
SE±			**0.114**		

Means followed by the same letter(s) are not statistically different at 5% level of significant using DMRT

Table 6 shows interaction between transplanting methods and NP – fertilizer rates on leaf length of female date palm offshoot March, 2019. The interaction between indirect transplanting method with rate 320g N +160g P produced statistically longer leaves (1.73a) which are at par with indirect transplanting method and rate 240g N +120g P (1.68a). Interaction between indirect transplanting method and rate 80g N +40g P produced statistically shortest leaves (0.61f) which is at par with direct transplanting method and control (0.71ef).

Table 7. Transplanting methods and NP- fertilizer rates interactions on length of leaf of female date palm offshoot June, 2019.

	Fertilizer rates				
Transplanting methods	1	2	3	4	5
Direct transplanting	0.82ef	0.96c	1.19d	1.43bc	1.60ab
Indirect transplanting	1.29cd	0.64f	0.91e	1.75a	1.80a
SE±			**0.010**		

Means followed by the same letter(s) are not statistically different at 5% level of significant using DMRT

Table 7 shows interaction between transplanting methods and NP – fertilizer rates on leaf length of female date palm offshoot June, 2019. The interaction between indirect transplanting method with rate 320g N +160g P produced statistically longer leaves (1.80a) which are at par with indirect transplanting method and rate 240g N +120g P (1.75a). Interaction between indirect transplanting method and rate 80g N +40g P produced statistically shortest leaves (0.64f) which is at par with direct transplanting method and control (0.82ef).

Table 8. Transplanting methods and NP- fertilizer rates interactions on length of leaf of female date palm offshoot September, 2019.

	Fertilizer rates				
Transplanting methods	1	2	3	4	5
Direct transplanting	1.00f	1.06ef	1.30de	1.52d	1.82bc
Indirect transplanting	1.58cd	0.92f	1.07ef	1.97ab	2.11a
SE±			**0.128**		

Means followed by the same letter(s) are not statistically different at 5% level of significant using DMRT

Table 8 shows interaction between transplanting methods and NP – fertilizer rates on leaf length of female date palm offshoot September, 2019. The interaction between indirect transplanting method with rate 320g N +160g P produced statistically longer leaves (2.11a) which are at par with indirect transplanting method and rate 240g N +120g P (1.97a). Interaction between indirect transplanting method and rate 80g N +40g P produced statistically shortest leaves (0.92f) which is at par with direct transplanting method and control (1.00f).

DISCUSSION

The indirect transplanting method maintained statistically longer leaves than direct transplanting method throughout the period of sampling indicates that, indirect transplanting method is more effective in increasing chances of survival of palm offshoot (Muhammad, 2003) Water stress appeared to be the most important limiting factor at the time of offshoot transplanting than any other factor. Indirect transplanting treatment appeared to have an effect on faster root development which would be related to the formation of longer leaves than offshoots that were transplanted directly into the field. This is in line with the finding of Broschat and Donselman (1984) that, any practice that reduces water stress and improve water absorption would have an effect on offshoot survival and growth. Chabot and Hicks, (1982) and Givnish (1984) established that, the growth of a plant is determined in part by the dynamics and longevity of its leaves since they are carbon gaining organs of the plants. Indirect transplanting method having producing statistically longer leaves would affect the general palm growth. The production of longer leaves and greater leaves dynamics was also influenced by rate 320g N +160g P as the crop responded most to the quantities of N and P in that rate, suggesting that, higher NP – fertilizer rate is necessary to caused that effect. Literature on effect of NP-fertilizer on female date palm offshoot transplant is lacking, however, Tagalsis et al. (2012) reported that application of 500g N + 500g P increased leaf number and length and canopy cover in a mature date palm. Ibrahim et al. (2013) reported that, application of 1.2 – 1.5kg N and 0.044 – 0.065kg P increased leaf number, leaf length and number of bunches in a matured female fruiting palm. It appeared from the foregoing, that rate 320g N +160g P is only sufficient to cause a pronounced effect in leaf length in the 3- 5 years' offshoot transplant and may not be sufficient for mature or fruiting female palms. Interaction between transplanting method and NP- fertilizer rate was highly significant from March, 2018 to September, 2019. A combination of indirect transplanting method with rate 320g N +160g P that produced longer leaves provided an insight to the more suitability of that combination for longer leaves and better offshoot establishment for offshoot between the ages of 3 – 5.

CONCLUSION

Studies on the effect of transplanting methods and NP – fertilizer rates on leaf length of a female date palm offshoot have been conducted over a period of 25 months (September, 2017 – September 2019). The trial was sited at the Date Palm Research Sub – station/ Federal University Dutse (11º50'N, 09º25'E) in the Sudan Savanna ecological zone of Nigeria. From the results,

indirect transplanting of date palm through nursery proved more effective than direct transplanting as it produces statistically longer leaves which are an indication of better chances of crop survival and establishment. Rate 320g N +160g P statistically outperformed other rates in the production of longer leaves throughout the sampling periods was found enough to caused longer leaves in offshoot transplant of 3 -5 years old. Interaction between transplanting methods and fertilizer rates was highly significant in most of the sampled periods except in June and September, 2019. A combination of indirect transplanting method with rate 320g N +160g P that produced longer leaves is recommended for date growers and crop scientist for adoption and further evaluations respectively in the Sudan Savannah ecological zone of Nigeria where this research was conducted.

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