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Influence of Sowing Date and Different Levels of Nitrogen Fertilizer on the Performance of Roselle (*Hibiscus Sabdariffa* L.) in Mubi Adamawa State, Nigeria.

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Short Communication

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ABSTRACT

Response of roselle (*Hibiscus Sabdariffa* L.) to sowing date and nitrogen fertilizer levels were examined in experiments conducted during the 2011 and 2012 cropping seasons at the Research and Teaching farm of the Department of Crop Science, Adamawa State University, Mubi. The experiment which consisted of four fertilizer levels viz: 0kgN/ha, 50kgN/ha, 100kgN/ha and 150kgN/ha as sub plots and three sowing dates viz: SD_1, (21/7/2011/2012), SD_2(31/7/2011/2012), and SD_3(10/8/2011/2012) as main plot laid in a split plot design and replicated three times. Data were collected on plant height (cm), number of branches per plant, Days to 50% flowering fresh weight of calyx, dry weight of calyx and 1000 dry seed weight. Result revealed that SD_1 and 150kgw/ha had significantly superior plant height, number of branches per plant, fresh and dry weight of calyx and 1000 dry seed weight. Days to 50% flowering significantly recorded lower number of days at SD_1, compared to other treatments in 2011 and 2012. Result from this also show that, there were significant interaction between sowing dates and nitrogen fertilizer level among some of the treatments. These result indicate that SD_1, and 150kgN/ha performed better and thus had impact on the growth, development and yield of roselle.

INTRODUCTION

Sowing date and fertilizer application are important factors in crop production as they can positively or negatively affect crop performance and yield. Roselle a tropical annual shrub, which fruit like structures contains edible pigment. Schippers [16] observed that, roselle is now considered one of the competitive beverage in the world In Nigeria; roselle has become an important source of raw material for beverage drink called “Zoborodo” in Northern Nigeria. This drink is a hot water extract of roselle calyx locally processes with sweeteners, spices and flavor such as ginger, vanilla, straw berry and pineapple (Arowosoge, 2008). The seeds are reported to contain about 17% oil which is similar in properties to cotton seed oil. In Nigeria, its production is mainly in the Guinea and Sudan Savanna Zones of the country where the red calyx genotype are prevalent and the green calyx type is mainly found in south western part of the country [1]. Roselle in spite of it food and medicinal value is classified as a minor crop where farmers in Nigeria plant it without due consideration for appropriate sowing date and fertilizer requirement which affect yield and quality of the calyx [5]. Among the various constraints limiting the production of roselle in Nigeria, nitrogen fertilizer appears to be among the most important ones because it cause yield reduction [12]. Roselle is tolerant to a wide range of environmental conditions, particularly well suited to activation in hot, dry regions on a wide range of soils. There is paucity of information on sowing date and nitrogen fertilizer requirements on roselle production in Northern Guinea Savanna agro ecological zone of Nigeria. There study was conducted with the objective to determine the influence of different sowing dates and nitrogen levels on growth and yield of roselle under Mubi condition in Northern Guinea Savanna.

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MATERIALS AND METHODS

The experiment was conducted during the 2011 and 2012 cropping seasons at the FAO/TCP Farm Department of Crop Science, Faculty of Agriculture Adamawa State University Mubi. Mubi lies at latitude (10°, 15′N) and longitude (13°16′E) at an attitude of 896m above sea level. The experimental designs was split plot with three sowing dates at an interval of 10 days (SD_1, SD_2 and SD_3) as main plots and four nitrogen levels: No (0kgN/ha), N_1 (50kgN/ha), N_2(100kgN/ha) and N_3(150kgN/ha) as subplots which were replicated three times. Unit plot size was 5m x 5m (25m^2), total land area was 50 x 21.5(1075m^2) with 1m and 0.5m pathway between the replications and plots respectively. Three central rows were used as net plots and were considered for data collection. Nitrogen fertilizer was applied in two split doses. Other cultural practices were followed as recommended for roselle crop production.

Data collection and Procedures

Data were collected on plant height at 4, 8 and 12WAS, number of branches per plant at 8 and 12WAS, Days to 50% flowering, fresh weight of calyx, dry weight of calyx and dry seed yield.

Plant height (cm): Height of five randomly selected plants within the net plot was measured at 4, 8 and 12 WAS by measuring the main stem height from the ground up to the apex of stem tip. Meter rule was used and averaged to get the mean height.
Number of branches: This was done by counting the number of branches at 8 and 12 WAS on five randomly sampled plants within the net plot. The average was recorded as mean number of branches.
Days to 50% flowering: Days to 50% flowering were recorded when 50% of the plants in a plot flowered.
Fresh weight of calyx (kg/ha): Calyx yield of the net plot were removed at harvest and weighed in the laboratory using electrical measuring scale.
Dry weight of calyx (kg/ha): Calyx yield was oven dried and was measured using electrical scale in the laboratory. This was converted into kg/ha through extrapolation.
Seed yield (kg/ha): Seed yield from net plot was sun dried and weight taken and converted into kg/ha through extrapolation.
Data analysis: Data were subjected to analysis of variance appropriate for split plot as reported by Gomez and Gomez [6]. Least significant differences (LSDs) at 5% level of probability were computed to delineate significant difference between treatment means.

RESULTS AND DISCUSSION

The main effects between sowing date and nitrogen fertilizer levels were significantly affected by plant height at 4, 8 and 12 WAS (Table 1) in 2011 and 2012 cropping seasons. At 4 WAS and 8 WAS in 2011 and 2012 SD_1 recorded significantly the tallest plants height compared to other treatments. Similarly, in 2011 at 12 WAS the tallest plants height of 59.72cm was recorded with SD_1. With nitrogen fertilizer treatment, the highest plants height at 4, 8 and 12 WAS were significantly recorded with 150kgN/ha. 0kgN/ha resulted in significantly reduced plants at 4, 8 and 12 WAS respectively. The interaction effect of sowing date and nitrogen levels were not significantly affected. The result of plants height from this study is in total conformity with the previous report by Pfeiffer and Harris [13] who viewed that, plant height measurements are used as an indicator of vegetative growth. In general, the result of the present investigation clearly brings out the fact that delayed planting and low or no fertilizer application resulted in reduced plant height though the degree and trend varied with some planting dates and nitrogen levels. Such results are unusual and have been reported by several workers [8,14]. The number of branches per plant and days to 50% flowering in presented in table 2. At 8WAS in 2012, SD_1 and 150kgN/ha treatment had significantly greater number of 11.26 while SD_2, SD_3 and 0kgN/ha trailed behind which produced the least number of branches. At 12WAS, SD_1 and 150kgN/ha still recorded the highest number of branches while 0kgN/ha produced least number of branches of 9.60. This result is in consonance with the findings of Akanbi et al [2] who observed a significant increase in number of branches per plant with fertilizer application when compared with the control treatments in roselle plant. This study also agrees with the findings of Ojokoh who noted that, roselle plant responds favorably to nitrogen fertilizer at different levels of application. Days to 50% flowering, SD_1 in 2011 recorded the least number of days of 99.59 whereas SD_2 produced the highest number of days of 115.12 in 2012. These indices of crop earliness indicated that, roselle crop in SD_1 with 150kgN/ha start bearing earlier than SD_2 and SD_3. This may have implication on the use of production resources and probably on crop productivity. Significant interaction between sowing dates and nitrogen fertilizer level was recorded. Contrary views were reported by Selim et al [15] and Udoh et al [17] that, nitrogen has been observed to elongate the juvenile stage in plants, thus delaying crop maturity. Table 3, shows the effects of sowing date and nitrogen fertilizer level on fresh weight, dry weight and dry seed weight of roselle.Fresh and dry weight of calyx were significantly (p=0.05) affected as influenced by sowing date and nitrogen fertilizer levels. SD_1 recorded the highest fresh weight of calyx of 125.60kg/ha and 142.76kg/ha in 2011 and 2012 respectively. Similarly, 150kgN/ha recorded the highest fresh weight of calyx of 182.40kg/ha and 162.01kg/ha in 2011 and 2012. 0kgN/ha recorded the least weight. Higher dry weight of calyx was also recorded with SD_1 and 150kgN/ha in 2011 and 2012.Similar trend was also observed

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with the dry seed weight in both years. These results are in tandem with Akanbi et al [2] who observed that roselle plants respond positively to nitrogen fertilizer application and that appropriate sowing date increases yield. Other researchers [3,9,10] thought that, increase in calyx yield as a result of nitrogen fertilizer application could be attributed to increase in crop photosynthetic ability as a result of good vegetative growth induced by the treatment. The yield superiority of SD_1 might be attributable to the production of longer calyx in relation to other sowing dates. It was observed from this result that, for every increase in nitrogen fertilizer level, there was a clear significant difference in the yield parameters. This implies that, higher application of nitrogen could further improve these parameters with a desirable improvement. This study corroborates with that of Bake and Futuless [4] who suggested the need to apply fertilizer to replenish depleted soil nutrients. However, IITA [7] in similar vein reported that, crop productivity in rain fed agriculture is limited mainly by low availability of mineral nutrients especially nitrogen fertilizer at planting and vegetative stage of the development or at both these stages is commonly associated with increase yields. Generally, 150kgN/ha and SD_1 produced significantly higher values in the yield and yield determining parameters. This finding is supported by Olufokunbi [11] who observed that, improved agricultural productivity could be achieved by the use of fertilizers.

CONCLUSION

Plant height was not significantly affected by sowing date and nitrogen levels at 4,8 and 12 WAS in 2011 and 2012. Significant number of branches were recorded with SD_1 and 150kgN/ha producing more branches. This was not the same with days to 50% flowering. Fresh weight of calyx and dry seed weight were significantly affected by sowing date and nitrogen levels as well as the interaction in dry weight of calyx. The performance of roselle increased with increased level of nitrogen. It may therefore be recommended based on these findings that SD_1 and 150kgN/ha should be adopted for maximum yield at Mubi.

Table 1: Effect of sowing date and nitrogen fertilizer level on height of roselle in 2011 and 2012 at 4, 8 and 12 WAS.

Sowing Date	Plant height at 4WAS		Plant height at 8WAS		Plant height at 12WAS	
	2011	2012	2011	2012	2011	2012
SD_1	22.81^{a}	21.30^{a}	32.40^{a}	31.60^{a}	59.72^{a}	53.59^{a}
SD_2	20.55^{b}	20.20^{b}	30.35^{b}	29.55^{b}	59.72^{a}	48.08^{b}
SD_3	18.93^{c}	20.00^{bc}	27.32^{c}	29.55^{b}	53.27^{c}	38.85^{c}
LSD (P=0.05)	2.287	7.63	1.322	1.931	0.365	2.327
Nitrogen (kg/ha)						
0	16.97^{d}	18.40^{d}	24.77^{d}	24.28^{a}	47.03^{d}	34.83^{d}
50	18.94^{c}	18.90^{c}	27.94^{c}	24.98^{c}	54.78^{c}	44.37^{c}
100	22.91^{b}	20.00^{b}	31.05^{b}	26.96^{b}	60.05^{b}	50.37^{b}
150	24.24^{a}	25.90^{a}	36.33^{a}	29.76^{a}	63.50^{a}	57.85^{a}
LSD (P=0.05)	2.068	9.55	0.747	1.673	1.004	1.849
Interaction SD x N	NS	NS	NS	NS	NS	NS

Means followed by the same letter(s) within the same column are not statistically different at 5% level of significance according to Duncan's Multiple Range Test (DMRT). NS = not significant, WAS = weeks after sowing

Table 2: Effect of sowing date and nitrogen fertilizer level on number of branches and days to 50% flowering in 2011 and 2012

Treatment	Number of branches per plant 8WAS		Days to 50% flowering 12WAS			
	2011	2012	2011	2012	2011	2012
SD_1	6.92^{a}	8.89^{a}	14.10^{a}	13.01^{a}	99.59^{a}	109.84^{C}
SD_2	6.73^{b}	7.73^{b}	13.47^{bC}	12.55^{b}	105.14^{b}	115.12^{a}
SD_3	6.91^{a}	6.91^{b}	13.64^{b}	12.70^{b}	104.15^{C}	113.50^{b}
LSD (P=0.05)	0.459	0.58	0.447	2.53	1.237	1.212
Nitrogen (kg/ha)						
0	5.03^{d}	4.57^{d}	10.24^{d}	9.60^{d}	108.87^{a}	115.65^{a}
50	6.23^{c}	7.75^{c}	12.41^{c}	12.01^{c}	104.59b	112.21^{c}
100	7.31^{b}	8.96^{b}	14.44^{b}	12.55^{b}	101.89c	114.40^{b}
150	8.79^{a}	11.26^{a}	17.86^{a}	16.79^{c}	96.97^{c}	109.03^{d}
LSD (P=0.05)	0.438	0.513	0.614	2.268	2.474	1.939
Interaction SD x N	*	*	*	*	*	*

WAS=Weeks after Sowing, SD = Sowing Date, LSD=Least Significant Difference, NS=Not Significant

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Table 3: Effect of sowing date and nitrogen fertilizer level on fresh weight, dry weight and dry seed weight (g) in 2011 and 2012

Sowing Date	Fresh weight of calyx		Dry weight of calyx		Dry seed weight (g)	
	2011	2012	2011	2012	2011	2012
SD_1	125.60[a]	142.76[a]	16.60[a]	22.63[a]	15.23[a]	18.38[a]
SD_2	113.30[b]	110.26[b]	16.04[bc]	19.53[b]	14.81[b]	14.36[b]
SD_3	96.80[c]	112.44[b]	15.51[a]	18.74[b]	14.00[c]	14.05[b]
LSD (P=0.05)	21.42	1.646	0.215	5.766	0.534	3.483
Nitrogen (kg/ha)						
0	90.50[d]	91.76[d]	11.96[c]	16.80[c]	9.52[c]	10.35[d]
50	93.10[c]	114.99[c]	12.11[c]	16.66[c]	10.23[c]	12.82[c]
100	109.50[b]	119.53[b]	12.87[b]	19.50[b]	12.03[b]	15.98[b]
150	182.40[a]	162.01[a]	24.46[a]	28.23[a]	26.95[a]	22.56[a]
LSD (P=0.05)	19.82	2.576	0.617	4.67	0.616	1.906
Interaction SD x N	NS	NS	*	*	NS	NS

NS=not significant, *=Significant at (5%) level of probability, LSD=Least Significant Difference

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