

GROWTH AND YIELD RESPONSES OF BANANA PLANT TO DESUCKERING PRACTICE

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Abstract: The objective was to study the influence of three selective levels of sucker pruning namely: (mother + 2 followers, mother + 3 followers and mother + 4 followers) on growth and yield of the banana compared to the traditional farmer practice (without pruning management). The results revealed a significant reduction in growth and yield parameters of banana plant with increase in number of suckers left with the mother plant. The treatments did not display significant variation in the time to shooting and pseudostem girth in the first cycle but significant effect was shown in the second cycle. The effect was clearly observed when no desuckering was practiced. Generally the high productivity associated with desuckering was mostly due to the high number of hands per bunch and the large fruit size.

Keyword: banana, growth, followers, desuckering, yield.

Introduction

Banana plants begin to produce suckers few months after planting, and these suckers compete with the main plant for water and nutrients and reduce productivity (Oluwafemi, 2013). Hence, sucker management in banana is a crucial cultural practice in which unwanted suckers developing from the base of the mother rhizome (plant crop) is removed, keeping a suitable sword sucker to produce the ratoon crop. The strategy is to remove the surplus suckers that compete with mother plant. Sword suckers, with the same size, on the most open side in the same direction are usually selected as followers; otherwise this system becomes unmanageable (Daniells, 1984). The suckers remain physiologically dependent on the mother plant until the latter is in bloom or harvested as in banana cultivars Gros Michel or Cavendish, respectively (Wybou, 1974). The yield potential of the banana plantation is maximized by choosing the correct number of suckers per mat; since higher densities reduces fruit size and increases fruit mass (Robinson, 1995; Oluwafemi, 2013). Setting of followers at appropriate is one of the most critical operations in banana cultivation, since it ensures reasonable timing between successive bunches on the same mat to avoid inter-mat competition that affect fruit quality and to produce fruit at a time of favorable weather and/or

markets (Simmonds, 1966). In Sudan, however, the banana growers concern is attaining a steady fruit harvesting throughout the year to the field decline. Thus, knowledge about the competitive effect of sucker is meager or even lacking and no pruning is practiced. It is very common to find multiple forms of suckers with the main plant having two to four bunches with reduced weight and quality hanging at the same time. This production system is directed primarily towards local markets. To compete in the international market, however, a better system of production should be employed. Therefore, the objective of this study was to investigate the influence of the number of suckers per mat on the growth, crop cycle duration, yield and yield component of banana plants.

Materials and Methods

The study was conducted at Kassala region (15^o27'N, 36^o40'E) in the Eastern part of Sudan for a period covering two production cycles of four cropping seasons (2006-2010). Cavendish banana cultivar "Zelig" suckers of 45x15 cm (height x pseudostem girth) were planted in 6 x 6 m plots at 3x 3 m spacing.

The planting materials were conventional uniform maiden suckers. Suckers were planted in mid-April of each year. Agronomic management was carried out as needed including regular irrigation, weeding and earthing-up. The number of newly formed suckers per mat was counted four months after planting. Pruning was first applied four months after planting by deep cutting of the unwanted suckers using a fish-tail weedier, and keeping selected sword suckers as followers. The experiment was laid out in a randomised complete block design with four replications. The treatments were 2, 3, 4 and multiple suckers (non-removed suckers, usually more than 4, which is the traditional farmer's practice). The suckers were deeply removed from the base at 3 weeks intervals from their emergence to maintain the required number. The data were collected on plant height which is from the ground to the base of bunch during maturity, pseudostem girth at 5 cm from the base and number of days to flowering (DTF i.e. days from planting to bunch emergence). Yield and yield components measurements were taken at bunch harvesting of bunches. The harvested bunches were weighed. The number of hands per bunch was counted. Finger length was determined by measuring the outer curve of individual fruit of the second hand of bunches. Bunch weight was used as an index of fruit yield. Total yield per cycle was calculated by multiply the weight of bunch by the actual number of harvested plants per hectare. The means of each

variable were analyzed by analysis of variance and compared using Duncan's Multiple Range Test at 0.05 Probability.

Results and Discussion

Growth parameters:

The effect of sucker management on agronomic performance and crop cycle of banana plant is shown in Table 1. At flowering time of the main crop, the height of the main plants and the first follower were increased progressively with sucker management. The highest values were associated with fewer number of suckers left per plant mat. Pseudostem girth and time from planting to flowering, on the other hand, were not affected. These results did not substantiate the findings of Hidoto (2009) and Oluwafemi (2013), who observed taller plants with thinner girth at higher planting densities. They attributed their results to the effect of competition between the main plant and the growing suckers. In Hidoto's (2009) trial, the suckers were removed at 30 cm height at monthly intervals from its emergence. In the current experiment, however, the suckers were deeply removed at shorter interval and perhaps no competition was encountered. It was recognized that at specific density; selection of single follower produces larger plants (Robinson and Nel, 1988) and variations in growth rate with respect to plant height were reported especially during initial stages of growth (Athani, 2009).

Table 2 depicts the effect of sucker management on growth characteristics of the first ratoon crop. The crop cycle under farmer method was comparable in crop cycle with 4 followers (Table 2). In the absence of pruning, the reduction in crop cycles between ratoon crops is a determinant factor that a single mat can expect to produce a number of bearing stems in the meantime. Robinson (1995) noted that, cycle time in the plant crop at high density is not representative of the plantation response to high density as expressed in ratoon cycle. This suggestion was true, in this study, for the first ratoon crop as its crop cycle was significantly reduced compared with farmers method.

Yield and yield components parameters:

Bunch weights, numbers of hands per bunch and finger lengths of the plant crop decreased significantly as the number of suckers per mat increased (Table 3). Similar results were also witnessed with the first ratoon crop (Table 4). The highest values for bunch weights and its components of both plant crop and the first ratoon were significantly higher on the mother with 2 followers. In the plant crop, bunch weight, number of hands per bunch and total yield under farmer methods was analogous to the treatment of mother +4 followers. In line with

these results, Lichtemberg *et al* (1986) accelerated evidence that selection of single followers produces larger bunches. The increase in bunch weight and yield components had been attained by removing unwanted suckers and leaving one sucker per plant/mat. In plantain crop (Robinson and Nel, 1990; Sarrwy, 2012). However, Martinez-Garnica (1984) observed that multiple sucker growth did not affect yields in the plant crop, but was declined in the ratoon follower progressively when the number of competing suckers increased.

Similar trend of bunch weight and number of hands was observed in finger length of the plant crop, however, the differences between desuckering to 3 and 4 followers were not emarkable (Table 3). In the first ratoon, on the other hand, all treatments improved the bunch weight, number of hands per bunch, fruit length and total yield significantly compared to control (farmer's method (Table 4). Generally the high productivity was mostly due to the high number of hands per bunch and the large fruit size. The findings are in agreement with Nambiar *et al.* (1979) and Sarrwy, (2012) who observed that the early removal of surplus suckers gave the highest ratoon yields of Robusta banana. The yield parameters of farmer's practice and desuckering to 4 followers were significantly influenced by the desuckering treatments. This was attributed to more intra-mat competition for photosynthates and nutrients between mother plant and followers. This is explained by the fact that finger girth and finger length (major determinants of bunch weight/size) were significantly reduced by leaving sucker with the mother plant. Similar effects of intra-mat competition have been reported by Robinson and Nel (1990).

From the findings of the present investigation, it can be concluded that desuckering and good management practices are indispensable for higher yields of banana. In general, plants with excess suckers removed performed better than leaving outgrowths attached to the mother plants as in conventional farmer's practice. Therefore, proper management practices must be adhered to otherwise farmers may not tap the full potential management practices.

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Table 1. Effect of the number of suckers per plant on crop cycle and agronomic performance of the plant crop of banana cultivar Zelig

Treatment	Time from planting to shooting (days)	Pseudostem height at shooting time	Pseudostem girth at shooting time	Height of tallest sucker at shooting time
Mother + 2 followers	301	196.5 ^a	73	119 ^a
Mother + 3 followers	299	193.5 ^b	72	115 ^{ab}
Mother + 4 followers	299	192.8 ^b	72	112 ^b
Farmer method	298	188.3 ^c	71	103 ^c
SE±	NS	0.87	NS	1.82

Table 2. Effect of the number of suckers per plant on crop cycle and agronomic performance of the first ratoon crop of banana cultivar Zelig

Treatment	Time from planting to shooting (days)	Pseudostem height at shooting time	Pseudostem girth at shooting time	Number of suckers at shooting time
Mother + 2 followers	459.5 ^a	211.3 ^a	79.8 ^a	2.75 ^d
Mother + 3 followers	457.3 ^a	209.8 ^{ab}	79.8 ^a	3.75 ^c
Mother + 4 followers	447.3 ^{ab}	206.8 ^{bc}	76.5 ^b	4.63 ^b
Farmer method	444.5 ^b	204.5 ^c	74.3 ^b	9.63 ^a
SE±	3.8	0.1	0.6	0.1

Table 3. Effect of the number of suckers per plant on yield parameters of the plant crop of banana cultivar Zelig

Treatment	Bunch weight (kg)	No of hands/bunch	Finger length (cm)	Total yield ton/hectare
Mother + 2 followers	21.8 ^a	10.2 ^a	21.9 ^a	24.2 ^a
Mother + 3 followers	21.0 ^a	10.1 ^a	21.3 ^{ab}	23.3 ^a
Mother + 4 followers	19.8 ^b	9.6 ^b	21.1 ^b	22.0 ^b
Farmer method	19.5 ^b	9.3 ^b	20.8 ^b	21.7 ^b
SE±	0.29	0.14	0.19	0.32

Table 4. Effect of the number of suckers per plant on yield parameters of the first ratoon crop of banana cultivar Zelig

Treatment	Bunch weight (kg)	No of hands/bunch	Finger length (cm)	Total yield ton/hectare
Mother + 2 followers	33.3 ^a	11.2 ^a	22.8 ^a	37.0 ^a
Mother + 3 followers	31.1 ^{ab}	10.5 ^b	22.6 ^{ab}	34.5 ^{ab}
Mother + 4 followers	30.3 ^b	10.2 ^b	22.4 ^b	33.7 ^b
Farmer method	27.3 ^c	9.6 ^c	21.7 ^c	30.3 ^c
SE ±	0.77	0.15	0.09	0.94