

Effect of sucker retention on growth and yield of banana (*Musa* spp., AAA) var. Grand Naine: plant crop

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Abstract: An experiment was carried out to study the sucker retention time and number on growth, yield and its attributes at Instructional farm, U.B.K.V., Pundibari, West Bengal during the year 2012-2014. The highest pseudostem height (225.30 cm), girth (75.00 cm), number of leaves (23.45), leaf area (1.02 m²) and lowest phyllocron (16.02 days), days taken to shooting (374.65) and maturity (106.29) were recorded at no sucker till harvest followed by retaining one sucker at shooting whereas the yield attributes like bunch length (86.64 cm), bunch diameter (35.10 cm), bunch weight (26.73 kg), number of fingers per bunch (161.37), finger length (17.08 cm), finger diameter (3.82 cm), finger weight (332.48 g), were also highest with no sucker till harvest followed by one sucker at shooting. Mother plants not retained with any suckers till harvest yielded highest (66.81 tha⁻¹) with superior growth, yield attributes and it remained statistically at par when 1-2 suckers were retained at 5th month after planting and at shooting though yield reductions of 13.14-20.76 % were recorded. Therefore it can be suggested that retention of one or two suckers at shooting is better to obtain higher yields in plant crop and to produce optimum sized bunches for ratoon crop.

Key words: banana, desuckering, growth, yield.

INTRODUCTION

Banana is widely cultivated in varying agro climatic regions under different systems of production (Mustaffa, 2011). With the increasing demand and vast export potential coupled with the farmers desire to grow banana on a large area, it is necessary that systematic and sustained sucker management practices as a planting material should be adopted. Initial sucker growth depends on supply of nutrients, water and photosynthesis products from the mother plant (Shanmugavelu *et al.*, 1992). In banana simple practice like de-topping of sucker or desuckering at different intensity, the stage at which it is done and its used as planting materials have been found to effect yield parameters and yield qualitatively and quantitatively (Odeke *et al.*, 1999).

Planting geometry, age/height of removed suckers and method of desuckering have a direct effect on bunch size as a result of inter- and intra-mat competition (Robinson, 1995). Higher number of suckers increase sink competition which reduces the bunch weight significantly (Obiefuna *et al.*, 1982, Tenkouano *et al.*, 2007). Still, though, it is one of the most neglected aspects in resource limited farmers fields (Bananuka and Rubaihayo, 1994) as was also observed in Terai region of West Bengal. Hence, the number of suckers per stool and right stage of retaining them to plant will give rise to optimum number of medium sized bunches and to establish the best system of desuckering in order to achieve optimum yield and developing optimum sized bunches for ratoon crop.

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MATERIALS AND METHODS

An experiment was conducted at Instructional farm, U.B.K.V., Pundibari, West Bengal during the year 2012-2014 in tissue culture banana var. Grand Naine planted at a spacing of 2 x 2 m. The suckers were cut horizontally at ground level and a depression was made at the centre of the cut surface and kerosene was directly poured at this point. The volume of kerosene applied for one stamp was 20 ml. Agronomic practices were carried out as needed including regular irrigation, fertilizer application, weeding and earthing-up. The experiment was laid out in a randomised complete block design with three replications. The treatments were retaining first emerging one sucker, retaining first emerging two suckers, retaining one sucker after five months, retaining two suckers after five months, retaining one sucker at shooting, retaining two suckers at shooting, retaining no sucker till harvest and control (retaining of all suckers). The suckers were deeply removed at the base 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. Yield and yield components measurements were taken after bunch harvesting. 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. The significance of results of the data was subjected to analysis of variance given by Gomez and Gomez (1984) employing the 'op-stat' software package.

RESULTS AND DISCUSSION

The effect of sucker management on agronomic performance and crop cycle of banana plant is shown in Table 1 and 2. The longest length and widest girth of pseudostem recorded at shooting was 225.30 and 75.00 cm when no suckers were retained till harvest while the shortest length of 177.88 cm and narrowest girth of 62.29 cm was recorded when all the suckers were retained. These results are in agreement with that of (Bhagat, 2012) who reported that 4-5 detopping of sucker improved

the height and girth of pseudostem. Pseudostem height and girth increased progressively with sucker management which can be attributed to the effect of lessening of competition between the mother plant and suckers (Mahdi *et al.*, 2014). No suckers retained till harvest resulted highest mother pseudostem height and girth, perhaps due to no competition encountered.

The number of leaves recorded per plant was statistically at par for all the treatments of sucker management, however at shooting highest and lowest number of leaves per plant counted was 23.45 and 19.74 when all suckers and none were retained, respectively. This indicates that the number of leaves in mother plant is independent of sucker management practices or not by sucker completion imposed to mother plant. The number of leaves recorded for sucker management is in agreement with the study of Oluwafemi (2013). Bhagat (2012) also reported highest number of leaves with maximum number of sucker detopping. Leaf length (194.54 cm), breadth (52.58 cm) and area (1.02 m²) at shooting was highest when no suckers were retained till harvest and lowest (158.12 cm, 37.02 cm and 0.59 m²) when all suckers were retained.

Days taken to shooting and shooting and maturity delayed due to competition pressure exerted by the suckers to its mother plant. Days taken to shooting (441.00 days) and shooting to maturity (171.20 days) were longest when all suckers were retained whereas were recorded shortest (374.65 and 106.29 days, respectively) when no suckers were retained till harvest. Other sucker management practices i.e. retaining first one sucker or one and two suckers at fifth month after planting and at shooting were statistically at par with no suckers retained till harvest i.e. all these sucker management practices lead to shooting and then shooting to maturity in similar number of day which is significantly lesser than that was recorded when all suckers were retained. The total cropping period on an average ranged from to 480.94 to 612.07 days i.e. the plants where all suckers were retained were harvested about four months later (131.13 days) than the plant where no suckers were retained during the cropping period. Days to shooting and shooting to maturity was also recorded lowest i.e. earlier

maturity was achieved with maximum number of sucker detopping (Bhagat, 2012). The growth parameters allowing more suckers to be retained increases competition for photosynthates, water and nutrients causing deficiency in the mother plant leading to inefficient metabolic activity and affecting physiological processes delaying growth and development thereby increasing the time required to attain or complete a particular phase of growth.

Significant differences were observed in bunch characters due to sucker management (table 2). Bunch length (86.64 cm), bunch weight (26.73 kg) and number of hands (10.59) and fingers (161.37) per bunch were recorded highest when no suckers were retained till harvest except bunch diameter which was recorded highest (35.19 cm) when one sucker was retained at shooting but not significantly different to that recorded when no suckers were retained (35.10). The observations recorded for bunch characters when one or two suckers retained after 5th month of planting and at shooting were generally at par statistically though reduced. This indicates that retaining one or two at any time from 5th month of planting did not deteriorate the bunch characters and is as good as retaining none till harvest. However adopting the sucker retaining practice earlier or retaining all suckers significantly reduced bunch characters as is indicated from lowest bunch length (70.13 cm), diameter (28.24 cm), weight (12.04 kg), hand/bunch (9.1) and fingers/bunch (123.55) recorded when all suckers were retained (figure 1 & 2). This is because of deficient translocation of photosynthates to the mother plants due to intra mat competition resulting reduced growth, development and setting that is reflected as reductions in length, diameter, number of hands and number of fingers. The vice versa is true when one or two suckers were retained or none retained effecting efficient, proper and timely development, growth and setting of bunches by the mother plant.

Mother plants not retained with any suckers till harvest yielded highest (66.81 t/ha, respectively) and it remained statistically at par when one or two suckers were retained at 5th month after planting and at shooting though yield reduction of 13.14-20.76%. The yield however reduced significantly when first one or two suckers were retained and

lowest yield was recorded when all suckers were retained with a reduction of 28.41, 29.90 and 54.95 %, respectively. This can be explained that retaining no suckers produced largest and heaviest fingers and so the bunches that ultimately was realized as highest yield and vice versa. This significant yield reduction of more than half in Grand Naine with holding all the suckers than holding none agrees with the results of Vargas *et al.* (2005) in plantain ('False Horn' type) and Oluwafemi (2013) in plantain but disagree with results from Martinez Garnica (1984) in French Horn type, Govea (1991) with False Horn type and Anez and Tavira (1999) in False Horn type where multiple suckers or retaining 1-3 suckers in the mat did not affect plantain yield in plant crop. Complete sucker removal gave comparable yield and yield components records that were higher than either three or multiple sucker plants in case of plantain as reported by Oluwafemi (2013). The workers reported that higher number of suckers led to reduced yield and yield components while zero or one sucker plants were recorded with increased yield and yield components as was recorded in this study also.

Robinson and Nel (1985) reported that early selection of William followers 5 months after planting did not affect bunch mass of the parent compared with late selection, 10 months after planting. Similarly, retaining all suckers reduced bunch length and bunch weight (Vargas *et al.*, 2005; Oluwafemi, 2013). Parent to sucker competition becomes more severe when more than one or all suckers are retained or kept in mat resulting in lighter bunches (Stover and Simmonds, 1987; Robinson and Nel, 1989). Walmsley and Twyford (1968), Teisson (1970), Anon., 1999, and Kurien *et al.* (2002) also indicated translocation of nutrients between the banana mother plant and the follower sucker which is important in the nutrition of the follower suckers (Martin-Prevel, 1964; Lahav and Turner, 1992). It was therefore better to retain no suckers or to remove suckers in the early stage to prevent withdrawal of nutrients from the mother plants as is clearly indicated from the best growth and highest bunch and finger attributes recorded from the plants where no suckers were retained till

Table 1
Effect of sucker management on growth characters

Suckers retained	Pseudostem height (cm)	Pseudostem girth (cm)	No of leaves	Leaf length (cm)	Leaf breadth (cm)	Leaf area (m ²)	Phyllocron (Days)	Shooting (Days)	shooting to maturity (days)
All	177.88	62.29	19.74	158.12	37.02	0.59	17.45	441.00	171.20
One (1 st emerging)	206.29	69.25	21.33	178.75	49.58	0.89	17.28	391.11	127.14
Two (1 st emerging)	204.27	67.29	20.07	177.77	49.50	0.88	17.31	433.52	133.97
One (after 5 MAP)	212.55	70.79	22.04	183.25	50.16	0.92	16.72	386.74	113.74
Two (after 5 MAP)	211.79	69.52	21.54	182.76	49.83	0.91	17.06	395.81	119.37
One at shooting	220.25	72.25	22.25	190.26	51.58	0.98	16.04	376.99	111.55
Two at shooting	216.92	71.75	22.26	190.45	50.91	0.97	16.31	381.07	110.06
None till harvest	225.30	75.00	23.45	194.54	52.58	1.02	16.02	374.65	106.29
CD _{P=0.05}	23.62	NS	NS	NS	6.10	0.11	NS	28.51	38.33

Table 2
Effect of sucker management on bunch and finger characters

Suckers retained	Bunch length (cm)	Bunch diameter (cm)	Bunch weight (kg)	Hands/ bunch	Fingers/ bunch	Finger length (cm)	Finger diameter (cm)	Finger weight (g)	Yield (tha ⁻¹)
All	70.13	28.24	12.04	9.10	123.55	13.75	2.92	170.13	30.10
One (1 st emerging)	75.12	31.96	19.13	9.58	136.86	15.93	3.52	278.08	47.83
Two (1 st emerging)	72.63	29.71	18.55	9.09	127.38	14.58	3.48	244.60	46.38
One (after 5 MAP)	76.64	33.92	21.21	10.11	148.91	16.39	3.62	305.17	53.03
Two (after 5 MAP)	75.67	33.76	21.18	10.27	148.40	15.43	3.51	286.33	52.94
One at shooting	85.17	35.19	23.21	10.60	158.38	16.88	3.73	328.33	58.03
Two at shooting	83.64	33.99	23.05	9.98	153.86	16.84	3.61	325.46	57.63
None till harvest	86.64	35.10	26.73	10.59	161.37	17.08	3.82	332.48	66.81
CD _{P=0.05}	8.46	3.92	6.80	0.97	23.11	NS	NS	73.58	16.96

MAP- month after planting

harvest, as was also reported by Walmsley and Twyford (1968). When suckers were eliminated later all these parameter reduced as has been reported (Anon., 1987) consequent of continuous movement of nutrients between the mother plant and the follower (Kurien *et al.*, 1999). This process ceases in the most developed sucker when it reaches independence from the parent plant but continues in the uneliminated suckers explaining the best results obtained in this study when none suckers were retained till harvest of the mother plant. On the contrary, it was also recommended leaving all the suckers, suggesting that they help in the anchoring and nutrition of the mother plants (Soto and Ruiz, 1992; Soto *et al.*, 1992). The banana plants,

at the end of its biological phase, present a weak and deteriorated root system which is not able to take up enough water and nutrients for bunch development, a situation that is overcome by suckers.

Finger length and diameter were not significantly influenced by sucker management though finger weight was significantly influenced by sucker management (table 2). The length and diameter of sucker ranged from 13.75-17.08 cm and 2.92-3.82 cm, lowest and highest being for all and none of the suckers retained indicating similar effect of sucker management on length and diameter of fingers. However, finger weight differed significantly between the practices of sucker

management which ranged between 170.13-332.48 g, lightest and heaviest fingers being for all and none of the suckers retained, respectively. These results are in agreement with Oluwafemi (2013) that reported highest finger characters in no bunches retained and vice versa with all bunches retained. Significant differences in the finger weight are thus reflected as significant differences in bunch weight with sucker management. As explained earlier for bunch, deficient translocation of photosynthates to the mother plants due to intra mat competition had resulted poor filling of fingers in the bunches reducing its weight. The vice versa is true when one or two suckers were retained or none retained effecting sufficient and proper translocation of metabolites to fingers filling it properly and thus optimum weight gained. Mahdi *et al.* (2014) also reported that yield attributes of crop generally decreased significantly as the number of suckers per mat increased. 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 the suckers (Robinson and Nel, 1990; Sarrwy, 2012). Martinez-Garnica (1984_b), however reported that retaining multiple suckers did not affect the yield attributes and yield. Therefore it can be concluded that retention of one or two suckers at shooting is good for higher yield with acceptable quality of fruits in both plant and ratoon crops, even though the removal of all the suckers throughout the cropping period recorded best performance in plant crop.

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