

EFFECT OF DE-HANDING ON BUNCH CHARACTERISTICS OF BANANA

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ABSTRACT

De-handing is a measure adopted to improve the fruit quality of banana in many countries. However, its impact has not been studied under local conditions. Therefore, a study was undertaken to identify the effect of de-handing on bunch characteristics and assess its economic importance for the commonly grown cultivars of Embul, Kolikuttu and Ash Plantain. Bunch weight was not reduced with de-handing in any variety but fruit weight, length and girth were increased significantly. The size difference between the second and the last-hand was marginal and bunches were more uniform and cylindrical in shape when de-handled. External appearance of the fruits was superior and alluring with de-handing in the tested varieties. However, overall appearance of the bunch was good only in cultivars that produced more number of hands. De-handing extended the green life of the fruits from 2 to 3 days depending on the cultivar.

KEYWORDS: Banana, Bunch characteristics, Cultivars, De-handing.

INTRODUCTION

Banana (*Musa* spp.) the fourth most important food crop in the developing world is grown on commercial and non-commercial scales in the tropics and the sub tropics. However, in the majority of banana growing countries including Sri Lanka, bunches with inferior quality are often produced. Hence, a number of cultural measures are being adopted to increase the quality of the produce especially the fruit size. Bunch trimming or de-handing is one of the measures used to enhance the fruit size and the yield of banana in different parts of the world. Bunch trimming or de-handing is the removal of unfilled or incompletely developed hands located at the distal end of a developing bunch. Removal of incomplete hands soon after bloom is reported to increase the weight of the remaining hands (Samson, 1980). Simmonds (1970) reported that intra bunch competition reflects an inverse relationship between fruit size and growth rate of fruits. Daniels and Bryde (1995) observed an increase in bronzing of banana fruits, and reduction in bunch weight at maturity and low profit per bunch due to de-handing. Daniels and Foster (2001) observed a 12% reduction in bunch weight and improvement of green life of fruits due to bunch trimming in banana. Since no information is available in this regard under local conditions, this study was undertaken to identify the effects of de-handing on bunch characteristics and assess the economic importance of the technique for commonly cultivated banana cultivars in Sri Lanka.

MATERIALS AND METHODS

Commonly grown banana (*Musa* spp) cultivars namely, Embul (AAB), Kolikuttu (AAB) and Ash Plantain (ABB) were selected for the experiment. The experiment was conducted at two locations namely, Grain Legume and Oil Crops Research and Development Centre, Angunakolapelessa and in a farmer field at Kattakaduwa in Hambantota district in 2003 (DL_{1b} agroecological region; NRMC, 2003). At the research field, banana was grown under the dense planting system (3 m x 1 m) and in farmer's field, the cultivars were maintained under conventional planting system with the spacing of 3 m x 3 m. Recommended practices were followed at both locations (DOA, 1995; Weerasinghe, 2000). At the farmer's field, the farmer was given the responsibility of adopting the recommended management practices.

Twenty bearing plants of each variety were randomly selected and male buds were removed soon after the differentiation of the last hand. Out of 20 plants, 10 were considered as controls and their bunches were allowed to develop without de-handing. Remaining ten plants were subjected to de-handing treatments by removing the last two hands. All twenty bunches in each variety were provided with bunch covers of woven poly sac bags.

The experiment was carried out in a Completely Randomized Design with 10 replicates in a two-factor factorial arrangement. Bunch weight, fruit weight, fruit length and fruit girth in the second and the last hand, green life of the fruits of a middle hand of a bunch and profits obtained due to bunch trimming were estimated. Data obtained at the Research Center only were subjected to statistical analysis using the MSTAT computer software package and only the mean values are presented for the experiment conducted at the farmer's field.

RESULTS AND DISCUSSION

Bunch weight

Effect of de-handing on bunch weight of Embul, Kolikuttu and Ash Plantain at both locations is illustrated in figure 1. In spite of the higher plant density the bunch weights of all three banana varieties recorded at the Research Centre are higher than that of the farmer's field. This variation was 10% for Embul, 24% for Kolikuttu and 50% for the Ash Plantain between two locations. The difference in bunch weight between the two locations could be the result of poor management practices adopted by the farmer.

Results indicated that the total bunch weight did not change with de-handing in any of the cultivar at both locations (figure 1). However, there was a marked difference in bunch weight among cultivars (mean bunch weights were 16.5 kg, 9.9 kg and 15 kg for Embul, Kolikuttu and Ash plantain.

respectively) at research centre as well as in farmer fields. This difference could be mainly due to the genetic variation associated with each cultivar. Figure 1 further shows that the weight gain due to de-handing is much greater at the farmer's field than that of the Research Center. This indicates the impact of de-handing could have an association with the type of crop management.

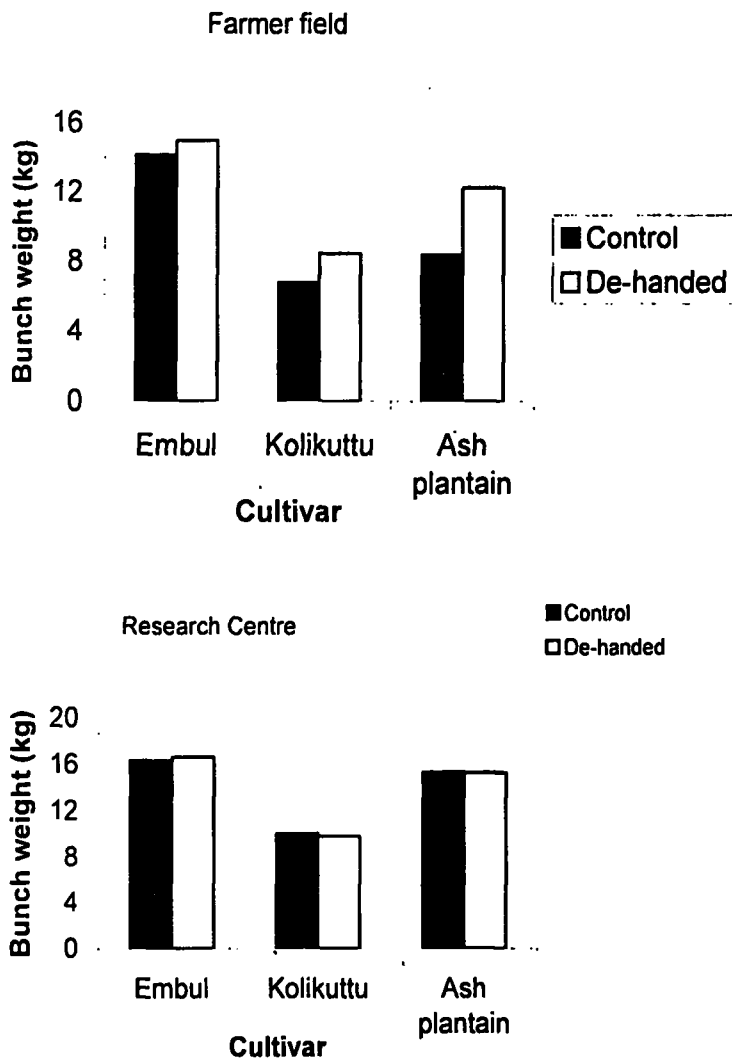


Figure 1. Effect of de-handing on bunch weight of the three cultivators.

Although the last two hands were removed during de-handing, the remaining hands gained the weight compensating the losses in de-handing operation. These who reported that the observations are in agreement with the findings of Samson (1980) the removal of incomplete hands increases

the weight of the remaining hands in banana bunches. However, these results are contradictory with those of Daniells and Bryde (1995) where bunch weight had decreased with de-handing in banana variety William Hybrids due to the reduction of the total number of hands.

Hand weight

De-handing reduced the variation between the weight of the second hand and the last-hand. This difference between the hand weights were significant ($p > 0.05$) in the control treatment whereas it was not significant ($p < 0.05$) in the de-handed bunches (table 1). This phenomenon occurred in all three cultivars demonstrating that the de-handing could result in hands with similar weights in all three popular banana cultivars. Observations made under farmer's field conditions also agree with the research station results (table 2).

Table 1. Influence of de-handing on the characteristics of the second-hand and the last-hand at the Research Centre at Angunakolapalassa.

Treatment	Cultivar	Second hand				Last hand			
		Weight kg	Weight g	Length cm	Girth cm	Weight kg	Weight g	Length cm	Girth cm
Control	Embul	1.5	100.0	12.4	10.8	0.73	61.5	9.7	8.5
	Kolikuttu	1.4	96.1	12.1	10.8	0.69	74.4	9.4	8.7
	Ash plt	1.7	105.4	10.5	9.3	0.61	78.3	8.7	7.2
De- handed	Embul	2.1	109.3	13.3	12.6	1.7	93.3	12.7	11.8
	Kolikuttu	1.7	105.0	12.2	11.7	1.4	100.1	11.4	10.9
	Ash plt	2.1	137.9	19.6	14.2	1.9	131.6	20.1	13.8
SED, cultivar		0.84	2.48	0.35	0.18	0.79	6.71	0.54	0.35
SED, treatment		0.07	2.02	0.29	0.14	0.06	4.66	0.44	0.29
SED, culti. x treat. (<i>df</i> = 34)		0.12	3.51	0.50	0.25	0.11	8.08	0.76	0.50
CV %		15	7.2	8.4	4.8	21.3	20	14	10.9

SED – Standard error of the difference.

The higher hand weights in de-handed bunch could be due to the reduction in the size of sink enhancing better filling of reserves in the remaining fruits. The fruits in the second hand were larger in size than those in the last hand. This difference varied with the cultivar as shown in figure 2. The data revealed that the weight differences between, the second and the last hand were 51% 50.7% and 64% in Embul, Kolikuttu and Ash Plantain, respectively, in normal bunches. In de-handed bunches, the respective differences were reduced to 19%, 17%, and 9.5% in three cultivars. This reduction in weight differences in de-handed treatment could be due to the minimized competition and better distribution of limited food reserves among the hands.

Table 2. Influence of de-handing on the characteristics of the second and the last - hand at the farmer's field at Kattakaduwa.

Treatment	Cultivar	Second hand			Last hand				
		Hand weight kg	Fruit Weight g	Fruit Length cm	Fruit Girth cm	Hand weight kg	Fruit Weight g	Fruit Length cm	Fruit Girth cm
Control	Embul	1.2 (±0.03)	89.5 (±0.41)	10.8 (±0.07)	8.3 (±0.05)	0.6 (±0.04)	60.6 (±0.06)	6.4 (±0.09)	4.2 (±0.09)
	Kolikuttu	1.0 (±0.13)	92.0 (±1.19)	8.2 (±0.50)	7.5 (±0.13)	0.8 (±0.04)	70.2 (±0.08)	7.0 (±0.21)	5.3 (±0.39)
	Ash Plantain	1.3 (±0.06)	98.6 (±0.08)	10.3 (±0.09)	9.0 (±0.11)	0.9 (±0.03)	85 (±0.49)	6.2 (±0.08)	4.2 (±0.11)
De-handed	Embul	1.9 (±0.08)	100.4 (±0.23)	12.0 (±0.28)	10.3 (±0.43)	1.6 (±0.13)	90.5 (±1.29)	10.4 (±0.16)	8.4 (±0.07)
	Kolikuttu	1.2 (±0.03)	98.6 (±0.38)	10.4 (±0.05)	8.4 (±0.19)	0.9 (±0.06)	88.4 (±1.25)	8.2 (±0.10)	7.3 (±0.35)
	Ash Plantain	1.6 (±0.10)	105.2 (±2.03)	14.6 (±0.09)	9.5 (±0.17)	1.2 (±0.08)	100.2 (±0.92)	7.5 (±0.08)	6.2 (±0.08)

Values in parenthesis are the standard errors of the estimates.

However, the existing differences between two hands even in de-handed treatments may be due to the position of fruits in the bunch, which modifies the source-sink relationship. The hand removal could reduce the size of sink enhancing the deposition of dry matter per unit sink capacity. Jullien (2002) reported that the fruits on the distal part of the bunch are 30%-40% smaller than those at the basal parts of banana bunches. This is in agreement with the results obtained, especially for the control treatment in the present study (figure 2). Similarly there could be differences in accumulation of food reserves within bunches due to the time of emergence of hands bearing fruits along the peduncle. Jullien (2002) also reported that the lag phase in development between the basal and distal hands results in a large number of cells in basal hands. However, de-handing could help to minimize the size difference that exists between the basal and the last-hand. The deposition of dry matter within cells should be greater in fruits of the basal hands compared to those at the distal hands. Therefore, a difference between the basal and distal hand has always existed.

Fruit size

Fruit weight of the second-hand in de-handed bunches was significantly higher than the fruits of the same hand in non de-handed bunches irrespective of the cultivar (tables 1 and 2). The increase in fruit weight of the second-hand in Embul, Kolikuttu and Ash Plantain were 9.5%, 9.2% and 30%, respectively, when compared to the normal bunches. Similar behaviour can be observed for fruit length and girth, too.

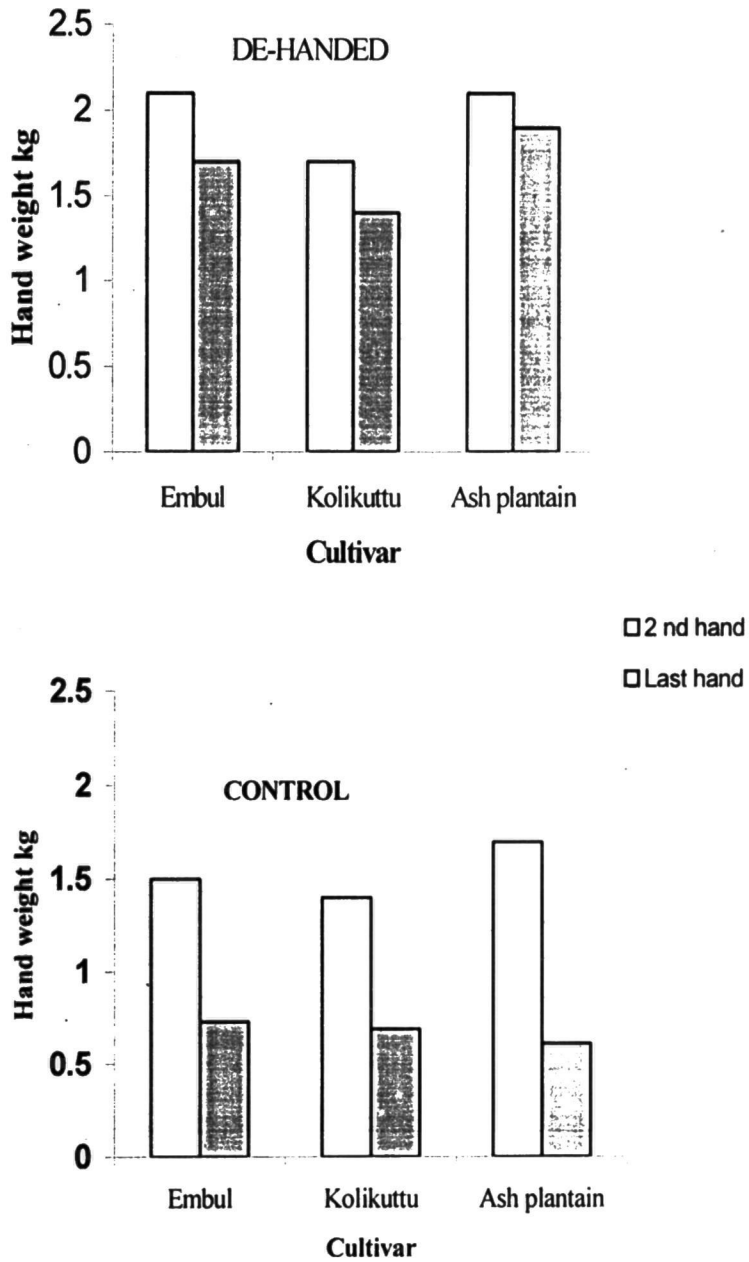


Figure 2. Influence of de-handing on the hand weight of three banana cultivars.

Fruits in the last hand also followed the same behavior, however, with a higher percentage difference between de-handed and non de-handed bunches. For the last - hand the increase in fruit weight was 52%, 34.5% and 68% for Embul, Kolikuttu and Ash Plantain, respectively, in de-handed bunches when compared to the control at the Research Centre. The effect of de-handing was more evident on Ash Plantain when compared to Embul and Kolikuttu. This could be a genetic character of Ash plantain. Being a cooking-type a greater amount of starch is accumulated in Ash Plantain when compared to the other dessert types. In Ash Plantain the number of fruits per hand was about 12 whereas it was 18 and 17 for Embul and Kolikuttu, respectively. Hence, the intra-bunch competition could be lower in Ash Plantain than that of the other cultivars, which promotes the filling of remaining fruits. Simmonds (1970) explained the inverse relationship between fruit number and fruit growth rate brought by the intra bunch competition, and that many-fingered French Plantain has fruits of average size, and few-fingered Horn Plantain has larger fruits. Daniells and Foster (2001) also observed that the percentage of large fruits increased with bunch trimming in banana. Similar observations have been made for certain temperate fruits, too. In Prune, size and the quality were increased with fruit thinning (Yeager *et al.* 1975). Kuroda (1974) reported of a favorable response in fruit size in Peaches caused by fruit thinning.

Green life of fruits

De-handing marginally extended the green life of fruits in Embul and Kolikuttu varieties. In the control treatment the mean green life was 2 days for Embul and 4 days for Kolikuttu. These periods were extended to 4 and 7 days in de-handed bunches of the respective cultivars.

Appearance of the fruits

De-handing resulted in a more homogeneous in size and alluring fruits when compared to bunches in the control treatment. De-handed bunches were more or less cylindrical and look perfect at a glance. Whereas bunches in control treatment were slightly conical in shape and less perfect. However, cultivars, which possess a fewer number of hands in a bunch such as in Ash Plantain and Kolikuttu, gave a bulge appearance to the bunch though the individual hands were attractive.

Economic importance

The farmer who practiced de-handing obtained about 20% higher price for one kg of fruits in the local market (table 4).

Table 4. Market prices in the month of November 2003 and the income obtained by the farmer for different cultivars.

<i>Cultivar</i>	<i>Control</i>			<i>De-handing</i>		
	<i>Bunch wt. kg.</i>	<i>Price per bunch Rs</i>	<i>Rs/kg</i>	<i>Bunch wt. kg.</i>	<i>Price per bunch Rs.</i>	<i>Rs/kg</i>
Embul	14.5	217.50	15.00	15	285.00	19.00
Kolikuttu	7.0	175.00	25.00	9	247.50	27.50
Ash Plantain	8.0	240.00	30.00	12	396.00	33.00

De-handing increased the price per kilo of banana in all three cultivars although the bunch weight was not increased. Farmers would be able to obtain higher profits even under de-handed condition, provided that the marketing of banana changes from selling of the whole bunch to crater-packed hands.

However, when de-handing is practiced, the growers should be cautious of the stage of maturity at harvesting of the crop. Unless bunches are harvested at the correct stage the fully expanded fruits tend to split longitudinally. This phenomenon was very common in Kolikuttu, which could also lead to development of secondary infections. Thus, practicing de-handing technique in an unattended cultivation of banana could be a disadvantage.

CONCLUSIONS

De-handing has influenced quality of banana by increasing the fruit size, fruit weight, bunch weight and hence the profits. The effect is prominent in Ash Plantain when compared to the other cultivars tested. The appearance of the hands were improved with de-handing and cultivars with a fewer number of hands produced bulged bunches. De-handing helped to obtain higher prices even under local market conditions. Therefore, de-handing is an appropriate technique, which can be practiced to improve the fruit size and the market price of banana especially for commercial cultivations. However, it is important to consider the stage of maturity at harvest when applying de-handing techniques since fruit splitting could occur due to over-ripening.

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