

## **DE-BELLING TO IMPROVE THE BUNCH QUANTITY IN BANANA (*MUSA SPP*) CULTIVATIONS AIMED AT LEAF-HARVESTING**

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### **ABSTRACT**

Banana (*Musa spp.*), the most extensively grown fruit crop in Sri Lanka, is used for both fruit and leaf harvesting. Although banana grown for leaf harvesting produces bunches with acceptable quality under optimum growing conditions, the quality of the bunches deteriorate under unsatisfactory growing conditions. This study attempted to enhance the bunch quality in banana cultivations aimed for leaves by removing the bell (de-belling) after the emergence of 4–5 hands. Results indicated that de-belling increased the fruit size and fruit weight and thus forming an alluring bunches, reduced the total bunch yield by 18% when compared to the control, but increased the profit per ha by 12.6%. De-belling technique can be recommended for banana cultivations aimed at leaf harvesting, to obtain improved bunch quality ensuring higher farmer income.

**KEYWORDS:** Banana, de-belling, bunch quality, finger size, leaf harvesting.

### **INTRODUCTION**

Banana (*Musa spp.*) occupies an area of 8.8 million ha in tropical and subtropical regions of the world (SAARC, 2009). It is one of the major commercial horticultural crops in Sri Lanka as well. Increasing interest for cultivation of banana was recorded recently as the Department of Agriculture has introduced the concept of cultivating banana for both leaves as well as for fruits (Weerasinghe *et al.* 2008) for more income generation. Weerasinghe *et al.* (2008) reported that the banana variety 'Embul' grown mainly aiming at harvesting leaves, under good growing conditions, produced bunches of around 10 kg with fruits of 80–90 g in weight. Same authors have shown that marginal lands, which are not suitable for cultivating banana for fruits, can easily be used for cultivating banana for harvesting leaves. However, they tend to produce small bunches with poor quality. In a standard banana cultivation leaf trimming reduces the bunch yield by 28% due to the reduction of the source capacity and the physiological stress (Weerasinghe *et al.* 2008). Generally, a healthy banana plant produces a bunch at the end of the life cycle and its quality depends on the prevailing growing conditions. Therefore, it is worth to make an attempt to improve the quality of bunches in banana cultivations established for leaf-harvesting under marginal conditions. Accordingly, the present study was conducted with objectives of developing an economically viable technique to improve the bunch quality in leaf-harvesting banana cultivations.

## MATERIALS AND METHODS

This experiment was conducted at the Agriculture Research Station, Thelijjawila, Sri Lanka, located in the wet zone (WL<sub>2a</sub>) during March 2008 - February 2010. The soil type at the experimental site was Dodangolla series of Typic Plinthudults (Senarath and Dasanayake, 1999). The site selected for this experiment was highly eroded with a poor grass cover indicating the low fertility of the soil. Five hundred plants of Embul banana (*Musa* spp.; Mysore AAB) variety Nadee were established in a double-row system leaving 2 m between couple rows, and 1 m between rows and within rows (2 m x 1 m x 1 m) at a density as 6,666 plants per ha (Weerasinghe *et al.* 2008). Broad-leaved suckers weighing 5–7 kg of fresh weight were dipped in boiling water for 30 sec to eradicate the banana corm weevil (Weerasinghe, 2007) prior to establishment. After field establishment all plants were de-topped at about 40–45 cm above the ground level to ensure uniform growth and emerging followers were removed leaving only the mother plant. Fertilizer was applied at 75% of the quantity recommended by the Department of Agriculture together with 500 g of compost per plant, as a measure to reduce the cost of fertilizer. Each alternate leaf was trimmed in all plants of the cultivation from four months after planting (MAP) to the emergence of the last leaf before the flag leaf. In the population of 500 plants, 50 plants were randomly selected for imposing the treatments. Twenty five plants were allowed to produce bunches freely (control) where only the male bud was removed after completion of the hand separation, leaving 10 cm from the last hand. The other 25 plants were subjected to the de-belling treatment where bells were removed after appearance of four hands, though the bell was still capable of continuing for hand separation. Bunches in both treatments were bagged with poly sac bags to enhance the bunch weight and quality. Bunch weight, number of hands/bunch, mean hand weight, number of fruits/bunch, mean fruit girth, mean fruit length and mean fruit weight was recorded. The performance of two populations were compared using the students t-test ( $p=0.05$ ). The cost effectiveness of the de-belling technique was also evaluated.

## RESULTS AND DISCUSSION

### **Yield performance**

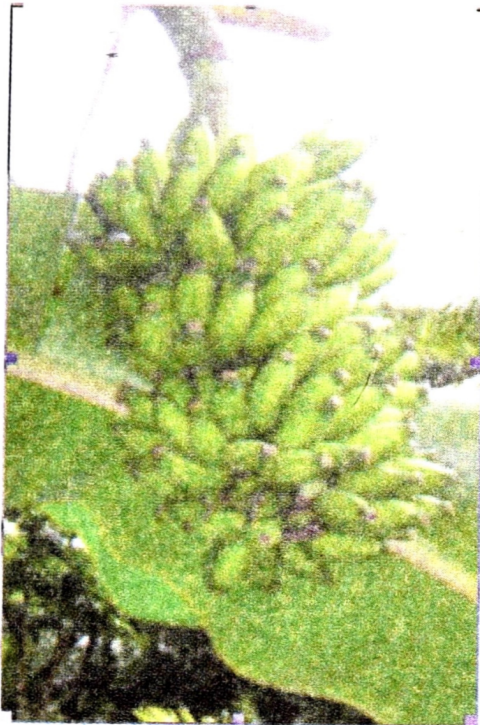
The plants in the control plots without de-belling showed a higher bunch weight per plant and number of fruits per bunch, but a lower hand weight, individual fruit weight, and length and girth of fruits (Table 1), resulting in a higher total yield than the de-belled plants. Similar observations were made by Aristizabal (2004) on the banana variety FHIA 20. The mean hand weight was 55.4% higher in de-belled bunches when compared to control as inferred from appearance of bunches in both treatments imposed in the

Present study is shown in Figure 1. This weight difference could be due to the minimized inter-hand competition for assimilates within the bunch.

**Table 1. Yield performance of banana under two management systems.**

<i>Parameter</i>	<i>Control</i>	<i>De-belled</i>
Number of hands/bunch	9 a	4 b
Weight of hand (g)	0.90 b	1.46 a
Number of fruits/hand	16.0 a	16 a
Number of fruits/bunch	142 a	65 b
Weight of fruit (g)	54.49 b	90.87 a
Length of fruits (cm)	8.68 b	13.85 a
Fruit girth (cm)	9.31 b	15.18 a
Bunch weight (kg)	7.35 a	5.96 b
Total yield (mt/ha)	44.13 a	35.76 b

Means followed by the same letter in each row are not significantly different at  $p=0.05$  by the students t-test.



**Normal bunch**



**De-belled bunch**

**Figure 1. Appearance of bunches under different management systems at maturity.**

Increase in fruit weight and hand weight with trimming of last hands have been reported by Quintero and Aristizabal (2003) and Weerasinghe and Ruwanpathirana (2004). The bunch weight and the total yield have declined by 18.9% and 18%, respectively, in-de belled plants compared to the control (Table 1). Increase in fruit weight and size in de-belled plants did not compensate for the decline in yield.

These results are in agreement with observations reported by Irizarry *et al.* (1994) on dwarf banana cultivars. Although removal of the bell was expected to distribute the total assimilates in remaining hands of the bunch and produce a similar yield to that of the control, the former recorded a lower yield. The reduction in yield in the de-belled treatment could also be due to the reduction in sink capacity thus adjusting sink capacity to suit the source capacity would increase the yield without affecting the overall quality. However, de-belling has increased the fruit size and appearance. Therefore de-belling could effectively be utilized in banana cultivation, which has subjected to various production constraints, to improve the bunch quality assuring a higher market price for the producers.

### Economic assessment

The cost incurred for both treatments were the same, but the de-belled bunches showed a 12.65 % higher profit than the control (Table 2). This is a result of generating an additional income of Rs 180,000 per ha, due to a higher price fetched by the better quality fruits in the de-belled treatment. Income generated from additional suckers and male buds were similar in both treatments. Thus, the loss in yield due to the de-belling practice was compensated for the producers.

**Table 2- Comparison of the costs and returns of two treatments on per ha basis.**

<i>Item</i>	<i>Control</i>	<i>De-belled</i>
Total cost of cultivation (Rs) (All inclusive)	1,200,000	1,200,000
Bunch yield (mt)	42	36
Male buds (Rs) (@ Rs 2/male bud)	12,000.00	12,000.00
Income from bunches (Rs)	1,260,000.00 (@ Rs 30/kg)	1,440,000.00 (@ Rs 40/kg)
Income from extra suckers (Rs) (3 suckers/plant @ Rs 25/sucker)	450,000.00	450,000.00
Income from bio plates (Rs) (three plates/leaf and Rs 5/plate)	900,000.00	900,000.00
Total income (Rs)	2,622,000	2,802,000
Profit (Rs)	1,422,000	1,602,000

The more alluring appearance of the hands and fruits in de-belled plants (Figure 1) has fetched a higher market price than those in the control treatment. This indicates that, even with 50% trimming of leaves, de-belling would produce fruits with better appearance which fetch a higher market price generating more income to the practitioners than without de-belling.

## CONCLUSIONS

De-belling is a practice that can effectively be adapted to improve the quality of bunches in banana cultivations. Though the technique reduced the quantity of the yield, it resulted in an increased quality of the fruits and hence leading to a higher market price and income. Therefore de-belling technique can be recommended for farmers to obtain higher profits from banana cultivations aimed at leaf harvesting.

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