

INFLUENCE OF BAGGING MATERIAL ON BUNCH DEVELOPMENT OF BANANA (*Musa spp.*) UNDER HIGH DENSITY PLANTING SYSTEM

S.S. WEERASINGHE and K.H. RUWANPATHIRANA

*Grain Legume and Oil Seed Crops Research and Development Centre,
Angunakolapellesa*

ABSTRACT

Bunch covering is a common practice in banana cultivation to produce more cleaner bunches with no blemishes and external spots. An investigation was carried to select a suitable type of bagging material for banana planted under high density planting system. Bagging materials - blue polythene, white polythene, colourless polythene, blue-coloured poly-propylene and woven poly-sac bags (super-sac) were tested and the bagging was done after the differentiation of the male bud. Although type of bagging material did not have any effect on the harvesting maturity, bunch covering increased the bunch weight by 32%. Colour of the material did not affect the bunch weight or the fruit weight but influenced the external appearance of bunches. Woven poly-sac bags were identified as the most economical type of bagging material. Bunches covered with colourless polythene bags are prone to the sun scorching under tropical conditions.

Key Words: Banana, Bunch Covers, Bunch Weight, Harvesting Maturity; Sun Scorching,

INTRODUCTION

Banana is one of the most popular fruit crops with an year round production in Sri Lanka. Sri Lanka produced nearly 780,000 t in year 2000 making a per capita availability of 27 kg/year. However, actual availability to the consumer is much lower due to various reasons including improper post-harvest handling. Therefore, a number of preventive measures are recommended to enhance the product quality including bunch covering.

Bagging is done to protect bunches from low temperature like in India (Gopalkrishna and Deo, 1960) and Australia (Berrill, 1956). It is also effective against sunburns and blemishes caused by wind-blown dust and birds (Samson, 1980). In Sri Lanka too, bunch covering was introduced as a protective measure against the thrips damage (Anon, 1995). Many researches (Perumal and Adam, 1968; Chillet and Jannoyer, 1996) reported that bagging raised the temperature around bunches and reduced the shooting to harvesting time under temperate conditions. According to Chillet and Jannoyer (1996), microclimate of bunch could favorably be changed by bunch covering. It is reported that the bunch weight could be increased by 18 - 23% while promoting the appearance of the fruits under Sri Lankan conditions (Anon, 1995). Samson (1980) observed a temperature rise of 1.1 - 1.6^o C surrounding the bunch and an increase of the bunch weight by 1 kg. Bunch covering has negative effect like peel hardness in varieties like Grand Naine and Dwarf Cavendish (Heenan, 1973).

Various types of bagging materials are used at present. Most of the banana growers use bags made of organic material such as hession (a fabric material similar to jute), coconut leaves, banana trash and paper bags (Simmonds, 1970). Today, the most commonly used bagging material is the perforated blue coloured polythene bags. The scientific reason behind the use of blue colour bags is not known. Wade *et al.* (1973) attributed it to the protection of bunches from UV radiation, which otherwise causes necrotic scorching of the fruit peel. However under large scale cultivations, blue colour bags have practical problems as they do not permit the detection of correct maturity for harvesting. Therefore, transparent bagging materials are more preferred in commercial cultivation under high density planting system (Weerasinghe, 2000).

The objectives of this study were to evaluate the effect of different bagging material on fruit growth and development in the southern dry region and to compare the performances of different bagging material with the conventionally used blue colour polythene.

MATERIALS AND METHODS

An experiment was conducted at the Grain Legume and Oil Seed Research and Development Centre, Angunakolapelessa in 2001 (Soil type: Rhodudalfts, Rainfall 677.5 mm in *maha* and 426.8 mm in *yala*, maximum average temperature 32 C⁰ and minimum average temperature 23 C⁰). *Embul* Banana (Mysoore) plants established under the dense planting system (3,333 plants/ha) were chosen for the study. Plants flowered within 3 days were selected for the study to ensure homogeneity. Male buds of the selected bunches were removed leaving 10 cm of the pedicle stalk from the distal hand. Bagging materials selected were, blue polythene, white polythene, colourless polythene (transparent), poly-propylene bags (patented by Macbolon company) and woven ploy-sac bags (super-sac bags). They were tested against the bunches with no bagging. The six treatments were replicated 5 times with two plants per replicate making all together 60 plants. Observations made were external appearance of the fruits, shooting to harvesting time, weight of bunches, weight of hands, fruit length and girth and cost involvement with different materials. Temperature inside the bags was monitored for a period of one week at 12:00 noon. Brix value of the fruits was measured using a hand held refractometer.

RESULTS AND DISCUSSION

Temperature inside the bags

The temperature measured surrounding the second hand inside the bunch cover at noon ranged from 29.7 °C to 31.4°C (Figure 1). The lowest value of 29.7°C was observed with woven poly- sac bags (super sac) and the maximum of 31.4°C was observed with colourless transparent polythene bags.

However these values were not significantly different. The variation in temperature inside the bags could be the result of the degree of light penetration through the bagging material. As the visible light spectrum is transmitted through colourless material, the temperature inside the covers could increase rapidly.

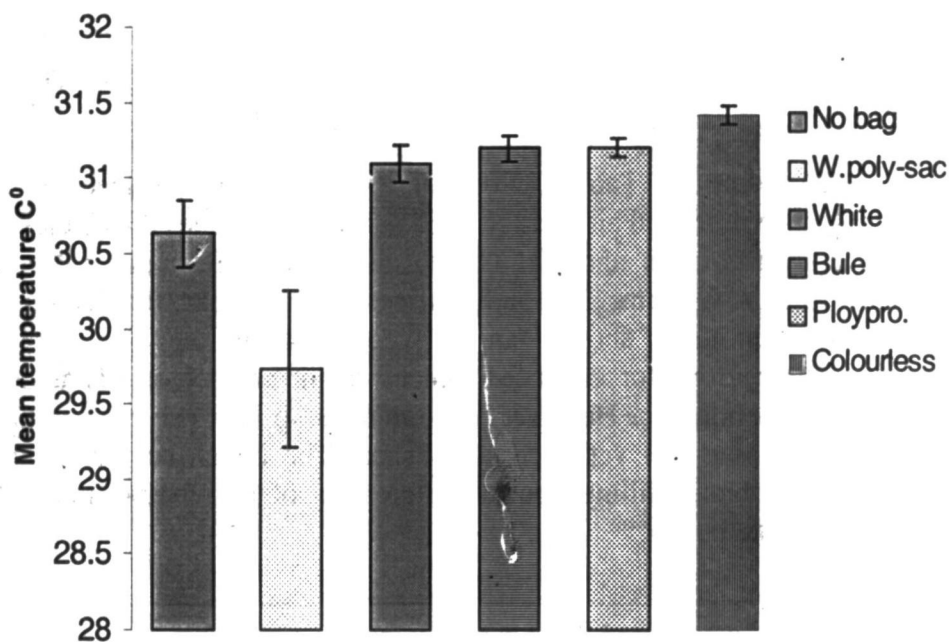


Figure 1. Temperature variations within the different bunch covers at 12 noon

Harvesting maturity and bunch characteristics

Time taken from shooting to harvesting ranged from 100 to 105-d and there was no marked difference among the treatments tested (Table 1). However, many authors reported that the time taken from shooting to harvesting has been reduced due to bagging under temperate conditions. (Perumal and Adam, 1968; Chillet and Jannoyer, 1996), and they have attributed the effect was due to the increased microclimatic temperature within the bunch covers. However, no such effect was observed under local conditions although temperature surrounding bunches had increased from 29.7°C to 31.4°C. Prediction of harvesting maturity was much easier with colourless bags. This reduces the risk for bird damage to ripen fruits in field.

Table 1. Performances of bunches with different bagging materials

<i>Treatments</i>	<i>Harvesting Maturity</i> (<i>d ± sd</i>)	<i>Bunch Weight</i> (<i>kg</i>)	<i>Hand Weight</i> (<i>kg</i>)
No bags	104 ± 2.8	13.74	1.32
Blue bags	103 ± 2.8	18.26	1.72
Colour less bags	103 ± 2.5	18.14	1.70
White bags	102 ± 2.6	16.86	1.58
Polyprop. bags	103 ± 2.6	18.24	1.62
Poly- sac bags	102 ± 2.1	18.90	1.64
CV%		8.28	11.31
LSD (0.05)		1.90	0.24

According to Table 2, bunches with covers, irrespective of the material, have produced an average of 32% heavier bunches than bunches with no covers. Robinson and Nel (1984) also observed similar behaviour in banana variety Williams in South Africa. In Sri Lanka too (Anon, 1995) previous observations showed an 18 - 23% increase in yield with bunch covers. The reasons for enhanced bunch weight are not clearly understood under local conditions. However, the relationship between temperature and bunch weight has not yet been established. The bunch covers might have enhanced the bunch filling due to the creation of a favorable microclimate surrounding the bunch.

Fruit characteristic

Table 2 shows the influence of bagging on fruit characteristics. Fruit weight, length and girth were significantly high in fruits of bunches with covers compared to bunches with no covers. These results do agree with the findings of Chillet and Jannoyer (1996). Comparatively larger fruits might be a result of the plump nature of the fruits in covered bunches. Relative humidity and temperature within the microclimate of the polythene bags are increased during daytime according to Robinson and Nel (1982). Under tropical conditions high relative humidity might have played a role to increase the plump nature of fruits when bunch covering is enforced. Chillet and Jannoyer (1996) pointed out 30°C as the optimum temperature for fruit development of banana. Brix value of the fruits ranged from 21-22% (Table 2) and the values were similar in all the treatments tested. Though the total soluble solid content of the fruits was not different between the bagged and un-bagged bunches, fruits in the uncovered bunches were sweeter than those in covered bunches. The bunch covering may have increased the water content within the fruits due to the increased levels of relative humidity (Robinson and Nel, 1982).

Table 2 Performances of banana fruits with different bagging material

<i>Treatment</i>	<i>Fruit Weight (g)</i>	<i>Fruit Length (cm)</i>	<i>Fruit Girth (cm)</i>	<i>Brix Value (% ± sd)</i>
No bagging	93.5	12.7	11.5	20.9 ±1.0
Blue bags	109.1	14.9	13.4	21.4 ±0.7
Colourless bags	117.2	14.6	13.9	21.1 ±1.2
White bags	110.9	14.3	14.6	20.7 ±1.4
Polypro. Bags	110.3	14.8	14.2	20.5 ±0.9
Ploy-sac bags	112.2	14.9	13.9	21.0 ±0.9
CV%	10.3	7.30	10.1	
LSD _{0.05}	14.8	1.4	1.8	

External appearance

Bunches developed within the bags seemed to be bigger, cleaner and attractive-green. Fruits of these bunches were markedly plump, showed no blemishes at all and alluring to consumer at a glance. Whereas the fruits of uncovered bunches, carried black spots and blemishes, caused by thrips damages and freckle fungi attacks. Therefore, external appearance of bunches with bags were superior to that of bunches with no bags. Robinson (1996) stated that the benefits of bunch covering is closely associated with physical aspects of bunches in tropical countries. Robinson and Nel (1984) showed that the number of first grade fruits was increased by 10 - 15% with the covering of bunches in variety Williams due to reduced mechanical damages and fewer underutilized fruits on the distal hands.

Sun scorching

In polythene covered bunches, irrespective of the colour, sun scorches were observed on the hands and bunch stalks where the polythene layer remained in contact. At points of contacts depressions of the polythene is formed externally and drops of water collected in the said depressions. These depressions with water could act as hot spots causing scorches on the stalk and fruits. This condition was further aggravated with transparent polythene bags due to the penetration of direct sunlight and also due to the action of water filled depressions acting as lenses. However with coloured bags, penetration of direct radiation is not that intensive and also the impact of the lens effect of the collected water. The woven poly-sac bags provide a perforated finish. Hence water drops may not retain on the woven poly-sac bags. Therefore sun scorches were not observed. Bunches covered with polypropylene bags also did not show sun scorches due to the porous nature of the material. Moreover, water filled depressions do not form due to the stiff nature of the material. The elevated temperature within the bunch covers might have aggravated the degree of sun scorches under the dry zone conditions. The maximum temperature was observed with transparent bagging materials (Figure 1) where the incidence of sun scorches was frequent too.

Cost of bagging

Costs involvement in bagging with different materials are shown in Table 3. Though polythene bags are cheaper, they can be utilized only once under dry zone conditions where intensity and duration of solar radiation is high. However, in temperate regions polythene bags could be used for 3 times before they are being discarded (Simmonds, 1970). Both polypropylene and supersac bags are re-usable and could be used at least twice under the conditions tested, thus the actual cost of the bag should be half the price shown in the Table 3.

Table 3. Cost of different bagging materials¹

Type of material	Cost (Rs).	
	Bag	ha
Blue polythene	8.00	24,000
Colourless polythene	6.50	19,500
White polythene	8.00	24,000
Poly propylene bags	50.00	150,000
Poly-sac bags	12.00	36,000

¹ Thickness of the polythene 150 gauge, Diameter of the polythene bags 60 cm, Length of the polythene bags 130 cm, No of bunches / ha 3,000

Also compared to polythene, poly propylene bags and poly-sac are easily degradable. Hence woven poly-sac bags are the cheapest, nature friendly and the most effective bagging material. In addition, it does not need to make punch holes as the bags are perforated. Performances of polypropylene bags are also comparable to the woven poly-sac, however they are not cost effective.

CONCLUSIONS

Bunch covering increased the weight and improve quality (appearance) of banana fruits. The increase weight of covered bunches could be attributed to the favorable microclimate created inside the bunch covers. Colour of the bagging material has no definite effect on growth and development of bunches under local conditions. Out of the materials tested colourless bags helped to detect the harvesting maturity easily. However, woven poly-sac (super-sac) bags found to be the most economical, technically suitable and environment friendly bagging material compared to other materials tested.

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