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EFFECT OF BUNCH SLEEVES IN REDUCING UNDERPEEL DISCOLOURATION IN BANANAS EXPOSED TO LOW TEMPERATURES

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Polyethylene sleeves (0.5 mil and 0.75 mil) significantly reduced the ocurrence of underpeel discolouration (U.P.D.) in Lacatan bananas. Distal hands were more susceptible to U.P.D. than others. Polyethylene sleeves (0.5 mil open and 0.75 mil closed) decreased bunch uniformity. Sleeving had no significant effect on shelf life (peel breaking force and pulp brittleness) of ripe fruit.

The use of polyethylene sleeves is therefore recommended for reducing the incidence of U.P.D.

INTRODUCTION

Underpeel discolouration (U.D.P) is manifested as reddish brown streaks in the vascular tissue just below the epidermis of the fruit peel. In the field, this defect occurs when the air temperature drops below 55ºF (12.8ºC). All exposed fruit is affected but fruit approaching harvesting grade is the most severely damaged (Stover, 1972).

Underppel discolouration less frequently results from dessication, from aging at low humidities with or without high temperatures, or in some cases from surface abrasion (Stover 1972). Berril (1956) reported the use of fertilizer bags, hessian covers, brown paper covers and plastic covers for the protection of developing banana fruit from chilling winds. Stover (1972) stated that single polyethylene bags gave no chill protection.

Phillips (1971) using mean finger weight and Muirhead (1977) caliper differentials (difference in caliper grade between the second distal and second proximal hands), showed that bunch covers adversely affected the uniformity of bunches.

Bond (1974) reported that bunch sleeves had no significant effect on pulp firmness, but significantly reduced peel firmness of green fruit, when the bunch sleeve was secured at both ends.

This investigation was initiated to determine the effect of bunch sleeving on the incidence of U.P.D. the uniformity of bunches (expressed as caliper grade differentials), and the peel breaking force and pulp brittleness of banana fruit.

MATERIALS & METHODS

This investigation was conducted between the months of February and May 1978 in a plant crop of the Lacatan cultivar at Glastonbury, Manchester. This site is at an altitude of 823 meters on friable brown clay loam in the Central Highlands of Jamaica with an annual rainfall of 1778 mm mainly in the months of May and October. Five treatments were applied, each treatment having 20 single plant replicates randomly selected in the field. Underdeveloped hands and floral buds were removed approximately three weeks after emergence of the ininflorescence. The treatments were as follows:

- Control (no sleeve)
- 0.5 mil sleeve with lower end open
- 0.75 mil sleeve with lower end open
- 0.50 mil sleeve with lower end closed
- 0.75 mil sleeve with lower end closed

The caliper grade (MM) of fruit on the second distal and second proximal hands of each bunch was measured on the middle finger of the outer whorl for each hand (the smaller the difference in caliper grade between hands measured, the more uniform the bunch). Air temperatures in the field were recorded with a Blick thermoscript recording thermometer. Fruit was reaped between caliper grades 30-33 mm and samples were taken from the distal, proximal and middle hands of each bunch. Four fingers per hand were sampled - two fingers (one each from the inner and outer whorls) from either side of each hand.

The following scoring system was used based on visual examination after stripping the peel:

0 = no U. P. D.
1 = trace
2 = light
3 = medium
4 = severe

Ripe fruit (yellow with green tips) was help at an air temperature of 19-21ºC and approximately 30% relative humidity and tested on shelf life days two and three, when peel breaking force and pulp brittleness was measured with a Tropical Products Institute designed pressure tester consisting of a motorized platform and a Chatillon force gauge (New, 1976).

RESULTS

Night air temperatures fell to 11 and 11.5ºC in the months of March and April respectively for 2 hours (Table 1). However, temperatures below 12.8ºC were maintained for up to 4 hours. This resulted in the occurrence of U.P.D. in all treatments. However, significantly hiher levels of U.P.D. were observed in the control treatment (Table 2), and no significant differences were found between sleeved treatments.

TABLE 1.

Field Temperature data for Glastonbury from February to May 1978

Month	Minimum Temperature (ºC)	Length of Time (hrs)
February	14.0	5
March	11.0	2
Abril	11.5	2
May	15.0	1

TABLE 2.

Effect of bunch sleeves on the incidence of underpeel discolouration.

Treatment	Mean U.P.D. Scores
Control	1.9 a *
0.50 mil sleeve open	1.2 b
0.75 mil sleeve open	1.4 b
0.50 mil sleeve closed	1.2 b
0.75 mil sleeve closed	1.2 b

* Column figures followed by the same letters are not significantly different ($p \leq 0.05$) according to Duncan's Multiple Range Test.

Hand position had a significant effect on the susceptibility of fruit to U.P.D. (Table 3.)

TABLE 3.
Level of U.P.D. in the distal, middle and proximal hands.

Treatment	Distal	Middle	Proximal
Control	2.05 a *	1.97 a	1.60 b
0.50 mil sleeve open	1.51 a	1.22 b	0.99 b
0.75 mil sleeve open	1.90 a	1.23 b	0.98 b
0.50 mil sleeve closed	1.70 a	1.17 b	0.95 b
0.75 mil sleeve closed	1.60 a	1.12 b	0.98 b

* Row figures followed by the same letters are not significantly different ($p \leq 0.05$) according to Duncan's Multiple Range Test.

For all sleeved treatments, distal hands recorded significantly higher levels of U.P.D. than both middle and proximal hands ($p \leq 0.05$). Comparison of middle and proximal hands showed that excepting for the treatment having 0.50 mil sleeve, open, there was no significant difference in the levels of U.P.D. observed. For the control, U.P.D. values for the distal and middle hands were significantly greater than those of the proximal hands ($p \leq 0.05$).

Caliper grade differentials within the bunches were markedly larger for treatments having 0.5 mil open sleeves and 0.75 mil closed sleeves (Table 4.).

TABLE 4.
Effect of bunch sleeves on caliper grade differences between the second proximal and second distal hands of each bunch.

Treatment	Mean Caliper Grade Differences (mm).
Control	0.73 b *
0.50 mil sleeve open	2.27 a
0.75 mil sleeve open	1.60 ab
0.50 mil sleeve closed	1.73 ab
0.75 mil sleeve closed	2.53 a

* Column figures followed by the same letters are not significantly different ($p \leq 0.05$) according to Duncan's Multiple Range Test.

No significant differences in peel breaking force of ripe fruit were recorded between treatments for shelf life days 2 or 3 (Table 5).

TABLE 5.
Effect of bunch sleeveson the peel braking force and pulp brittleness of ripe fruit.

Treatments	Peel braking force (Kg) Shell life days		Pulp brittleness (Kg) Shelf life days	
	Day 2	Day 3	Day 2	Day 3
Control	2.62 a	2.12 a *	2.89 a	2.62 a
0.50 mil sleeve open	2.14 a	1.73 a	3.00 a	2.78 a
0.75 mil sleeve open	2.24 a	1.81 a	2.89 a	2.65 a
0.50 mil sleeve closed	2.49 a	2.01 a	2.98 a	2.69 a
0.75 mil sleeve closed	2.14 a	1.70 a	2.82 a	2.50 a

* Column figures followed by the same letters are not significantly different ($p \leq 0.05$) according to Duncan's Multiple Range Test.

Mean pulp brittleness values recorded on shelf life day 2 were markedly higher than those obtained on day 3 for all sleeved treatments ($p \leq 0.05$). No important differences were noted for the control treatments. There were no noteworthy differences between treatments on either shelf life days 2 and 3.

DISCUSSIONS

Contrary to Stover (1972), single perforated polyethylene sleeves did give a significant degree of chill protection, although this was not sufficient to remove all symptoms. These findings are supported by the reports of Berril (1956) and Wardlaw (1972).

Results for the effect of hand position suggest that the proximal hands are less susceptible to U.P.D than distal hands as demonstrated in the control treatment and that sleeving offers a greater degree of protection to proximal hands.

The observed decrease in uniformity within bunches confirms the reports of Phillips (1971) that bunch sleeves may reduce uniformity of bunches. Phillips (1971) reported that polyethylene sleeves reduced the firmness of pulp of green fruit. He however observed that the peel of fruit covered with polythylene sleeves was softer. Results of both pulp brittleness and peelbreaking force measurements done on ripe fruit imply that the effect is reversed during ripening. This could be associated with loss of moisture from fruit during storage and ripening.

RECOMMENDATIONS

The use of single polythylene sleeves (0.5 and 0.75 mm) is recommended for reducing the incidence of U.P.D in the fields where this phenomenon occurs. However, tying of the sleeves at the distal end of the bunch is not recommended because accumulation of water and latex in the lower end of the sleeve results in peel blemishes.

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