

MARKETING PRELONGATION OF RIPENED BANANA USING NATURAL SUBSTANCES

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Abstract

Great quantities of ripened bananas in Egypt are lost at the retail level, because the fruits reach an overripened stage, causing them to become very soft and distorted in shape. To prolong shelf life, banana lots were subjected in two seasons of 2001 and 2002 to two treatments, by a very dilute concentration of a natural substances, (jasmine oil). The first treatment was fruit dipping for one hour in a jasmine oil solution of 0.025% concentration, while in the second treatment, an activated solution of jasmine oil (having a PH of 3.3) was used in the same way, in addition to a control. Afterwards, fruit were kept in ambient conditions (march-april). Activated jasmine oil treatment has resulted in longer shelf life (9.5-10 days), with good quality and better looking. Ordinary Jasmine oil and control fruits survived for 6-7 days with an inferior quality. It is recommended to use this natural treatment to prolong banana shelf life.

INTRODUCTION

Banana fruit is largely cultivated in Egypt with a production of 850000 tons (2001)*. It's a highly nutritious fruit and contributes in providing human body with potassium and vitamins.

Banana, a climacteric fruit, when reaching its final stage of maturity, passes through characteristic physiological changes of ripening (pulp softening, color turning, volatile emissions – etc). To hasten and harmonize these favorable changes, among whole lots of bananas, they should be treated by a ripening treatment, like exposure to ethylene in most cases (or any other treatments). Ripened bananas have usually a short shelf life, especially when reaching full ripe stage and deteriorate quickly, causing many losses due to excessive softening, skin darkening and fungal growth (Kader *et al*, 1994). Combating fungal infection on banana fruits (crown rot, cigar end rot or anthracnose) is another important factor, which may contribute in reducing losses during marketing cycle (Sommer, 1982).

Attempts to lengthen shelf life of ripened banana will be beneficial in cutting off losses and increasing revenues, and boost strongly exporting potentials for Egypt.

* Ministry of Agriculture (2001)

Some promising natural substances are tried actually to prolong shelf life and maintain fruit quality such as Jasmine oil, extracted from Jasmine plant flowers. It contains two hormonal compounds, methyl Jasmonate (MJ) and Jasmonic acid

(JA), which are extensively studied in the last fifteen years, and their useful effects are put under investigation (Fuchs *et al* 1995, Shiozaki *et al*, 1998, Yamane, 1995, and Sanieuski *et al*, 1987). Some of their proven effects were encouraging fruit development and growth, delaying internal ethylene production in fruits (Mitra *et al*, 2001) and enhancing fruit color (Takeuchi *et al*, 1997).

In the mean time, M. J and J. A have a known and recognized antifungal effect as sabelis stated (2001) about the role of M. J in enhancing plants to produce plant defense proteins. Zhinong (2002) cited a similar effect for M. J after being applied on tomato.

This research aims at investigating the effects of Jasmine oil application on shelf life and quality ripened banana at the ambient conditions (like those prevailed at the retail level).

MATERIALS AND METHODS

Green banana bunches of three quarter stage (mature fruit) were brought from a farm at El Kanater El Khairia district, in 2001 and 2002 seasons, and subjected immediately to a traditional ripening treatment (by gaseous emanations of carbide calcium coal).Afterwards, banana fruits were divided into three parts and treated as follows:

- 1- First part:** Bananas were dipped for one hour in an aqueous solution of Jasmine oil (after being dissolved in Ethanol) of 0.025% in concentration (1.5 cm³ in 4 liters).
- 2- Second part:** Bananas were treated as above, but using an activated Jasmine oil solution (prepared to have a PH of 3.3) and as stated above in the same concentration of 0.025%.
- 3- Third part:** A control treatment

Each part is composed of 10 banana hands of 2 – 3 kg each.

All banana hands were left in room at ambient temperature of winter (20 °C – 25 °C) for a period 7 days and their quality was evaluated after 3 and 7 days according to the following criteria:

- 1- General appearance: normal color development, presence or absence of skin discoloration or pitting or any other defects (grades of this scale, excellent "10-8", good 7.9-6", barely acceptable "5.9-4.5", bad "less than 4.5), after 3 and 7 days.
- 2- Fungal infection, at the end of shelf life (7 days) using a visual estimation scale,excellent, sound, weak infection by any common disease, cigar end, anthracnose ...etc, and heavily infected,corresponding respectively to these notes (10-8), (7.9-6), (5.9-4.5), and less than 4.5.
- 3- Degree of ripening progress: It is measured by mature banana percentage after 3 days and then percentage of fully mature banana after 7days that reaches stages of 6 and 7 of Del Monte banana chart . This latter chart qualify numerically maturity (from immature green, till ripe yellow banana),
External color (skin): It is measured bya Hunter colorimeter (taking "a" value as a comparing criteria) to estimate the effect of treatment on delaying coloration as an aspect of ripening.
- 4- Flesh firmness: using a hand penetrometer (Effi-gi type).
- 5- Total soluble solids, estimated by a digital refractometer. (Leica – Hamilton).
- 6- Acidity: by titration, using a solution of 0.1 Na oh..
- 7- Organoleptic quality: by a panel test to evaluate eating quality according to this scale, excellent(10 – 8) – good (7.9 – 6), barely acceptable(5.9 – 4.5) and unacceptable <4.5 .
- 8- Number of marketable days : Banana were left in air to note the longest period of time which at its end, banana is fully ripe with deep yellow color and the appearance of first sign, of over ripening percent (black spots on skin), but banana is still good for eating.

RESULTS AND DISCUSSION

Banana general appearance:

It is shown in table (1),and in the joined figures,general appearance revealed its highest values after 3 days and declined afterwards ,but was still acceptable after 7 days in ambient conditions (with a yearly average of 7.6 and 6.9 for the first and second years respectively).Bananas treated with activated jasmine had the best appearance after 3 days in ambient conditions in both seasons ,having a note over 8 in all cases,but banana treated with jasmine only and control had a hardly acceptable appearance after 7 days (a range of notes 4.5-5).

Safety of banana and fungal infection

All bananas included control were in an acceptable safe state, with relatively minor infections on the cut surface of banana hands and some black spots of overripening stage of control. As it is indicated in table (2), banana treated with jasmine only or with activated jasmine were exempted from fungal infections, even after 7 days, and their notes exceeded 8.5 in both seasons. This was an obvious action of jasmonates as antiseptic agent. This role of defence against microbial infection was stated by Ueda (1991) and Michael et al (1998).

Maturity progress:

It is clear from table (3A) that banana stored after 3 days in ambient conditions showed that activated jasmine treated banana was advancing slowly towards the ripening as 90% of hands in first year and 85% in second year were still in stages "1-2" of the Del Monte ripening chart, while 77.3% and 70% of banana hands treated by jasmine only were still at these stages. In the mean time control banana was more advanced in maturity as it recorded 46,6% and 51.6% of its banana hands in the first and second year respectively, in these early stages.

After 7 days in ambient conditions (table 3 a2), most control banana (96.6% 1st year and 95% 2nd year) were reaching its full maturity or stages "6-7" by Del Monte banana chart, while activated jasmine treated banana recorded a percentage of 62.3% on 1st year and 65.3% on 2nd year. Jasmine only treatment recorded 70.3% of advanced ripe banana in both seasons. These results prove that activated jasmine treated banana display a certain progress due to the delaying maturity action of activated jasmine oil as it is mentioned in kondo et al (2001).

Peel color:

Ripening progress as expressed by the change in "a*" value of the hunter colorimeter, as in table (3-b) proved clearly the slow conversion of green color to the distinguishing yellow of ripe banana, for the activated jasmine treated banana (as shown also in the joined pictures).

Banana of this latter treatment had a value of (-1.23) at the 1st year and (-1.63) at the 2nd year after 7 days in ambient conditions, while control banana was more advanced recording a value of 0.7 in both seasons, which indicates a less green color intensity than activated jasmine treated banana. This is another proof of the effect of activated jasmine oil on maturity by acting through the minimization of internal ethylene as Del Monte (1992) proposed to explain ripening delay of banana.

Banana pulp firmness:

Table (4) indicates the change in banana pulp firmness at ambient conditions . It is clear that the activated jasmine oil treated banana had a firmer pulp after 7 days storage at ambient conditions , (9.3 lb/sq.in 1st year and 8.3 for the 2nd year), compared to control with values of 4.3 and 7.6 for control in both seasons respectively) This is caused by a maturation slower rate that reduces destruction of starch and cell walls of banana treated by activated jasmine. These results are confirmed by the banana ripening criteria values, mentioned by Kader (1994).

Total soluble solids percentage:

It is clearly displayed in table (5) that activated jasmine oil treated banana had a slow T.S.S. evolution during the stay in ambient conditions, recording at the end of 7 days the values of 22.8% 1st year and 23% 2nd year. On the contrary, in the same conditions, both control and jasmine only treated bananas had higher values of T.S.S. (over 24 %). These results indicate that bananas were subject to a clear ripening delay effect by activated jasmine oil , which may be explained by the interference of jasmonates compounds (more disposable in activated jasmine oil) in ripening phenomena by slowing or opposing ethylene action (Shiozaki.1998).

Acidity percentage of banana pulp:

Table (6) indicates the change in acidity percentage during storage at ambient temperature. Acidity decreased in all banana treatments , but the decrease rate was noticeably slow for activated jasmine oil treated banana , which recorded 0.25% and 0.31% after 7 days in the first and second season consequently. Control banana had an acidity of 0.17% and 0.25% for the 1st and 2nd year . This is an additional indicator to the action of jasmine oil in delaying maturity.

Organoleptic quality:

After 7 days in ambient conditions , all banana were acceptable for eating, but control had a lesser grade because of its state of overripeness and softening of the fruit pulp, while both jasmine banana treatments had a better eating quality(a note of over 7) because of its high pulp firmness and a balanced taste , in contrary to the control fruits which had a slightly fermented taste because of anaerobic respiration due to attaining the senescence stage .That is the reason of their lower taste grade (5.7 and 6.3) in the first and second seasons respectively.

Marketability period:

Activated jasmine treated banana fruits recorded significantly the longest marketable time . Banana of this treatment survived 10 days in good conditions and acceptable eating quality, while control banana were marketable only for 6.6 days the first year and 6 days in the second year . Jasmine only treated fruits had similar or slightly better results to the control (7.3 and 6.7 days for 1st and 2nd years in consequence).Gowen (1996)confirmed the importance of prolonging the shelf life of banana to increase marketing possibilities and export potentials.

Conclusion:

Ripened banana, treated with activated jasmine oil in a very dilute concentration (a natural compound and cheaper than other chemicals used for the same purpose) had a longer shelf life in ambient conditions with good eating quality and better appearance , compared to control or pure jasmine oil treated bananas . It's highly recommended that this material could be applied in retail outlets and for export to prolong banana shelf life and keep fruit quality.

Table 1. Banana general appearance after 3 and 7 days in ambient conditions.

Treatments	1 st year			2 nd year		
	At start	3days	7 days	At start	3 days	7 days
Jasmine only	(9)	6.83	4.83	(9)	6.33	4.50
Activated Jasmine	(9)	8.50	8.17	(9)	8.50	8.17
Control	(9)	7.50	4.83	(9)	6.00	5.00
Average		7.61	5.94		6.94	5.89
Average of the year		6.54			5.85	
L.S.D at 5% level		1.710	0.7553		1.580	.7553

Table 2. Safety of Banana and extent of fungal infection after 3 and 7days in two seasons.

Treatments	1 st year At			2nd year At		
	start	3 days	7 days	start	3 days	7 days
Jasmine only	10	9.67	9.00	10	8.83	8.67
Activated Jasmine	10	8.67	8.67	10	9.00	9.00
Control	10	9.00	8.33	10	7.67	7.33
Average		8.45	8.67		8.50	8.33
L.S.D at 5% level		0.7553	0.9264		0.9264	0.6531

Table (3-a1): Banana ripening stage after 3 days in ambient conditions expressed by percentage of banana hands still in stage green or (stage 1 and 2)*

Treatments	start	1 st year	start	2 nd year
Time				
Jasmine only	100	77.33	100	70.00
Activated Jasmine	100	90.00	100	85.00
Control	100	46.67	100	51.67
Average		71.33		68.89
L.S.D at 5% level		17.95		8.861

*- These stages are stated in "Del Monte" banana company color chart, describing the deep green immature banana as stage (1) and passing all stages of banana ripening color changes till grade "7", full ripe yellow banana.

Table (3 - a2): Banana ripening stage after 7 days in ambient conditions (percentage of banana reaching stage 6 - 7) according to "Del monte" chart of banana color at different maturity stages.

Treatments	At start	1 st year	At start	2 nd year
Time				
Jasmine only	0.0	70.33	0.0	70.33
Activated Jasmine	0.0	62.33	0.0	65.33
Control	0.0	96.67	0.0	95.00
Average		76.44		76.89
L.S.D at 5% level		12.09		11.17

Table (3-b): Maturity progress in Banana as expressed change in skin color "Hunter a* value".

Treatments	AV. start	1 st year		AV. start	2 nd year	
		3 days	7 days		3 days	7 days
Jasmine only	8.90	-3.27	-0.15	8.93	-3.10	-0.67
Activated Jasmine		-8.40	1.23		-5.73	-1.63
Control		-1.05	0.70		-2.43	0.70
Average		-4.24	0.59		-3.75	-0.53
L.S.D at 5% level		3.949	3.135		1.918	2.412

Table 4. Banana pulp firmness after 3 days and 7 days in ambient conditions in two seasons (lb/in²).

Treatments	Start	1 st year		Start	2 nd year	
		3 days	7 days		3 days	7 days
Jasmine only	25	14.67	5.00	30	14.67	6.17
Activated Jasmine		15.00	9.33		16.00	8.33
Control		11.67	4.33		12.67	7.67
Average		13.78	6.22		14.45	7.39
L.S.D at 5% level		1.511	1.511		3.023	2.724

Table 5. T.S.S evolution in Banana pulp after 3 and 7 days in two seasons.

Treatments	Start	1 st year		Start	2 nd year	
		3 days	7 days		3 days	7 days
Jasmine only	5.2	16.67	24.57	5.7	16.67	24.33
Activated Jasmine		10.67	22.87		11.00	23.00
Control		17.33	24.83		21.00	25.00
Average		14.89	24.09		16.22	24.11
L.S.D at 5% level		3.023	0.836		4.689	1.448

Table 6. Acidity percentage of Banana pulp after 3 and 7 days in two seasons..

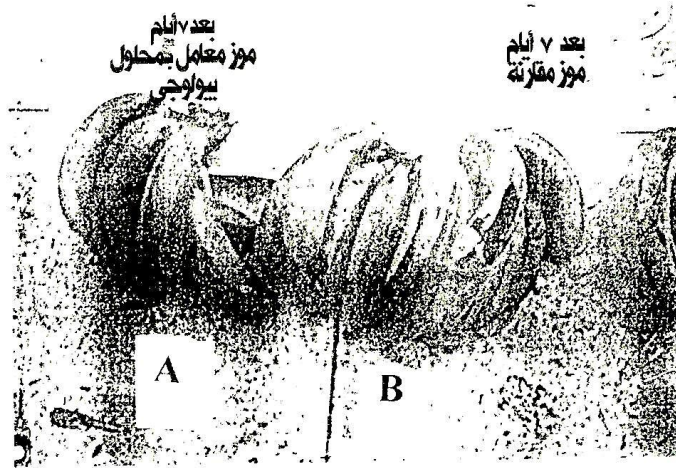
Treatments	Start	1 st year		Start	2 nd year	
		3 days	7 days		3 days	7 days
Jasmine only	0.41	0.27	0.22	0.42	0.27	0.23
Activated Jasmine		0.43	0.25		0.38	0.31
Control		0.30	0.17		0.28	0.25
Average		0.33	0.21		0.31	0.26
L.S.D at 5% level		0.02267	0.07169		0.02378	0.02267

Table 7. Organoleptic quality at the end 7 days storage.

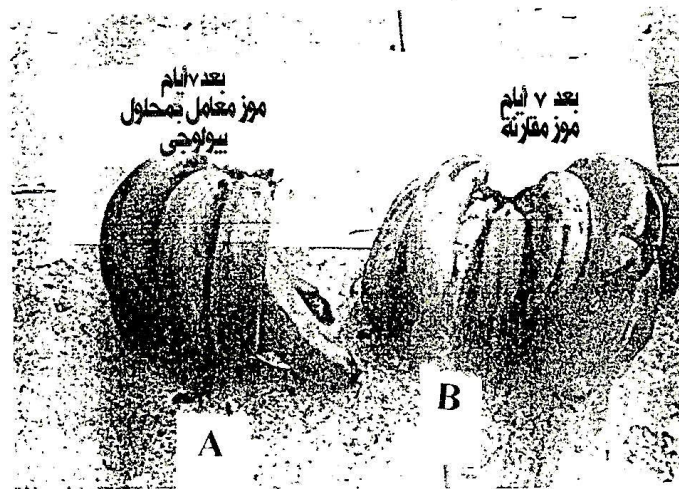
Treatments	1 st year	2 nd year
Jasmine only	7.67	7.00
Activated Jasmine	7.67	7.67
Control	5.67	6.33
Average	7.00	7.00
L.S.D at 5% level	2.617	2.617

Table 8. Marketability period (number of days after which banana reaches full and complete ripeness).

Treatments	1 st year	2 nd year
Jasmine only	7.33	6.67
Activated Jasmine	10.00	9.67
Control	6.67	6.00
Average	8.00	7.45
L.S.D at 5% level	1.308	1.195



A: Fruits treated with Activated jasmine oil after 7 days at ambient conditions.
 B: Control fruits after 7 days at ambient conditions.



A: Fruits treated with Activated jasmine oil after 7 days at ambient conditions.
 B: Control fruits after 7 days at ambient conditions.

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إطالة فترة تسويق الموز الناضج باستخدام مواد طبيعية

حمدي السيد مصطفى الزييات

معهد بحوث البساتين - مركز البحوث الزراعية - الجيزة .

تتعرض كميات كبيرة من الموز بعد إنضاجه في مصر إلى التلف وعلى الأخص عند تجار التجزئة . حيث تصبح الثمار بعد فترة من تعرضها للجو العادي (يوم فأكثر) زائدة النضج وطريه وذات تشوهات في القشرة . وإطالة فترة حياة الثمار بعد الإنضاج فقد أجريت تجريبه باستخدام مواد طبيعية (زيت الياسمين) في معاملتين . تم تغطيس الثمار (بعد الإنضاج مباشرة) لمدة ساعة في تركيز مخفف جدا من زيت الياسمين فقط (بتركيز ٠,٠٢٥ %) في المعاملة الأولى . أما الثانية فقد استخدمت زيت ياسمين منشط (درجة حموضه PH ٣,٣) وبنفس طريقة العمل .

ووضعت الثمار (مع المقارنه) في الجو العادي خلال موسمي ٢٠٠١ و ٢٠٠٢ .

أسفرت النتائج عن إطالة فترة حياة الموز المعامل بزيت الياسمين المنشط ليصل من ٩ - ١٠ أيام مع درجة جوده مرتفعه . بينما وصلن فترة حياة الموز المعامل بزيت الياسمين وحده أو المقارنة من سته إلى سبعة أيام مع ظهور علامات بداية الشيخوخة على الثمار (تشوهات سوداء) . يوصى باستخدام هذه المادة الرخيصه والفعاله . لإطالة فترة حياة الموز بعد إنضاجه وعند عرضه في الأسواق .