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EFFECT OF THE COMBINATION BETWEEN ORGANIC (COMPOST) AND BIO-FERTILIZERS ON QUALITY, RIPENING AND MARKETING ABILITY OF "GRAND NAIN" BANANA FRUITS.

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ABSTRACT: ***For product banana fruits free from chemicals and safe for human nutrition and with good quality, ripening and marketing ability, this investigation was conducted as a trial for applying organic cultivation "clean cultivation" through satisfying the nitrogen requirement of 'Grand Nain' banana plants from organic manure and bio-fertilization instead of mineral nitrogen fertilization. The present investigation was planned and carried out during the two successive seasons of 2006/2007 and 2007/2008 years in the experimental orchard at El-Kanater Horticulture Research Station, Kalubia Governorate, Egypt. The amount of actual nitrogen (500 g/plant/year) and the treatments of soil added fertilization were chemical as a control, compost, compost plus "Rhizobacterin", "Microbein" or "Nitrobein".***

Results revealed that, feeding compost by "Nitrobein" give the highest bunch weight and estimated yield per feddan compared with other fertilizer treatments and control. Chemical fertilizer (control) had the least score of economic study, ripening and marketing ability and total evaluation grade (83.30%). Inoculation of compost by "Rhizobacterin" recorded the highest total evaluation grades (96.50%) and had more pronounced effect on pulp/peel ratio, fruit weight loss%, moisture content, TSS% and total sugars at mature stage or during ripening period with ideal peel color and taste after 14 days from treatment by acetylene gas.

Key Words: ***Banana, 'Grand Nain', Organic fertilizers, Compost, Bio-Fertilizers, Fruit Quality, Ripening and Marketing Ability.***

INTRODUCTION

Banana (*Musa sp*.) is considered one of the most important and favorite fruits in the world, since it has an excellent flavor with high nutritional value. Banana as one of the most important fruit crops in Egypt however, is difficult to be stored. During ripening and marketing, quality and shelf life are limited by excessive fruit softening and rotting (Li, 2008; Lin, *et al*., 2008). During banana ripening, there is a massive transformation of starch to sugars

(Gelencsér, *et al,.* 2008), and there is a close relationship between this transformation and fruit ripening and senescence processes, such as respiratory and ethylene production (Cordenunsi and Lajolo, 1995).

Increasing banana productivity under Egyptian condition is one of the main target of many specialists. Several factors play a vital role in this respect, fertilization is an important one. Thus, a great attention is focused on fertilization in order to correct plant nutritional status and enhance vegetative growth of Banana plants, which in turn will be reflected on increasing yield and improving fruit quality.

Banana plants need intensive fertilization program and large amounts of fertilization, especially nitrogen and potassium. Moreover, it draws nutrients from a very limited soil depth because its relatively shallow root system (Saleh, 1996).

So, one of the main problems facing banana growers is the high cost of excessive chemical fertilizers, needed for plant growth. Besides, these chemical fertilizers considered as air, soil and water polluting agents results from leached chemical fertilizers into the soil consequently, it has drawn the attention of researchers and banana growers to use the bio-fertilizers and organic fertilizers which are safe for human and environment thus, it is preferred to avoid pollution and reduce the cost of fertilizers.

The effectiveness of organic matter to supply the required nutrients to the crops is determined by their chemical composition and C : N ratios using microorganisms has illustrated greater nutrient use efficiencies of crops when such inoculates were added to either organic matter or soil. Furthermore, the use of bio-fertilizers was suggested to be one possibility to restore the nature condition of bio-fertilizers mainly consist of beneficial microorganisms that can release nutrient substance from rakes and plant residences in the soil and make them available for economical plants. A variety of such material is now available commercially – specific strains are used as biological fertilizers containing nitrogen, phosphorus. N – fixing bacteria such as Azotobacter, Azospirillum and Bacillus are considered the most important beneficial microorganisms Rhizobacterin, Nitrobein and Microbein could be used as sources for fixing nitrogen in the soil and make the phosphorus available to the plant nutrition, which is always found in soil in available status. The use of bio-fertilizers in combination with organic fertilizer results in encouraging yield and helps to keep the environment clean for coming generation.

The main target of the study is to produce banana fruit, safe for human nutrition with good quality and marketing ability. This investigation was conducted as a trial for organic cultivation "Clean cultivation" through satisfying the nitrogen requirement of banana plants from organic manure (Compost) and bio-fertilization instead of mineral nitrogen fertilization and the evaluation of this process through studying the effects of organic

manure and bio-fertilizers on some parameters of plant fruiting and fruit quality for "Grand Nain" banana plants.

MATERIALS AND METHODS

The present investigation was planned and carried out during the two successive seasons of 2006/2007 and 2007/2008 years in the experimental orchard at El-Kanater Horticulture Research Station, Kalubia Governorate, Egypt.

Soil analyses Table (1) indicated that Nitrogen, phosphorus and potassium was found as follows:

Table (1): Mechanical and chemical analysis of experimental orchard soil (0-40) cm depth in 2004 season.

Character	Levels		Character	Levels	
	Total	Available		Total	Available
Texture class	Clay loam			Nutrient element (ppm)	
pH	7.90	--	N	690.0	0.076
Ec (ds/m)	3.70	--	P	370.0	16.30
CaCO3 (%)	3.75	--	K	4590.0	610.70
Organic matter (%)	1.802	--	Fe	3241.0	23.20
Organic carbon (ppm)	0.066	--	Zn	123.2	6.10
			Mn	165.0	16.80
			Cu	58.3	3.90

Table (2): Chemical analysis of Compost El-Obour and Chicken manure.

Organic manure	Contains				
	N %	P %	K %	Organic matter%	Organic carbon%
Farm yard manure (Compost El-Obour)	1.4	0.75	1.75	>34	>20
Chicken manure	2.35	0.212	0.71	>60	>35

- **Organic manure (Compost El-Opour) and Chicken manure Table (2) was applied superficially and rigged in the season. The amount of actual nitrogen (500 unit (N) / plant/year = 30 kg compost + 3kg chicken manure).**
- **Commercial bio-fertilizers (Microbein, Rhizobactrein and Phosphorein) were applied in the first week of March of each season in trenches.**
- **Chemical fertilizer as nitrogen soil was added in the form of ammonium sulphate (20.6 % N) the N level was applied in five equal spit doses monthly from March to October a source of nitrogen according to the recommendation of Horticulture Research institute, Ministry of Agriculture, Egypt. The amount of actual nitrogen (500 g/plant/year).**

The treatments of soil added fertilization were:

1. **Chemical (Control).**
2. **Compost.**
3. **Compost+100g Rhizobacterin.**
4. **Compost+100g Microbein.**
5. **Compost+100g Nitrobein.**

- Fruit ripening. Banana bunches for every treatment were harvested at maturity stage when Ovality% attained 8.7% (according to Sobeih, 1992), and held for 24 hours in the laboratory at room temperature. Bunches were divided into hands, washed with tap water and air dried then packed in cardboard boxes were placed on shelves in ripening room at 20°C±2 and 90%±2 relative humidity and subjected to acetylene gas generated from calcium carbide (5gm calcium carbide in boiling water/m^3 ripening room) for 48h then transferred to be held at 22°C±2.

Each treatment was replicated three times. The samples of all treatments were examined for the following characters:

1. Physical properties.

1.1 Bunch weight (kg) and estimated yield (Ton/feddan). Bunches were harvested and weighted at the full maturity stage when fingers of the bunch attend the three quarter full stage in both seasons.

1.2.Pulp/peel ratio. Peel and pulp as well as pulp/peel ratio was determined in sample of 15 fruits replicated three times.

1.3. Fruit firmness (kg/cm^2) was measured by a hand Magness and Taylor pressure tester equipped with 5/16 inch plunger.

1.4. Fruit peel color index was estimated according to Horticultural color chart index and abbreviated in Table (3) (Von Lesecke, 1950).

Table (3). Grades of color were abbreviated as follows:

Grade	Color	Description
1	Green	Normal color of bananas when they arrive at ripening facility
2	Light Green with Light Tinge of Yellow	First color change during ripening cycle
3	Half Green-Half Yellow	Color change indicates the ideal stage for shipping to retailer
4	Three Quarters Yellow with Green	
5	Yellow with Green Tips	Ideal for retail display
6	Full Yellow	Ideal for consumer use
7	Yellow with Brown Spots	Over ripe banana

1.5. Fruit organoleptic quality score was determined to express the taste condition as the following scores suggested by Nelson and Steinberg (1957).

Taste condition	Astringent	Mealy dry	Mealy but slight sweet	Sweet but slight mealy	Sweet	Very sweet
Score	1	2	3	4	5	6

1.6. Fruit weight loss percentage was calculated as the following equation:

$$\text{Weight loss \%} = \frac{\text{Initial fruit weight-Weight at inspect date}}{\text{Initial fruit weight}} \times 100$$

2. Chemical properties.

2.1. Fruit moisture percentage was determined by weighing 100gm of fresh banana fruits then oven dried at 70°C till constant weight was reached.

The moisture percentage was calculated as following equation.

$$\text{Moisture\%} = \frac{\text{Initial weight-Weight After dried}}{\text{Initial weight}} \times 100$$

2.2. TSS% of the pulp was estimated by a'bbe digital refractometer, according to A.O.A.C., (1980).

2.3. Fruit total sugars% were adjusted colourimetrically in the dried fruit pulp extracted with water according to the modification done by Smith *et al*., (1956). Soluble sugars were calculated as percentage of glucose in fruit dry pulp.

2.4. Fruit total carbohydrate % was adjusted as soluble and non-soluble sugars according to Miclory (1948) in the dried fruit pulp. Non-soluble sugars were determined in the residue left after the extraction of soluble sugars, using hydrolisation with HCl and adjusted colourimetrically at 490 nm and calculated as percentage of soluble sugars.

3. General evaluations:

The final grade of different fertilizers treatments was determined by summarizing up all the total grades of various characters as follows:

Characters	Yield	Economical study.	Ripening ability.	Marketing ability.	Total
Grades	25	25	25	25	100

4. Statistical analysis. All data for all fruit parameters studied were analyzed as Complete Randomized Design as described by Snedecor and Cochran (1980). All measurements were done in triplicate and data presented are averages of the measurements. The differences between means were differentiated using Duncan multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

a. Physical characteristics

1. Bunch weight (kg) and estimated yield (Ton/feddan).

As shown in Fig (1), inoculation compost by "Nitrobein" give the highest bunch weight (28.33 , 25.50 kg) and estimated yield per feddan (22.67, 20.40 ton), while inoculation compost by "Rhizobacterin" or "Microbein" recoded (27.00, 24.33kg) and (26.67, 22.67kg) for bunch weight and (21.60, 19.47 ton) and (21.33, 18.13 ton) for estimated yield per feddan in both seasons, respectively.

Furthermore, chemical fertilizer (control) resulted significantly in the lowest value for bunch weight (20.50 and 23.00 kg) and estimated yield per feddan (16.40, 18.40 ton) during the two seasons, respectively. These results are in line with those reported by Chezhiyan *et al*., (1999), Abd El-Naby and Gomaa (2000), Geetha and Nair (2000), Eman *et al*., (2008) on banana.

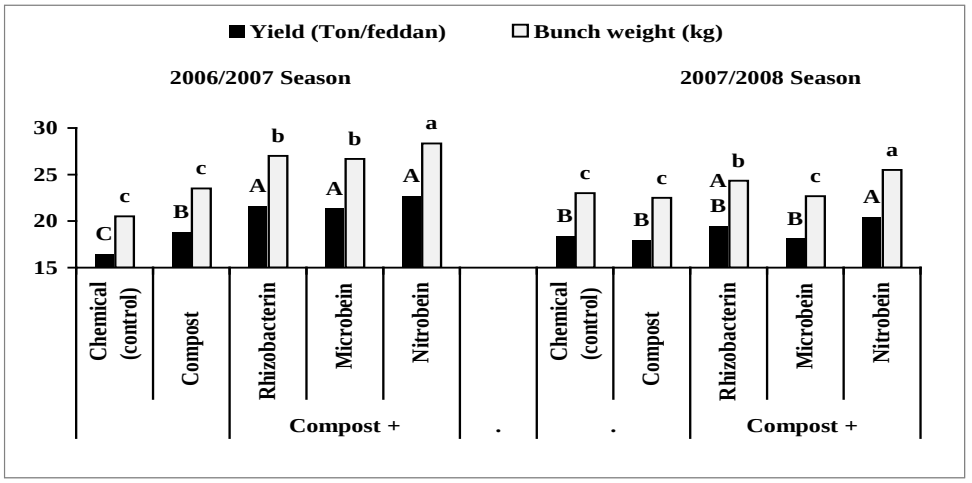

Fig (1): Effect of chemical, compost and compost plus bio-fertilizers on bunch weight (kg) and yield (ton/feddan) of "Grand Nain" banana cultivar in 2006/2007 and 2007/2008 seasons. The same letter(s) above each column are not significantly different at P≥0.05

2. Pulp/peel ratio:

Data in Table (4) showed a gradual increase in pulp/peel ratio toward the end of the ripening period (14 days after acetylene gas treatment). Moreover, the least pulp/peel ratio (1.10 and 1.12) and (1.11 and 1.12) was recorded by chemical fertilizer and inoculation compost by "Microbein" with no significant difference in between, while inoculation compost by "Rhizobacterin" recorded the highest ratio (1.14 and 1.15) at maturity stage (Initial time of ripening period) in both seasons, respectively. However, compost, chemical fertilizer and inoculation compost by "Rhizobacterin" exhibited the highest value of pulp/peel ratio (2.31) in the 1st season and (2.31, 2.35 and 2.30) in 2nd one at the end of ripening period, respectively, with no significant difference in between.

The rise in pulp/peel ratio during ripening stage related to changes in sugar concentration in the two tissues. The increasing of sugars in the pulp more than in the peel created an osmotic gradient between the two tissues (peel and pulp) which led to withdraw water from the peel by the pulp and the

pulp/peel ratio increased accordingly (Simmonds, 1970). Nyanjage, *et al*., (2001) working on "Cavendish" cv. found that, ripe non-organic bananas had both higher gravimetric pulp: peel ratio and impedance compared with organic fruits. Moreover, Sobeih (1992) found that pup/peel ration increased during ripening of Williams and Poyo banana fruit cultivar.

3. Fruit firmness (kg/cm^2):

Data in Table (5) showed a negative correlation in fruit firmness (kg/cm^2) of "Grand Nain" banana cultivar with advanced ripening period by acetylene for all treatments under study in both seasons. Also, results revealed that the least fruit firmness (8.40 and 8.50 kg/cm^2) at initial time of ripening period and (4.70 and 4.30 kg/cm^2) at the end of ripening period was recorded by inoculation compost with "Rhizobacterin" in both seasons, respectively.

The reduction in firmness value during ripening period might be due to the breakdown of insoluble pectic substances to soluble forms by a series of physicochemical changes that, were caused by the action of pectic enzymes i.e. esterase and polygalacturonidase formed in the tissues during ripening (Weichmann, 1987). The results were in agreement with those obtained by Abd-El-Aziz (2002) on Williams banana and Eman *et al.*, (2007) on banana

Table (4): Effect of chemical, compost and compost plus bio-fertilizers on pulp/peel ratio of "Grand Nain" banana cultivar during ripening by acetylene gas in 2006/2007 and 2007/2008 seasons.

Pre-Harvest Treatments		Ripening period (days)					
		Initial	7	14	Initial	7	14
		2006/2007 Season			2007/2008 Season		
Chemical		1.10 c	1.70 b	2.31 a	1.12 c	1.88 a	2.31 a
Compost		1.12 b	1.75 b	2.31 a	1.14 ab	1.92 a	2.35 a
Compost +	R	1.14 a	1.85 a	2.31 a	1.15 a	1.90 a	2.30 a
	M	1.11 bc	1.60 c	2.22 b	1.12 c	1.65 c	2.23 b
	N	1.13 ab	1.70 b	2.25 ab	1.13 bc	1.70 b	2.26 ab

R = Rhizobacterin M= Microbein N= Nitrobein

Means followed by the same letter(s) within each column are not significantly different at P≤ 0.05

Table (5): Effect of chemical, compost and compost plus bio-fertilizers on Fruit firmness (kg/cm^2) of "Grand Nain" banana cultivar during ripening by acetylene gas in 2006/2007 and 2007/2008 seasons.

Pre-Harvest Treatments		Ripening period (days)					
		Initial	7	14	Initial	7	14
		2006/2007 Season			2007/2008 Season		
Chemical		8.60 ab	6.20 a	4.50 a	8.80 a	6.00 b	4.65 b
Compost		8.60 ab	6.00 a	4.80 a	8.70 ab	6.50 a	4.90 a
Compost +	R	8.40 b	6.00 a	4.70 a	8.50 b	5.70 b	4.30 d
	M	8.80 a	6.10 a	4.80 a	8.70 ab	5.90 b	4.60 b
	N	8.50 ab	6.10 a	4.80 a	8.60 ab	5.80 b	4.50 c

R = Rhizobacterin M= Microbein N= Nitrobein

Means followed by the same letter(s) within each column are not significantly different at P≤ 0.05

4. Fruit peel color index.

Table (6) showed that, all fertilizer treatments did not have any responses in fruit peel color index at mature stage (Initial time of ripening period). It has a normal color of bananas (Green) when they arrive at ripening facility (fruit peel color index, 1).

On the other hand, a gradual increase in peel color index was shown towards the end of the ripening period. The full yellow (Ideal peel color for consumer use) peel color index (6) was recorded by compost or inoculation compost by "Rhizobacterin" after 14 days of acetylene gas treatment in both seasons. However, other fertilizer treatments exhibited the highest value (yellow with brown Spots) of peel color index (7) at the end of ripening period (14 day after acetylene gas treatment) in both seasons.

Changing of the peel color is due to chlorophyll disappearing to reveal the yellow color caused by xanthophylls and carotenes might be regarded as the visible sign of ripening of banana fruits (Sobieh, 1992). These results are in harmony with that reported by Abd El-Aziz (2002) on "Williams" banana and Prabha (2008) on banana.

Table (6): Effect of chemical, compost and compost plus bio-fertilizers on Fruit peel color index of "Grand Nain" banana cultivar during ripening by acetylene gas in 2006/2007 and 2007/2008 seasons.

Pre-Harvest Treatments		Ripening period (days)					
		Initial	7	14	Initial	7	14
		2006/2007 Season			2007/2008 Season		
Chemical		1.00 a	4.00 b	7.00 a	1.00 a	5.00 a	7.00 a
Compost		1.00 a	5.00 a	6.00 b	1.00 a	5.00 a	6.00 b
Compost +	R	1.00 a	4.00 b	6.00 b	1.00 a	4.00 b	6.00 b
	M	1.00 a	5.00 a	7.00 a	1.00 a	5.00 a	7.00 a
	N	1.00 a	5.00 a	7.00 a	1.00 a	5.00 a	7.00 a

R = Rhizobacterin M= Microbein N= Nitrobein

Means followed by the same letter(s) within each column are not significantly different at P≤ 0.05

5. Fruit organoleptic quality score.

Data in Table (7) revealed that, all fertilizer treatments did not have any responses in organoleptic quality score of "Grand Nain" banana cultivar fruits at mature stage (Initial time of ripening period). It have a score 1 (astringency taste) when arriving at ripening facility.

On the other hand, a direct correlation in fruit organoleptic quality score of "Grand Nain" banana cultivar with advanced ripening period by acetylene for all treatments under study in both seasons. A gradual increase in organoleptic quality was shown towards the end of the ripening period. The sweet taste of organoleptic quality (score 5, Ideal taste for consumer) was recorded by inoculation of compost by "Rhizobacterin" after 14 days of acetylene gas treatment in both seasons. However, other fertilizer treatments exhibited the highest taste score (very sweet) of organoleptic quality (score 6) at the end of ripening period (14 day after acetylene gas treatment) in both seasons.

It could be concluded that acetylene treatments enhanced the organoleptic quality taste of banana fruits, whatever the level of compost or the species of bio-fertilizer used, through their influence in accelerating ripening and inducing the analytical enzymes that affect the starch in fruit pulp (Sobieh, 1992).

6. Fruit weight loss percentage:

It was clear from data in Fig (2) that a continuous loss in weight was existed with the extend of the ripening period in all treatments to attain the maximum at the end of the ripening period (14 days after harvest).

Table (7): Effect of chemical, compost and compost plus bio-fertilizers on Fruit organoleptic quality score of "Grand Nain" banana cultivar during ripening by acetylene gas in 2006/2007 and 2007/2008 seasons.

Pre-Harvest Treatments		Ripening period (days)					
		Initial	7	14	Initial	7	14
		2006/2007 Season			2007/2008 Season		
Chemical		1.00 a	4.00 a	6.00 a	1.00 a	4.00 a	6.00 a
Compost		1.00 a	4.00 a	6.00 a	1.00 a	4.00 a	6.00 a
Compost +	R	1.00 a	3.00 b	5.00 b	1.00 a	3.00 b	5.00 b
	M	1.00 a	4.00 a	6.00 a	1.00 a	4.00 a	6.00 a
	N	1.00 a	4.00 a	6.00 a	1.00 a	4.00 a	6.00 a

R = Rhizobacterin M= Microbein N= Nitrobein

Means followed by the same letter(s) within each column are not significantly different at P≤ 0.05

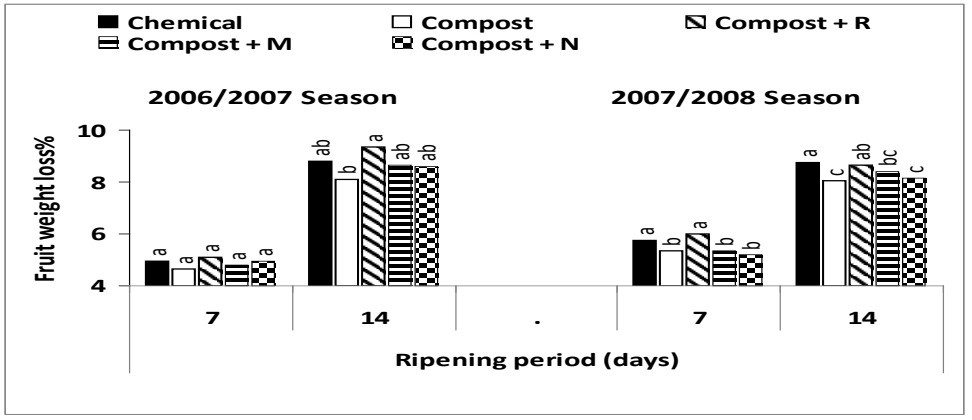

Fig (2): Effect of chemical, compost and compost plus bio-fertilizers on Fruit weight loss% of "Grand Nain" banana cultivar during ripening by acetylene gas in 2006/2007 and 2007/2008 seasons. The same letter(s) above each column are not significantly different at P≥0.05
R = Rhizobacterin M= Microbein N= Nitrobein

The compost fertilizer showed the least percentage of fruit weight loss (4.65% and 5.37%) and (8.09% and 8.05%), while inoculation compost by "Rhizobactrein" give the highest percentage of fruit weight loss either after 7 days (5.11% and 5.99%) or 14 days (9.33% and 8.63%) of acetylene gas treatment in both seasons, respectively.

Loss of fruit weight during ripening might be the end result of many physiological processes that occurred during ripening. Starch hydrolysis and the accompanied water loss, anabolism of hemicellulos, anabolism of

tannins……etc. that accompanied the rise of fruit respiration during ripening are some physiological processes that led to loss of dry matter. In addition, loss of water through transpiration and respiration might be responsible to a great extent for loss of weight of fruits during ripening process.

The above mentioned results are in line with Abd El-Aziz (2002) on 'Williams' banana and Eman, *et al*, (2008) on banana.

b. Chemical properties:

1. Fruit moisture percentage:

It was observed that, an initial slight increase in fruit moisture percentage that continued up to 7 days after treatment by acetylene gas, followed by a period of an intensive increase that continued up to 14 days in both seasons (Table 8). The comparison between the resulted figures shows no significantly differences among all fertilizers treatments used in the first season either at mature stage (Initial time of ripening period) or during all ripening periods. But in the second season, moisture percentage was higher in fruits treated by compost fertilizer plus "Rhizobactrein" either at mature stage or for a ripening period of 7 or 14 days.

Moisture content of banana fruit are governed during ripening by many factors such as respiration, temperature and humidity (Simmonds, 1970). The results confirmed the findings of other workers (Yan, *et al*., 2008 and Nyanjage, *et al*., 2001), who reported that moisture content of banana fruits increased during ripening process.

2. Fruit total soluble solids percentage.

A sharp increase in fruit T.S.S.% was shown in Table (9) within first period of ripening (7 days after acetylene gas treatment) followed by a gradual increase towards the end of the ripening period (14 days after acetylene gas treatment).

In the first season, no significantly differences among all fertilizers used in fruit TSS % either at mature stage (Initial time of ripening period) or during all ripening periods. In the second season, no significantly differences among all fertilizers used in fruit TSS % at mature stage (Initial time of ripening period). Fruit TSS% were higher in fruits treated by compost fertilizer plus either "Rhizobactrein" or "Microbein" or "Nitrobein", while chemical fertilizer (control) recorded the lowest fruit TSS% at the end of the ripening period (14 days after acetylene gas treatment).

The changes in TSS % at the ripening period are a result of respiration, inversion of insoluble compounds to soluble form and moisture loss by evaporation. So, the tendency of TSS % to increase may be attributed to enhancing conversion of insoluble solids to soluble ones beside the high rate of moisture loss. These findings are in accordance with those obtained by Abd El-Aziz (2002) and El-Kholy (2004) on banana fruits.

Table (8): Effect of chemical, compost and compost plus bio-fertilizers on Fruit moisture percentage of "Grand Nain" banana cultivar during ripening by acetylene gas in 2006/2007 and 2007/2008 seasons.

Pre-Harvest Treatments		Ripening period (days)					
		Initial	7	14	Initial	7	14
		2006/2007 Season			2007/2008 Season		
Chemical		72.1 a	73.5 a	76.0 a	72.2 b	74.0 b	76.0 a
Compost		72.2 a	73.5 a	76.2 a	72.3 b	74.0 b	75.5 b
Compost +	R	72.4 a	73.6 a	76.6 a	72.7 a	74.8 a	76.2 a
	M	72.3 a	73.5 a	76.3 a	72.5 ab	74.0 b	76.1 a
	N	72.2 a	73.3 a	76.2 a	72.2 b	73.6 b	76.0 a

R = Rhizobacterin M= Microbein N= Nitrobein

Means followed by the same letter(s) within each column are not significantly different at P≤ 0.05

Table (9): Effect of chemical, compost and compost plus bio-fertilizers on Fruit TSS % of "Grand Nain" banana cultivar during ripening by acetylene gas in 2006/2007 and 2007/2008 seasons.

Pre-Harvest Treatments		Ripening period (days)					
		Initial	7	14	Initial	7	14
		2006/2007 Season			2007/2008 Season		
Chemical		4.4 a	19.5 a	21.6 a	4.5 a	20.2 d	21.7 b
Compost		4.5 a	20.5 a	21.7 a	4.6 a	20.5 c	22.0 b
Compost +	R	4.7 a	20.5 a	22.0 a	4.7 a	21.0 a	22.5 a
	M	4.5 a	20.4 a	21.9 a	4.7 a	20.8 b	22.4 a
	N	4.4 a	20.4 a	21.9 a	4.5 a	20.7 b	22.4 a

R = Rhizobacterin M= Microbein N= Nitrobein

Means followed by the same letter(s) within each column are not significantly different at P≤ 0.05

3. Fruit total sugars percentage.

As shown in Table (10) percentage of total sugars (based on dry weight) of "Grand Nain" banana cultivar as affected by chemical, compost and compost plus bio-fertilizers increased rapidly at the beginning of ripening period (within 7 days) and followed by a gradual and slight increase during the late ripening period by acetylene gas to attain the maximum values at end of the ripening period (after 14 days) in both seasons.

On the other hand, fruit total sugars% was significantly responded to compost inoculation with "Rhizobactrein" followed in descending order by those "Microbein" and "Nitrobein" treatments. The compost inoculation by

"Rhizobactrein fertilizer gave the highest percentage of fruit total sugars (2.00% and 2.30%) at maturity stage (Initial time of ripening period) and (20.80% and 20.10%) at the end of ripening period (14 day after acetylene gas treatment) during the two seasons, respectively.

According to Simmonds (1970), the beginning of the increase of sugars coincided with the respiration climacteric. Therefore the rapid increase in sugar concentration that was observed 7 days after acetylene gas treatment could be a result of respiration rise in climacteric leading to accelerate of ripening and accumulation of sugars during ripening coincided with starch-hydrolysis.

These results coincide with the findings of El-Kholy (2004) and Eman *et al*., (2008) on banana.

4. Fruit total carbohydrate percentage.

As shown in Table (11) percentage of total carbohydrate (based on dry weight) of "Grand Nain" banana cultivar as affected by chemical, compost and compost plus bio-fertilizers compost and chemical fertilizer decreased gradually with prolong the ripening period by acetylene gas to attain the minimum values at end of the ripening period (after 14 days), in both seasons.

The decrease of carbohydrates coincided with the respiration climacteric and starch-hydrolysis during ripening.

No significant different was observed between all fertilizer treatments used on fruit total carbohydrate % either at maturity stage or during all ripening periods.

These results coincide with the findings of El-Kholy (2004) and Eman *et al*., (2008) on banana.

Table (10): Effect of chemical, compost and compost plus bio-fertilizers on Fruit total sugars % (based on dry weight) of "Grand Nain" banana cultivar during ripening by acetylene gas in 2006/2007 and 2007/2008 seasons.

Pre-Harvest Treatments		Ripening period (days)					
		Initial	7	14	Initial	7	14
		2006/2007 Season			2007/2008 Season		
Chemical		1.7 a	17.5 b	20.5 ab	2.2 a	19.2 a	19.9 a
Compost		1.7 a	18.2 a	20.8 a	2.3 a	19.2 a	19.9 a
	R	2.0 a	18.5 a	20.8 a	2.3 a	18.6 b	20.1 a
Compost +	M	1.9 a	18.2 a	20.5 ab	2.2 a	17.4 c	19.8 ab
	N	1.8 a	18.1 a	20.2 b	2.0 a	17.2 c	19.4 b

R = Rhizobacterin M= Microbein N= Nitrobein

Means followed by the same letter(s) within each column are not significantly different at P≤ 0.05

Table (11): Effect of chemical, compost and compost plus bio-fertilizers on Fruit total carbohydrates % (based on dry weight) of "Grand Nain" banana cultivar during ripening by acetylene gas in 2006/2007 and 2007/2008 seasons.

Pre-Harvest Treatments		Ripening period (days)					
		Initial	7	14	Initial	7	14
		2006/2007 Season			2007/2008 Season		
Chemical		22.5 a	21.8 a	21.3 a	22.7 a	22.4 a	22.2 a
Compost		22.5 a	21.8 a	21.3 a	22.8 a	22.4 a	22.1 a
Compost +	R	22.5 a	22.5 a	21.7 a	22.8 a	22.6 a	22.0 a
	M	22.5 a	22.0 a	21.4 a	22.6 a	22.4 a	22.0 a
	N	22.5 a	21.9 a	21.2 a	22.5 a	22.1 a	21.7 a

R = Rhizobacterin M= Microbein N= Nitrobein

Means followed by the same letter(s) within each column are not significantly different at P≤ 0.05

Conclusion.

General evaluation of the yield, economic value, ripening ability and marketing ability of "Grand Nain" banana cultivar fruits were shown in Table (12). The total grade of general evaluation for above mentioned parameters declared that:

a) **Inoculation of compost by bio-fertilizer (Rhizobacterin) and compost only were the superior of fertilizer treatments than others. These treatments had the highest grades (96.5% and 95.6%) of evaluation.**
b) **Inoculation of compost by bio-fertilizer (Microbein) and (Nitrobein) recorded 93.4 % and 92.2 % of evaluation grades, respectively.**
c) **Chemical fertilizer (Control) recorded the least value (83.3 %) of evaluation grades.**

Table (12): Values of comparative evaluation of chemical, compost and compost plus bio-fertilizers of "Grand Nain" banana cultivar fruits (average two seasons of experiment).

Pre-Harvest Treatments		Yield	Economic study	Ripening ability	Marketing ability	Total
Grades %		25	25	25	25	100
Chemical		24.30	16.00	20.90	22.10	83.30
Compost		23.00	22.90	25.00	25.00	95.90
Compost +	R	23.60	22.90	25.00	25.00	96.50
	M	22.70	22.90	23.30	24.50	93.40
	N	24.50	22.90	22.20	22.60	92.20

R = Rhizobacterin M= Microbein N= Nitrobein

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تأثير الخلط بين التسميد العضوى والحيوى على جودة وإنضاج ثمار الموز "جراند نان" وقابليتها للتسويق

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الملخص العربي

من أجل إنتاج ثمار موز خالية من الكيماويات وذات جودة من حيث الإنضاج والقابلية للتسويق وآمنة للاستهلاك تم إجراء هذه التجربة من خلال ممارسة ما يسمى بالزراعة العضوية (الزراعة النظيفة) ولتلبية احتياجات نبات الموز صنف "الجراند نان" من التسميد النيتروجينى من مصادر عضوية كبديل للتسميد النيتروجينى أجري هذا البحث خلال موسمين متتاليين (٢٠٠٦/٢٠٠٧، ٢٠٠٧/٢٠٠٨) بمحطة بحوث البساتين بالقناطر الخيرية، محافظة القليوبية.

الكمية الفعلية للنيتروجين ٥٠٠ جم/نبات/سنة ومعاملات التسميد المضافة للتربة وهى الكنترول، الكمبوست، الكمبوست + الريزوباكترين، الكمبوست + الميكروبين أو الكمبوست + النيتروبين. وقد أوضحت النتائج أن تلقيح الكمبوست بواسطة النيتروبين أعطت أعلى قيمة لوزن السوباطة والمحصول المقدر للفدان مقارنةً بمعاملات التسميد الأخرى والكنترول.

إضافة إلى ذلك التسميد الكيماوى (الكنترول) أعطى أقل قيمة من خلال نتائج الدراسة الاقتصادية وكذلك بالنسبة للإنضاج والقدرة التسويقية محققاً (٨٣.٣ %)، وقد سجلت معاملة تلقيح الكمبوست بالريزوباكترين أعلى درجات التقييم الكلية (٩٦.٥ %) وكان لها أثر واضح على نسبة اللحم/القشرة ونسبة الفقد فى وزن الثمار، المحتوى الرطوبى، نسبة المواد الصلبة الذائبة والسكريات الكلية سواء فى مرحلة النضج أو فى فترة الإنضاج مع المحافظة على اللون المثالى للقشرة والطعم وذلك بعد ١٤ يوم من المعاملة بغاز الأسيتلين.