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EFFECT OF SPRAYING WITH ASCORBIC ACID, VITAMIN B AND ACTIVE DRY YEAST ON GROWTH, FLOWERING, LEAF MINERAL STATUS, YIELD AND FRUIT QUALITY OF GRAND NAIN BANANA PLANTS

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ABSTRACT

This work was carried out during 2002/2003 and 2003/2004 seasons in order to study the effect of spraying ascorbic acid (Vit. C), vitamin B1 (thiamin) and active dry yeast on vegetative growth, flowering, leaf mineral status, yield and fruit quality of Grand Nain banana plants grown under Gharbia governorate condition, Egypt. Grand Nain banana c.v. plants were sprayed three times in early April, June and August treated with tap water (control) or ascorbic acid (Vit. C) or vitamin B1 (thiamin) each at 500, 1000 and 2000 ppm or active dry yeast at 1%, 2% and 3%. The same concentrations were used in the three spraying times throughout the two investigated seasons. Results showed that all concentrations were effective in improving pseudostem length, number of green leaves at bunch shooting, leaf area, leaf mineral content, and bunch weight and inducing early bunch shooting and cropping cycle. This improvement was positively correlated with the increase in concentration of ascorbic acid, vitamin B1 and active dry yeast. The most promising treatment was spraying active dry yeast at 2%, which increased bunch and finger weight, and increased N and K percentages in leaf compared with the control and other treatments in both seasons. In addition, ascorbic acid and vitamin B1 at 2000ppm had increased bunch weight, finger weight and achieved early bunch shooting as well as bunch harvest and cropping cycle compared with the control plants. The best results with regard to yield and fruit quality of Grand Nain banana grown plants under Gharbia governorate conditions were achieved by spraying plants three times with ascorbic acid at (2000ppm), or vitamin B1 at (2000 ppm) or active dry yeast at 2%..

Key words: Grand Nain banana, Ascorbic acid, Vitamin B1, Active Dry Yeast, growth, flowering, yield, fruit quality, leaf mineral content

INTRODUCTION

Banana is a herbaceous plant, where any limiting factor affect growth and development developed a decline in overall plant size. Recently, it is doubtless that fertilization techniques have been developed such results in banana orchards located at newly reclaimed areas.

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Foliar spray with active dry yeast on banana plants has recently received apparent interest. The various positive effects of applying active dry yeast were attributed to its content of different nutrients, higher percentage of proteins, large amount of vitamin B and natural plant growth hormones, namely, cytokinins. **(Kihlberg, 1972)**

Vitamin compounds act as coenzymes in a number of enzyme systems and thus take a part in the regulation of metabolism. Recently, it was suggested that B-vitamins participate in plant growth and development indirectly by enhancing the endogenous levels of various growth factors such as cytokinins and gibberellins **(Kodendaramaiah and Gopala Rao, 1985)** farther more, Most B-vitamins are synthesized in leaves and translocated in the phloem.

Ascorbic acid (Vit.C) foliar application was reported to induce many stimulating effects of growth and some physiological activities of different plants. **Kamiya *et al* (1984)** stated that the physiological effects of ascorbic acid included: stimulation of lipase, catalase and peroxides isoenzymes activities. In addition, ascorbic acid revealed an effect on the metabolism of gibberellic acid.

In Egypt, the possibility of using yeast in fruit orchards was mentioned by some research workers, i.e. **Ahmed *et al* (1997)** on grapes, **Laz *et al* (2000)** on figs, **El-Shammaa, (2001)** on banana. However, the importance of this biofertilizer (yeast), vitamin B1 (thiamin), and vitamin C (ascorbic acid) on banana plants should be considered as part of improving banana production.

The present investigation was outlined to explore alternative practices that may enhance growth, yield and fruit quality of Grand Nain banana palnts.

MATERIAL AND METHODS

This investigation has been carried out during the two consecutive seasons of 2002-2003 and 2003-2004 in a private orchard (El-Shaka "Mostafa Isamil") at Tanta Gharbia Governorate Egypt on Grand Nain banana cv. Plants grown at 3.5x3.5 meters apart.

Three suckers only / mat were selected in June for fruiting during the following season in addition to the mother plant which will give the crop of the current season. The experiment included ten treatments in three replicates, each of 12 holes. The selected plants (similar in growth vigour) were thoroughly subjected to foliar application with active dry yeast at 1%, 2% and 3%, or vitamin B1 at 500, 1000 and 2000 ppm) or ascorbic acid at 500, 1000 and 2000 ppm. Which prepared recently just before spray. Each treatment was sprayed three times in early April, June and August in each season. Spraying was carried out on plants till run off and Triton B as a wetting agent was added to each solution at 1%. Dry yeast was activated by dissolving the definite amount in warm water (38°C), adding sucrose at the same rate, and kept over night for nearly 12 hours before spraying. Dry yeast contained 36.6% protein, 6.68% ash, 7.32% glycogen, 2.80 fats and 4.86% cellulose **(Kihlberg, 1972).**

All plants under investigation had received the traditional and regular fertilization programme applied in such location. [(500 gm N/plant/year) as ammonium sulphate added on 14 equal amounts every two week intervals starting from 1st

April until October. Potassium fertilizer (600 gm K_2O/plant/year) as potassium sulphate in three equal amounts (200gm K_2O) in April, June and August. Phosphorus was added in December as 250gm super phosphate/plant/year for every season].

The randomized complete block design was arranged and the following measurements and determinations were considered in the two studied seasons.

(1) Vegetative growth

Morphological measurmetns were done at bunch shooting time including :

- Pseudostem length and circumference (cm), number of green leaves, leaf dimensions and leaf area (m^2) as described by **Abou-Aziz *et al* (1993).**

(2) Flowering

- Periods from sucker emergence to bunch shooting and from bunch shooting to bunch harvesting were recorded then cropping cycle was determined in days for each season.

(3) Leaf mineral status

At bunch shooting time, a transverse band section (20 cm wide) was cut from the central part of the third full sized leaf below the inflorescence **(Garcia *et al* 1977)** and were used to determine N,P and K (in dry weight basis) according to methods outlined by **Wilder *et al* (1985).**

(4) Yield

Bunches were picked at the first week of January 2003 and 2004 when fingers reached the full mature stage, then bunch weight (Kg), number of hands and number of fingers per bunch were determined.

Three hands were taken from the basal, middle and distal end of the bunch as a composite sample for each replicate to determine, characters finger weight (gm), finger length and diameter (cm).

After artificial repining, of fruits total soluble solids %, and total acidity expressed as malic acid % were determined **(A.O.A.C. 1985).**

The obtained data were tabulated and statistically analyzed for variance and duncans multiple range test was used to differentiate means **(Duncan, 1955).**

RESULTS AND DISCUSSION

(1) Vegetative growth

It is evident from the data in Table (1) that spraying ascorbic acid, or vitamin B1 or active dry yeast significantly increased pseudostem length compared with the control plants of Grand Nain banana during both seasons. The promotion was coincided with the increase in the concentrations of the three studies materials.

Spraying active dry yeast at the highest concentration (3%) produced the highest pseudostem length in both seasons. The values was 314.6 cm in the first season and 310 cm in the second one. Followed by spraying vitamin B1 at 2000ppm and the values were 304 cm and 310 cm in the first and second seasons, respectively. In addition spraying ascorbic acid at 2000ppm gave values of 289 cm in the first season and 294cm in the second one.

The lowest pseudostem length was obtained by control plants (sprayed with water only) in both seasons. The values were 270cm and 275cm in the first and second seasons, respectively.

Table 1. Effect of spraying with ascorbic acid vitamin B and active dry yeast on pseudostem length, circumference, number of green leaves, leaf dimension and leaf area of Grand Nain banana plants during 2003 and 2004 season

Treatments	Pseudostem length (cm)		Pseudostem circumference (cm)		Number of green leaves		Leaf length (cm)		Leaf width (cm)		Leaf area $(m)^2$	
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Control	270.0^{F}	275^{e}	80.0^{d}	81.0^{c}	11.0^{d}	11.5^{b}	259^{e}	260^{d}	96.0^{c}	99.0^{d}	1.99^{b}	2.06^{c}
Ascorbic acid 500 ppm	280.3^{e}	279^{d}	85.3^{c}	87.0^{b}	11.7^{c}	12.4^{a}	265^{d}	263^{d}	100^{b}	102^{cd}	2.12^{c}	2.14^{c}
Ascorbic acid 1000ppm	288.3^{d}	290^{c}	86.7^{c}	88^{b}	12.3^{bc}	12.8^{a}	270^{d}	268^{c}	102^{ab}	104^{bc}	2.20^{d}	2.23^{d}
Ascorbic acid 2000ppm	289^{d}	294^{bc}	86.6^{c}	89^{b}	12.4^{bc}	12.9^{a}	282^{bc}	269^{c}	105^{a}	108^{a}	2.37^{ab}	2.32^{cd}
Vitamin B 500ppm	285.3^{de}	290^{c}	88.0^{b}	88^{b}	12.3^{abc}	12.9^{a}	277^{c}	280^{b}	102^{ab}	103^{bc}	2.26^{bc}	2.31^{cd}
Vitamin B 1000ppm	290^{cd}	296^{b}	88.7^{b}	90^{a}	12.7^{ab}	13.0^{a}	280^{bc}	282^{b}	103^{ab}	106^{ab}	2.31^{abc}	2.32^{cd}
Vitamin B 2000ppm	304^{b}	310.0^{a}	89.0^{b}	91^{a}	13.0^{a}	13.2^{a}	286^{bc}	282^{b}	105^{a}	106^{ab}	2.40^{a}	2.39^{ab}
Yeast 1%	280^{cd}	296^{b}	90.6^{a}	91^{a}	12.3^{abc}	12.8^{a}	280^{bc}	281^{b}	102^{ab}	102^{cd}	2.28^{bc}	2.29^{cd}
Yeast 2%	296.3^{c}	298^{b}	92.8^{a}	92^{a}	12.5^{ab}	12.9^{a}	285^{ab}	285^{ab}	103^{ab}	103^{bc}	2.37^{ab}	2.37^{ab}
Yeast 3%	314.6^{a}	310^{a}	93.0^{a}	93^{a}	12.7^{ab}	13.0^{a}	290^{a}	288^{a}	104^{ab}	104^{bc}	2.40^{a}	2.40^{a}

Means having the same letter (s) in each column are not significantly differ at 5% level

Concerning the pseudostem circumference, data in Table (1) indicated that spraying ascorbic acid (Vit. C), vitamin B1 and active dry yeast at different concentrations were without beneficial effect during the two seasons.

The relatively highest pseudostem circumference was recorded by spraying active dry yeast at 3% in both seasons. (93 cm). where as, the lowest pseudostem circumference resulted by control plants in the two seasons (80 – 81 cm).

From Table (1) it is obvious that spraying vitamin B1 at 2000 ppm develop the highest number of green leaves in both seasons . The values were 13 and 13.2 leaves/plant at bunch shooting in the first and second season, respectively. Followed by spraying vitamin B1 at 1000ppm and active dry yeast at 3% (12.7 and 13 and leaves, respectively then spraying active dry yeast at 2% (12.5 and 12.9) in the first and second season, respectively. Spraying ascorbic acid at 2000 ppm gave 12.4 leaves in the first season and 12.9 leaves in the second one.

The lowest number of green leaves per plant at bunch shooting was recorded by control plants in both seasons. The values were 11 and 11.5 leaves/plant in the first and second season, respectively.

Data in Table (1) showed that spraying ascorbic acid or, vitamin B1 or active dry yeast significantly increased leaf length of Grand Nain banana compared with control plants in both seasons. The promotion affect was occurred coincided by increasing concentrations of the three studied materials.

The highest leaf length was recorded by spraying active dry yeast at the high concentration 3% in both season of the study. The values were 290cm and 288 cm in the first and second seasons, respectively.

The shortest leaf length had resulted by control plants in the two seasons of the study. The values were 259 cm in the first season and 260 cm in the second one.

Considering leaf width, data showed that leaf width increased by increasing the concentration of spraying ascorbic acid, or vitamin B1 or active dry yeast in both seasons.

The lowest leaf width had resulted by control plants in both season. The values were 96 cm in the first season and 99 cm in the second one.

However, leaf area was affected significantly by the different sprays comparing with the control plants in both seasons.

The greatest, leaf area was recorded by Grand Nain banana plants received dry yeast at 3%, since it was 2.40 m^2 in both seasons. Followed by vitamin B1 at 2000ppm (2.40m^2 in the first season and 2.39m^2 in the second one), then and finally spraying ascorbic acid at 2000ppm (2.37m^2 and 2.32m^2 in the first and second seasons, respectively). The lowest leaf area was recorded by control plants (1.99m^2 in the first season and 2.06m^2 in the second season).

In this respect, **Muller and Leopold (1996)** demonstrated that the enhancing effect of yeast preparation might be due to that yeast as a natural source of cytokinins which enhanced cell division and cell enlargement. So far, increasing the extraction of leaf surface area enhanced the accumulation of soluble metabolites as maintained about the role of cytokinins.

Also, the beneficial action of ascorbic acid on leaf area in the present study is in agreement with those obtained by Ahmed

et al (1997&1998) and Omer (1999), and the action of ascorbic acid certainly reflected on enhancing cell division and nutritional status resulting increasing the leaf area.

(2) Flowering

Period from planting to flowering

Data in Table (2) indicated that spraying active dry yeast on Grand Nain banana plants was necessary for the regulation of bunch shooting. The shooting period was generally shorter as yeast concentration increased. The lowest period was recorded by spraying active dry yeast at 3% (394 days and 390 days in the first and second seasons, respectively).

The highest period to bunch shooting had recorded by control plants in both seasons (419 days in the first season and 420 days in the second one).

The results of **Pawtar *et al* (1985)** and **Hewedy *et al* (1996)** supported the beneficial effect of active dry yeast on flowering earliness.

Period from flowering to harvesting

Data showed that spraying active dry yeast at 3% induced the earliest to bunch harvesting in both seasons followed by spraying active dry yeast at 2% and 1%, respectively.

The longest period to bunch harvesting was recorded by control plants in both seasons (120 days and 116 days in the first and second season, respectively).

Cropping cycle

Data indicated that plants sprayed with active dry yeast showed the lowest cropping cycle, where the values were ranged from 496-506 days in the first season and 490-502 days in the second one.

The longest cropping cycle was recorded by control plants in the two seasons (539 days in the first season and 536 days in the second one).

(3) Leaf mineral status

Table (3) indicated that leaf mineral contents increased with increasing the concentration of the ascorbic acid, vitamin B1 and active dry yeast in both seasons.

Nitrogen percentage in leaves showed higher levels with spraying active dry yeast at 2% (3.8% in the first season and 3.7% in the second season) followed by spraying vitamin B1 at 2000 ppm, (3.6% and 3.7% in the first and second season, respectively) then spraying ascorbic acid at 2000ppm (3.5 in the first season and 3.6% in the second one). The lowest Nitrogen percentage was recorded by control plants in both seasons (2.8% in the first season and 3.0% in the second one).

Phosphorus percentage in leaf of Grand Nain banana revealed insignificant differences between treatments in both seasons. The values ranged form (0.19-0.22%) in the first season and from (0.20-0.23% in the second one.

Potassium percentage in leaf was increased by increasing the concentration of ascorbic acid (Vit.C), vitamin B1 and active dry yeast in both seasons. The highest potassium percentage was recorded by active dry yeast at 2%, ascorbic acid at 2000 ppm, and vitamin B1 at 2000 ppm in the first season. The values were 4.3%, 4.2% and 4.3%, respectively. While in the second season the highest

Table 2. Effect of spraying with ascorbic acid vitamin B and active dry yeast on number of days from planting to flowering, Number of days from flowering to harvesting and cropping cycle of Grand Nain banana plants during 2003 and 2004 seasons

Treatments	Number of days from planting to flowering		Number of days from flowering to harvesting		Cropping cycle (days)	
	2003	2004	2003	2004	2003	2004
Control	419[a]	420[a]	120[a]	116[a]	539[a]	536[a]
Ascorbic acid 500ppm	415[b]	409[b]	111[c]	110[c]	526[b]	519[b]
Ascorbic acid 1000ppm	412[b]	406[b]	109[c]	108[c]	521[c]	514[c]
Ascorbic acid 2000ppm	410[b]	408[b]	105[cd]	103[d]	515[cd]	511[c]
Vitamin B 500ppm	411[b]	405[b]	116[b]	114[b]	527[b]	519[b]
Vitamin B 1000ppm	410[b]	402[b]	113[b]	112[b]	523[c]	514[c]
Vitamin B 2000ppm	406[c]	402[b]	110[c]	109[c]	516[cd]	511[c]
Yeast 1%	400[cd]	398[bc]	106[cd]	104[d]	506[e]	502[d]
Yeast 2%	396[d]	396[bc]	104[d]	103[d]	500[e]	499[d]
Yeast 3%	394[d]	390[d]	102[d]	100[d]	496[e]	490[e]

Means having the same letter (s) in each column are not significantly differ at 5% level

Table 3. Effect of spraying with ascorbic acid, vitamin B and active dry yeast on leaf mineral content of Grand Nain banana plants during 2003 and 2004 seasons

Treatments	Nitrogen %		Phosphorus %		Potassium %	
	2003	2004	2003	2004	2003	2004
Control	2.8[d]	3.0[d]	0.19	0.20	3.6[b]	3.5[d]
Ascorbic acid 500ppm	3.4[c]	3.5[ad]	0.22	0.22	3.9[ab]	4.0[ab]
Ascorbic acid 1000ppm	3.4[c]	3.4[c]	0.23	0.22	4.1[a]	4.2[abc]
Ascorbic acid 2000ppm	3.5[c]	3.6[ab]	0.22	0.21	4.2[a]	4.3[ab]
Vitamin B 500ppm	3.3[c]	3.3[c]	0.21	0.21	3.9[ab]	3.9[c]
Vitamin B 1000ppm	3.4[c]	3.4[c]	0.21	0.22	4.2[a]	4.1[abc]
Vitamin B 2000ppm	3.6[d]	3.7[a]	0.22	0.21	4.3[a]	4.3[ab]
Yeast 1%	3.4[c]	3.3[c]	0.21	0.22	4.0[a]	4.1[abc]
Yeast 2%	3.8[a]	3.7[a]	0.22	0.22	4.3[a]	4.4[a]
Yeast 3%	3.5[c]	3.6[ab]	0.22	0.23	4.2[a]	4.3[ab]

Means having the same letter (s) in each column are not significantly differ at 5% level

potassium percentage in leaf recorded by spraying active dry yeast at 2% (4.4% followed by spraying ascorbic acid and or vitamin B1 at 2000 ppm 4.3%).

The lowest value of potassium percentage was recorded by control plants in both seasons (3.6% in the first season and 3.5% in the second one).

The present results are in harmony with those obtained by **Hegab *et al* (1997)** on active dry yeast, **Omer (1999), El Sayed *et al* (2000)** and **Ahmed *et al* (2003),** on ascorbic acid.

(4) Yield

Bunch weight

Form Table (4) it is clear that bunch weight increased with increasing the concentration of ascorbic acid, vitamin B1 and active dry yeast compared with the control in both seasons of study.

Maximum yield/plant was noticed when Grand Nain banana plant was sprayed with active dry yeast at 2% in both seasons (36.9 Kg and 37.6 Kg/bunch in the first and second seasons, respectively). Followed by spraying active dry yeast at 3% (35.9 Kg in the first season and 37.5 Kg in the second one).

In general, active dry yeast produced the greatest bunch weight, followed by vitamin B1 and ascorbic acid treatments in both seasons.

The lowermost bunch weight had resulted from control plants (28.7 Kg and 29.5 Kg/bunch) in the two seasons.

Number of hands/bunch

Data in Table (4) indicated that spraying active dry yeast at different concentration produced almost the same number of hands/bunch in both seasons. While, spraying vitamin B1 or ascorbic acid gradually.

The lowest number of hands/bunch was recorded by control plants in the two seasons (10.9 hand/bunch and 11.0 hand/bunch in the first and second seasons, respectively).

Concerning the number of fingers/bunch it is clear that number of fingers/bunch was affected significantly by increasing the concentration of ascorbic acid or vitamin B1 or active dry yeast in both seasons. Spraying active dry yeast at (3%) produced the highest number of fingers/bunch in both seasons (301.6 in the first season and 309.9 in the second one). Generally, active dry yeast was promising for increasing number of fingers/bunch, followed by spraying vitamin B1 or ascorbic acid was shown, respectively.

The lowest number of fingers/bunch was shown control plants in both seasons of the study.

Data in Table (5) clearly show that finger weight, finger length and diameter were positively affected by spraying ascorbic acid, vitamin B and active dry yeast compared with the control plants. The increase in such parameters was associated with the increase in the concentrations of ascorbic acid or vitamin B1 or active dry yeast except the active dry yeast at 3% on finger weight in both seasons.

Spraying active dry yeast at 2% produced the heavies finger weight 125 gm in the first season and 125.8 gm in the second season. Followed by spraying active dry yeast at 1% (122 gm and 123 gm in the first and second seasons), and spraying vitamin B1 at 2000 ppm, (121.3 gm in the first season and 125 gm in the

Table 4. Effect of spraying with ascorbic acid vitamin B and active dry yeast on bunch weight, number of hands/bunch and number of fingers/ bunch of Grand Nain banana plants during 2003 and 2004 seasons

Treatments	Bunch weight		No. of hands/bunch		No. of fingers/bunch	
	2003	2004	2003	2004	2003	2004
Control	28.7 ^{e}	29.5 ^{f}	10.9 ^{c}	11.0 ^{c}	265.7 ^{de}	270.8 ^{cd}
Ascorbic acid 500ppm	29.6 ^{ef}	31.6 ^{ef}	11.7 ^{b}	12.0 ^{b}	258.9 ^{ef}	268.9 ^{de}
Ascorbic acid 1000ppm	30.9 ^{def}	33.0 ^{de}	12.3 ^{ab}	12.6 ^{ab}	268.7 ^{cd}	264.0 ^{de}
Ascorbic acid 2000ppm	31.5 ^{cde}	33.4 ^{cde}	12.3 ^{ab}	12.6 ^{ab}	267.6 ^{cd}	281.1 ^{c}
Vitamin B 500ppm	32.5 ^{cd}	34.6 ^{bcd}	12.3 ^{ab}	12.5 ^{ab}	283.3 ^{b}	293.4 ^{b}
Vitamin B 1000ppm	33.8 ^{bc}	35.0 ^{abcd}	12.8 ^{a}	12.8 ^{ab}	278.6 ^{c}	290.2 ^{b}
Vitamin B 2000ppm	35.2 ^{ab}	36.2 ^{ab}	13.0 ^{a}	13.2 ^{a}	290.2 ^{b}	289.6 ^{b}
Yeast 1%	35.6 ^{ab}	35.9 ^{abc}	12.9 ^{a}	13.2 ^{a}	299.2 ^{b}	291.9 ^{b}
Yeast 2%	36.9 ^{a}	37.6 ^{a}	12.9 ^{a}	13.3 ^{a}	295.2 ^{b}	298.9 ^{b}
Yeast 3%	35.9 ^{ab}	37.5 ^{a}	13.0 ^{a}	13.3 ^{a}	301.6 ^{a}	309.9 ^{a}

Means having the same letter (s) in each column are not significantly differ at 5% level

Table 5. Effect of spraying with ascorbic acid, vitamin B and active dry yeast on finger weight, length and diameter of Grand Nain banana plants during 2003-2004 seasons

Treatments	Finger weight (gm)		Finger length (cm)		Finger diameter (cm)	
	2003	2004	2003	2004	2003	2004
Control	108.0 ^{e}	108.9 ^{c}	16.7 ^{f}	17.0 ^{g}	3.2 ^{d}	3.1 ^{e}
Ascorbic acid 500ppm	114.3 ^{d}	117.5 ^{b}	17.0 ^{ef}	17.4 ^{fg}	3.3 ^{cd}	3.3 ^{de}
Ascorbic acid 1000ppm	115.0 ^{cd}	118.0 ^{b}	17.7 ^{def}	17.8 ^{bfg}	3.4 ^{bcd}	3.4 ^{cd}
Ascorbic acid 2000ppm	117.7 ^{bcd}	118.8 ^{b}	19.0 ^{bc}	19.2 ^{bc}	3.4 ^{bcd}	3.5 ^{cd}
Vitamin B 500ppm	114.7 ^{cd}	117.9 ^{b}	18.7 ^{cd}	18.5 ^{cde}	3.3 ^{cd}	3.4 ^{cd}
Vitamin B 1000ppm	116.7 ^{cd}	120.6 ^{ab}	18.7 ^{cd}	18.8 ^{cd}	3.4 ^{bcd}	3.5 ^{cd}
Vitamin B 2000ppm	121.3 ^{ab}	125 ^{a}	19.0 ^{bc}	18.9 ^{cd}	3.4 ^{bcd}	3.5 ^{cd}
Yeast 1%	122.0 ^{ab}	123.0 ^{ab}	18.0 ^{cde}	18.4 ^{cde}	3.6 ^{abc}	3.8 ^{ab}
Yeast 2%	125.0 ^{a}	125.8 ^{a}	20.0 ^{ab}	20.0 ^{ab}	3.7 ^{ab}	3.8 ^{ab}
Yeast 3%	119.0 ^{bc}	121.0 ^{ab}	21.0 ^{a}	20.8 ^{a}	3.8 ^{a}	3.9 ^{a}

Means having the same letter (s) in each column are not significantly differ at 5% level

second one) then spraying ascorbic acid at 2000ppm (117.7 and 118.8 in the first and second season, respectively).

The least finger weight was recorded by control plants (108 gm in the first season and 108.9 gm in the second one.

The present data are in accordance with those obtained **Mansour *et al* (2000)** on ascorbic acid, **Hegab *et al* (1997)** and **Ahmed *et al* (2003)** on active dry yeast and ascorbic aicd.

Data in Table (5) showed that finger length increased with increasing the concentration of ascorbic acid , vitamin B1 and active dry yeast in both seasons of study the tollest.

Finger was resulted by spraying active dry yeast at 3% in both seasons (21 cm in the first seasons, and 20.8 cm in the second one).

The shortest finger was recorded by control plant in both seasons. (16.7 cm and 17.0 cm in the first and second seasons, respectively).

Fruit diameter

It is obvious from Table (5) that fruit diameter increased with increasing the concentration of ascorbic acid, Vitamin B1 and active dry yeast in the two seasons. Spraying active dry yeast produced the greatest finger diameter in both seasons (3.6-3.8 cm in the first season and 3.8-3.9 cm in the second one).

Other treatments resulted finger diameter ranged from 3.3-3.5 cm in both seasons.

Total soluble solids %

As shown in Table (6) all the studied treatment increased TSS% in both seasons as compared with the control plants. Spraying ascorbic acid or vitamin B1 or active dry yeast significantly increased TSS% in both season of the study.

The highest TSS% was recorded by sprying active dry yeast at 3% (19.2% in the first season and 19.3% in the second one) followed by spraying ascorbic acid at 2000ppm, (19.2% and 19% in the first and second seasons, respectively). The least percentage of TSS% was shown by control plants in both seasons. (17.8% in the first season and 18% in the second one).

The increase in TSS% and chlorophyll was related to the increase in leaf area as a result of yeast application **Ahmed *et al* (1997)** and **Fathy and Faird, (1996)**. These two factors increased photosynthesis leading to an enhancement of the synthesis and accumulation of sugars so, increased TSS. **Ahmed *et al* (1997 and 1998)** and **Omer (1999)**.

Total acidity % and TSS/acid ratio

Data in Table (6) showed that total acidity % and TSS/acid ratio did not affected by different treatments in both seasons.

Acidity ranged from 0.34-0.37% in the first season and from 0.35-0.38% in the second one, and TSS/acid ratio ranged form 50-54.4 in the first season and from 50.5-52.7 in the second one.

The above mentioned results are nearly similar to those obtained by **Ahmed *et al* (1997), El-Mogy *et al* 1998, Mansour (1998)** and **Ahmed *et al* (2003).**

Conclusively, the present investigation supported the beneficial effects of active dry yeast for improving growth and productively of fruit crops.

Table 6. Effect of spraying with ascorbic acid, vitamin B and active dry yeast on total soluble solid, acidity and TSS/acid ratio of Grand Nain banana plants during 2003 and 2004 seasons

Treatments	Total soluble solid (TSS%)		Acidity (%)		TSS/acid	
	2003	2004	2003	2004	2003	2004
Control	17.8 [c]	18.0 [c]	0.34	0.35	52.3	51.4
Ascorbic acid 500ppm	18.8 [a]	18.8 [a]	0.36	0.36	52.2	52.2
Ascorbic acid 1000ppm	19.0[a]	19.0[a]	0.36	0.37	52.2	51..3
Ascorbic acid 2000ppm	19.2[a]	19.0[a]	0.36	0.36	53.3	52.7
Vitamin B 500ppm	18.5 [b]	18.2 [b]	0.34	0.36	54.4	50.8
Vitamin B 1000ppm	18.4[b]	18.3[b]	0.36	0.36	51.1	50.5
Vitamin B 2000ppm	18.5[b]	18.4[b]	0.37	0.35	50.0	52.5
Yeast 1%	19.0 [a]	18.6 [a]	0.35	0.36	54.2	51.6
Yeast 2%	19.0[a]	19.0[a]	0.37	0.37	51.3	51.3
Yeast 3%	19.2[a]	19.3[a]	0.37	0.38	51.8	50.7

Means having the same letter (s) in each column are not significantly differ at 5% level

Various positive effects of applying active dry yeast as newly used biostimulation were attributed to its content of different nutrients, higher percentage of proteins, larger amount of vitamin B and the natural plant growth hormone namely cytokinins. In addition, application of active dry yeast was very effective in releasing CO_2 which reflected on improving net photosynthesis (Larson *et al* 1962; 1987 and Idso *et al* 1995). Spraying Valencia orange tree with yeast improved growth, yield and fruit weight (Hegab *et al* 1997). The same authors suggested that the various positive effects of applying active dry yeast on growth, nutritional status of trees and productivity could be attributed to its content of different nutrients and higher values of vitamins especially vitamin B which play a key role in improving growth. Moreover, it aids in activating the photosynthesis process through enhancing the release of carbon dioxide which produced from fermentation process (Larson *et al* 1962).

Among other tested treatments, the most promising treatment was thiamin (Vit. B1) at 2000 ppm which increased the bunch weight, fruit weight and fruit length as well as N and K percentage in leaves.

In addition, ascorbic acid at 2000 ppm had increased the bunch weight, fruit weight, fruit length as well as N and K percentage in leaves comparing with the control plants.

In a conclusion, spraying Grand Nain banana plants three times at April, June and August with active dry yeast at 2% or vitamin B1 or ascorbic acid at 2000ppm may considered promising treatments for achieving the maximum yield and improving fruit quality.

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مجلة حوليات العلوم الزراعية ، كلية الزراعة ، جامعة عين شمس ، القاهرة ، م٤٩ ، ع(٢)، ٦٤٣ - ٦٥٩ ، ٢٠٠٤

تأثير الرش بحمض الاسكوربيك وفيتامين (ب) والخميرة الجافة النشطة على النمو والمحتوى المعدنى للأوراق والمحصول وجودة الثمار فى نباتات الموز صنف جراندنين

[٤٥]

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١- قسم بحوث الفاكهة - المركز القومى للبحوث - ش البحوث - الدقى - القاهرة

أجرى هذا البحث فى عامين ٢٠٠٢/٢٠٠٣ و ٢٠٠٣/٢٠٠٤ لدراسة تأثير الرش بحامض الاسكوربيك وفيتامين (ب١) والخميرة الجافة النشطة على النمو والمحصول وجودة الثمار ومحتوى العناصر بالورقة لصنف الموز جراند نين النامية تحت ظروف محافظة الغربية.

رشت نباتات الموز صنف جراند نين ثلاث مرات هى (ابريل - يونية - اغسطس) وكانت المعاملات كالآتى رش النباتات بالماء فقط (كنترول)، ورش النباتات بفيتامين (ج) بتركيزات (٥٠٠، ١٠٠٠ ، ٢٠٠٠ جزء فى المليون) وفيتامين (ب١) بتركيزات (٥٠٠، ١٠٠٠، ٢٠٠٠ جزء فى المليون) والخميرة الجافة النشطة بتركيزات (١%، ٢%، ٣%) واستخدمت نفس التركيزات خلال الثلاث رشات على التوالى.

أوضحت النتائج أن جميع التركيزات أدت إلى زيادة واضحة فى طول الساق الكاذب وعدد الأوراق الخضراء على النبات عند الإزهار ومساحة الورقة محتواها من العناصر المعدنية ووزن السباطة كما أدت إلى التبكير فى الأزهار وتقصير دورة المحصول.

وكان التأثير ايجابياً بزيادة تركيز المواد المستخدمة.

تم الحصول على أفضل النتائج بالنسبة لوزن السباطة ووزن الاصبع وكذلك محتوى الورقة من النيتروجين والبوتاسيوم عند استخدام الخميرة الجافة النشطة رشا بتركيز ٢% ثلاث مرات فى السنة مقارنة بالكنترول والمعاملات الأخرى فى كلا الموسمين.

بالإضافة إلى ذلك أدى رش نباتات الموز بحمض الاسكوربيك فيتامين (ج) وفيتامين (ب) بتركيز ٢٠٠٠ جزء فى المليون إلى زيادة وزن السباطة ووزن الاصبع والتبكير فى الازهار والحصاد ودورة المحصول مقارنة بالنبات الغير معاملة (كنترول).

وكانت أفضل النتائج بالنسبة للمحصول وجودة ثمار الموز صنف جراندنين النامية تحت ظروف محافظة الغربية هى معاملة رش نباتات الموز ثلاث مرات بحمض الاسكوربيك بتركيز (٢٠٠٠ جزء فى المليون) وفيتامين ب (٢٠٠٠ جزء فى المليون) والخميرة الجافة النشطة بتركيز ٢%.

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