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# EFFECT OF SOME TREATMENTS ON IMPROVEMENT OF MARKETING CHARACTERS OF HINDY BANANA FRUIT TREATED WITH YEAST

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## ABSTRACT

The present investigation was carried out during 2006 and 2007 growing seasons in order to study the effect of soil application of yeast on yield and fruit quality of Hindy banana cv. Also, to extend the shelf life of banana obtained from plants treated with yeast using some nutrient elements such as calcium chloride, potassium citrate and boric acid spray.

The obtained results indicated that soil application of yeast enhancement the yield and fruit quality but, decreased the shelf life of banana fruits. Concerning to the effect of yeast application and spraying with Ca, K and B on banana fruits held at room temperature for 9 days, data revealed that both leaf content of Ca, K and B and parameter of yield were increased. Firmness and starch % were gradually decreased with prolonged storage but SSC, total sugars, peel colour, decay, weight loss as well as total loss were increased. The highest percentage of total loss was found in fruits from the plants treated with yeast only. While, the lowest percentage was found in fruits from the plants treated with yeast and sprayed with Ca and K combined with B.

## INTRODUCTION

Banana is considered one of the most important commercial fruits in Egypt. Recently there is an increasing demand for banana to meet the need for local as well as foreign markets especially Arabian countries.

Nowadays, great attention has been focused on using natural and safe substiuent for enhancing growth and quality of banana and many other fruits. Thus, treatments that increase yield and improve quality to satisfy market demands and prolong shelf-life are greatly appreciated.

Yeast is one of the natural products that used widely for this propose. Some banana growers practice using yeast as natural biostimulant to improve growth and productivity of the plants using some nutrient elements such as calcium (Wills & Tirmazi, 1982), potassium (Ramesh & Kumar, 2007) and boric acid (Awad & EL-Dengawy, 2006).

The possibility of using yeast in fruit orchards was mentioned by some research workers (EL-Shammaa, 2001 on Williams banana; Mostafa, 2004 and Mostafa & Abou-Raya, 2004 on Grand nain banana).

Some previous studies for improving yield and fruit quality indicated that shelf-life of the bunches is rather longer than untreated banana with yeast (Hosam El-Deen *et al.*, 2001).

Therefore, the present investigation was outlined to examine some alternative practices that may enhance yield and fruit quality of banana. In the same direction, to extend the shelf-life of banana fruits obtained from plants treated with yeast alone or with using some nutrient elements such as calcium, potassium and boric acid.

## MATERIALS AND METHODS

This investigation was carried out during two successive seasons of 2006 and 2007 in a private orchard at Badawy village near Mansoura city, Dakahlia Governorate, Egypt on the fourth and fifth ratoon of Hindy banana cv. The plants are grown at 2.5 x 3 meters apart on clay loamy soil. All plants under the experiment received the same cultural practices carried out by the banana growers in the district.

Three suckers which sprouted in May per mat were selected in June for fruiting in the following season in addition to the mother plant that would give the crop of the current season.

**This study included six treatments as the following :**

1- Control, yeast at 3 % (30 gm/L/plant) applied three times at April (growth start), July (at bunch shooting) and October (before maturity).
2- Yeast at 3 % plus spraying with calcium chloride at 3 g/L water.
3- Yeast at 3 % plus potassium citrate spray at 3g/L water.
4- Yeast at 3 % plus calcium chloride spray at 3 g/L water + boric acid at 0.25 g/L water.
5- Yeast at 3 % plus potassium citrate spray at 3 g/L + boric acid spray.
6- Yeast at 3 % plus calcium chloride, potassium citrate and boric acid spray at the same previous concentrations.

*All treatments except control were applied three times at (August, September and October).

Dry yeast was activated by dissolving in worm water (38 °C) and adding sugar at the same rate (1:1) then kept over night before adding to the soil, while calcium, potassium and boric acid were added as foliar spray. Each treatment was replicated three times in both seasons of the study. The experiment was designed as complete randomized blocks. The following parameters were carried out :

**Leaf mineral content :**

Leaf samples were taken from the 3rd fully opened leaves as recommended by Bhargava & Reddy (1992). Potassium was determined by the photometric method as described by Brown & Lilliland (1946). Calcium was determined using atomic absorption spectrophotometer according to the method described by Piper (1958). Boron was estimated using an atomic absorption spectrophotometer as described by Brandifeld & Spincer (1965).

Harvest date was adjusted when the top hand have slightly yellow colour and when the angulation reached about 9 % according to Abou Aziz *et al.*, (1970).

**At harvesting, the following determinations were carried out :**

- Yield/plant (kg), hand weight (kg), finger weight (gm), finger diameter (cm), finger length (cm) and finger size (ml).

**Fruit keeping :**

Two banana hands were taken at harvest time from each replicate of all treatments, then put in carton boxes and held at room temperature (18 ± 2 °C) and 65-70 % relative humidity for 9 days. Samples were taken at 3 days

interval and subjected to the following determinations: weight loss, decay and total loss. Firmness was determined using PHSH-Pull Dynanometer Model DT (01). Peel colour was evaluated by Delmonte Co. colour chart 7 grades from full green to complete yellow. SSC and total sugars were determined by using phenol sulphoric acid method, Smith *et al.*, (1956) and starch was determined using colorimetric method as described by Forsee, (1938).

**Statistical analysis :**

The data obtained were statistically analyzed as complete randomized block design according to Snedecor & Cochran (1980).

## RESULTS AND DISCUSSION

**Leaf mineral content :**

Data presented in Table (1) show the effect of yeast soil application plus spraying calcium chloride, potassium citrate alone or in combination with boric acid on the content of Ca, K and B in the leaves of Hindy banana plants.

**1- Calcium :**

Calcium content in the leaves was significantly affected by treatments in both seasons of study. It is also noticed that Ca sprays increased the content of the leaves from that element significantly during both seasons of study. The highest values of calcium in the leaves were obtained from plants sprayed with Ca and K combined with boric acid followed by spraying with Ca + K and spraying calcium alone. These results are in agreement with those reported by Ashour (2000) who found that both calcium and potassium sprays increased calcium content in leaves and fruits of Anna apples.

**2- Potassium :**

Data in Table (1) indicated that potassium content in the leaves was significantly affected by different treatments in both seasons of study. It is clear that all treatments significantly raised potassium content than the control. Combined application of yeast plus Ca, K and boric acid was favorable for stimulating potassium content than using each element alone. The highest values were obtained from plants sprayed with Ca + K and boric acid together followed by spraying with K+B and spraying with K alone which was 2.48 % as the mean of the two seasons of study. These results are in agreement with those reported by Saleh and Abd El-Monem (2003) working on Fagri Kalan mango trees using potassium citrate solely or combined with boric acid.

**3- Boron :**

Boron content in the leaves of Hindy banana plants was significantly affected by all treatments. Higher values of boron in the leaves were obtained from plants treated with yeast and sprayed with potassium + boric acid followed by spraying with combination of Ca + K and boric acid and spraying with Ca + boric acid together. These results are in line with those reported by Saleh and Abd El-Monem (2003) on "Fagri Kalan" mango trees. Sallam *et al.* (2002) found that single application of Zn, Cu or B and their combined were associated with the highest values of Zn, Cu and B in Hindy banana leaves.

**Table (1) : Leaf mineral content as affected by yeast and some mineral elements.**

| Treatment | $Ca^{+}$ % | | | K % | | | B ppm | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | Mean | 2006 | 2007 | Mean | 2006 | 2007 | Mean |
| Control yeast at 3% | 0.23 | 0.22 | 0.23 | 1.93 | 1.86 | 1.90 | 16.67 | 19.00 | 17.84 |
| yeast at 3% + Ca at 3 g/L | 0.28 | 0.27 | 0.28 | 1.96 | 1.90 | 1.93 | 18.00 | 19.67 | 18.85 |
| yeast at 3% + K at 3 g/L | 0.24 | 0.23 | 0.24 | 2.43 | 2.53 | 2.48 | 19.67 | 20.00 | 19.84 |
| yeast at 3% + Ca +K | 0.30 | 0.29 | 0.30 | 1.93 | 2.03 | 1.98 | 37.30 | 41.30 | 39.30 |
| yeast at 3% + K + B | 0.25 | 0.23 | 0.24 | 2.70 | 2.70 | 2.70 | 40.00 | 41.00 | 40.50 |
| yeast at 3% + Ca + K + B | 0.32 | 0.30 | 0.31 | 2.93 | 2.97 | 2.95 | 40.30 | 40.00 | 40.15 |
| L.S.D at 5 % | 0.28 | 0.019 | --- | 0.271 | 0.248 | --- | 2.327 | 2.721 | --- |

**Yield and its components :**

**Hand and finger weight :**

The results in Table (2) clearly showed that all treatments used were effective in increasing both hand and finger weight than control. In this respect, yeast plus foliar spray had significant and positive impact on weight especially in case of the combined treatments (Ca + K + B), followed by spraying with K & B and spraying with potassium.

**Finger size :**

It is also noticed from the same Table that in both seasons the finger size responded to the spraying materials. The combined treatments significantly increased finger size compared with the control. The other treatments take the same trend in increasing finger size.

**Finger diameter and length :**

Data presented in Table (2) indicated that application of yeast and spraying treatments significantly increased both diameter and length of the finger of Hindy banana than the control. The combined treatments gave highly significant effect in this respect followed by spraying with (K + B) and spraying with K alone.

**Table (2) : Yield and some physical characters of fruits as affected by yeast and some mineral elements.**

| Treatment | Yield/plant (kg) | | Hand weight (g) | | Finger weight (g) | | Finger size (ml) | | Finger diameter (cm) | | Finger length (cm) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 |
| Control yeast at 3% | 19.93 | 18.60 | 2.08 | 2.16 | 86.83 | 87.23 | 86.70 | 87.37 | 3.13 | 3.26 | 15.33 | 15.66 |
| yeast at 3%+ Ca at 3 g/L | 20.07 | 19.00 | 2.16 | 2.23 | 88.00 | 87.80 | 87.56 | 87.60 | 3.40 | 3.26 | 15.66 | 16.66 |
| yeast at 3%+ K at 3 g/L | 22.83 | 19.20 | 2.70 | 2.53 | 90.93 | 91.26 | 91.33 | 91.06 | 3.70 | 3.47 | 16.66 | 17.00 |
| yeast at 3%+ Ca +K | 20.93 | 19.07 | 2.30 | 2.27 | 91.56 | 89.90 | 91.87 | 89.50 | 3.80 | 3.43 | 16.33 | 16.33 |
| yeast at 3%+ K + B | 23.83 | 19.97 | 2.60 | 2.66 | 92.60 | 91.46 | 92.43 | 91.33 | 3.90 | 3.73 | 17.33 | 17.66 |
| yeast at 3%+ Ca + K + B | 24.17 | 22.23 | 2.90 | 2.8 | 93.23 | 92.40 | 93.00 | 92.27 | 4.03 | 3.96 | 17.66 | 18.66 |
| L.S.D at 5% | 0.604 | 0.826 | 0.253 | 0.159 | 1.353 | 0.199 | 1.786 | 1.334 | 0.265 | 0.228 | 0.997 | 0.997 |

**Yield :**

It is clear from Table (2) that yield per plant (kg) was significantly increased by all treatments compared with the control. However, the yield per plant was improved and reached the maximum (24.17 and 22.23 kg/plant) in the first and second season, respectively, when plants treated with yeast and sprayed with combined treatment followed by spraying with K + B and with K alone. Meanwhile, control recorded the lowest values (19.93 and 18.6 kg/plant) in both seasons, respectively. The increment in yield might be due to the increase in yield attributes i.e. hand weight, finger weight, finger size, finger diameter and finger length.

The abovementioned results are in harmony with those of Ramesh & Kumar (2007) who found that potassium spray had a significant and positive impact on bunch weight. Fruit bunch components including hand and finger number, finger length, girth and weight. Since, led to increase the yield of Neypoovan banana. Saleh & Abd El-Monem (2003) also found that spraying " Fagri Kalan " mango trees with potassium citrate combined with boric acid increased the yield and its components. Ashour (2000) found that both calcium and potassium spray increased the yield and its components of Anna apple. Sallam *et al.* (2002) found that single application of Zn, Cu and B and their combination increased yield and its component of Hindy banana.

**Soluble solids content (SSC %) during room storage :**

The results in Table (3) indicated that with all treatments, SSC was gradually increased toward the storage period, and the highest values of SSC were gained at the end of storage. Moreover, spraying Ca, K and boric acid significantly increased SSC in banana fruits than the control. In this respect, the best results were obtained when treated plants with yeast and sprayed with Ca and K combined with boric acid followed by spraying with K & B and spraying with K alone. This increment may be due to that calcium enhanced translocation of carbohydrates from leaves to fruits (Winkler *et al.*, 1974) and reduced respiration rate (Kumar & Gupta, 1987). Higher fruit quality among SSC can be explained by the role played by K in carbohydrate and protein synthesis (Tisdale and Nelson, 1966).

**Table (3): SSC and total sugars as affected by yeast and some mineral elements during storage period.**

| Treatment | Soluble solids content (SSC %) | | | | | | | | Total sugars | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Zero day | | 3 | | 6 | | 9 | | Zero day | | 3 | | 6 | | 9 | |
| | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 |
| Control yeast at 3% | 14.4 | 14.2 | 16.3 | 16.1 | 18.4 | 18.6 | 0.0 | 0.0 | 8.2 | 8.4 | 11.0 | 11.1 | 13.3 | 13.2 | 0.0 | 0.0 |
| yeast at 3%+ Ca at 3 g/L | 14.8 | 15.0 | 17.0 | 16.6 | 18.8 | 19.0 | 20.0 | 20.1 | 9.1 | 9.3 | 11.5 | 11.9 | 14.0 | 14.0 | 15.0 | 15.0 |
| yeast at 3%+ K at 3 g/L | 15.4 | 16.0 | 18.0 | 18.2 | 20.1 | 20.3 | 22.0 | 21.4 | 9.5 | 10.0 | 11.8 | 12.0 | 15.0 | 15.8 | 16.1 | 16.3 |
| yeast at 3%+ Ca +K | 15.0 | 15.1 | 17.2 | 17.0 | 19.4 | 19.8 | 21.0 | 20.9 | 9.4 | 9.8 | 11.3 | 12.0 | 14.9 | 15.2 | 16.0 | 16.1 |
| yeast at 3%+ K + B | 15.8 | 16.0 | 17.0 | 18.0 | 20.0 | 20.1 | 22.0 | 21.9 | 10.0 | 10.0 | 12.4 | 12.6 | 15.8 | 15.8 | 16.5 | 16.8 |
| yeast at 3%+ Ca + K + B | 16.0 | 16.1 | 18.2 | 18.4 | 20.6 | 20.8 | 22.7 | 23.2 | 10.4 | 10.4 | 13.2 | 13.1 | 16.2 | 16.6 | 17.0 | 17.1 |
| L.S.D at 5% | 0.87 | 0.92 | 1.05 | 1.12 | 1.26 | 1.15 | 1.47 | 1.68 | 0.65 | 0.48 | 0.73 | 0.82 | 0.73 | 0.85 | 0.94 | 0.98 |

The present results are in accordance with those obtained by Ramesh & Kumar (2007) on Neypoovan banana, Ashour (2000) on Anna apples and El-Ansary *et al.*, (1999) on Thompson seedless grapes.

**Total sugars during room storage :**

Results in Table (3) indicated that, total sugars in Hindy banana fruits were significantly affected by all treatments during storage. This parameter took the same trend of SSC. The previous results revealed that application of yeast and spraying calcium, potassium citrate and boric acid improved physical and chemical properties of Hindy banana comparing with the control. These results are in harmony with those obtained by Ramesh & Kumar (2007) on Neypoovan banana.

**Starch % and peel colour during room storage :**

Data in Table (4) show that all treatments significantly increased starch percentage in banana fruits at harvest as compared with the control. Both calcium and potassium sprays alone and in combination with boric acid increased starch percentage. The best results were obtained from the combined treatments. The high amount of starch at harvest is important for increasing the sugar during storage.

Mengel & Kirkaby (1987) found that potassium is responsible for energy production in the form of ATP and NADPH in chloroplast by maintaining balanced electric charges. Besides, K is involved in phloem loading and unloading of sucrose and amino acids, and storage in the form of starch in developing fruit by activating the enzyme starch synthase.

As for peel colour of banana fruits during storage, it was determined as a criterion for appearance, which considered significant indicator for fruit quality. Data in Table (4) revealed that banana colour was enhanced at storage period at room conditions during the two seasons of study. Moreover, all treatments used gave lower values of banana colour, and the duration of colour of the banana treated was less than the control during storage.

**Table (4) : Starch % and peel colour as affected by yeast and some mineral elements during room storage.**

| Treatment | Starch % | | | | | | | | Peel colour | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Zero day | | 3 | | 6 | | 9 | | Zero day | | 3 | | 6 | | 9 | |
| | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 |
| Control yeast at 3% | 22.5 | 21.63 | 7.30 | 6.40 | 1.75 | 1.66 | -- | -- | 2.0 | 2.0 | 4.5 | 5.0 | 6.5 | 6.5 | -- | -- |
| yeast at 3%+ Ca at 3 g/L | 22.76 | 21.97 | 10.60 | 9.80 | 7.30 | 6.55 | 2.30 | 2.05 | 2.0 | 2.0 | 3.5 | 4.0 | 5.0 | 5.0 | 6.0 | 6.0 |
| yeast at 3%+ K at 3 g/L | 23.93 | 23.07 | 11.20 | 10.80 | 8.00 | 7.20 | 3.60 | 3.00 | 2.0 | 2.0 | 4.0 | 4.5 | 5.5 | 5.5 | 7.0 | 7.0 |
| yeast at 3%+ Ca +K | 22.93 | 23.70 | 10.70 | 11.10 | 7.40 | 7.90 | 2.10 | 2.20 | 2.0 | 2.0 | 3.5 | 4.0 | 5.0 | 5.0 | 7.0 | 7.0 |
| yeast at 3%+ K + B | 24.10 | 24.63 | 11.60 | 12.30 | 8.00 | 8.20 | 2.80 | 2.95 | 2.0 | 2.0 | 4.0 | 4.5 | 5.5 | 5.5 | 7.0 | 7.0 |
| yeast at 3%+ Ca + K + B | 24.37 | 24.90 | 11.72 | 12.50 | 8.30 | 8.50 | 2.80 | 2.80 | 2.0 | 2.0 | 3.5 | 4.0 | 5.0 | 5.0 | 7.0 | 7.0 |
| L.S.D at 5% | 2.058 | 2.029 | 0.632 | 0.674 | 0.215 | 0.444 | 0.068 | 0.081 | N.S | N.S | 0.523 | 0.257 | 0.389 | 0.333 | 0.535 | 0.928 |

These results are in line with those obtained by Hosam El-Deen *et al.*, (2001) who found that two yeast applications gave larger value of banana colour during storage at room temperature compared with the control.

**Firmness during room storage :**

Regarding the effect of soil application of yeast, calcium, potassium and boric acid spray on banana fruit firmness, data in Table (5) indicated that it has a great effect on fruit firmness at harvest and during storage. It is clear from the obtained data that all applied treatments had a significant effect on decreasing the rate of softening of the fruits during both seasons of study. In this respect, the best results were obtained from spraying with calcium and potassium combined with boric acid followed by calcium and boric acid combination and potassium & boric acid spray. Such results are in line with those reported by Ashour (2000) that both calcium and potassium spray increased firmness of Anna apples. Awad and El-Dengawy (2006) found that boric acid spray increased firmness of guava fruits.

**Weight loss during room storage :**

It is interesting to notice from the same Table that weight loss % during storage was affected by all treatments in both seasons of study. All treatments significantly decreased the weight loss percentage compared with the control. In this respect, the most effective treatment was calcium & boric acid combination spray followed calcium chloride and potassium spray alone. This data is in harmony with those mentioned by Ramesh & Kumar (2007) that Neypoovan banana cv. receiving foliar spray either at 1.0 or 1.5 % potassium sulphate gave significant reduction in weight loss percentage. Awad & El-Dengawy (2006) on guava fruits found that boric acid spray decreased its weight loss percentage.

**Table (5) : Firmness and weight loss % as affected by yeast and some mineral elements during room storage.**

| Treatment | Firmness ($lb/in^2$) | | | | | | | | Weight loss % | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Zero day | | 3 | | 6 | | 9 | | Zero day | | 3 | | 6 | | 9 | |
| | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 |
| Control yeast at 3% | 9.5 | 8.9 | 7.5 | 7.25 | 3.30 | 3.20 | -- | -- | 0.0 | 0.0 | 8.1 | 9.2 | 12.5 | 13.5 | -- | -- |
| yeast at 3%+ Ca at 3 g/L | 11.5 | 9.5 | 9.33 | 7.90 | 5.50 | 5.20 | 3.45 | 3.20 | 0.0 | 0.0 | 5.5 | 7.5 | 10.5 | 15.8 | 15.8 | 16.5 |
| yeast at 3%+ K at 3 g/L | 11.0 | 9.2 | 8.5 | 7.70 | 4.50 | 4.50 | 2.20 | 2.80 | 0.0 | 0.0 | 7.1 | 8.2 | 11.3 | 12.1 | 18.0 | 19.8 |
| yeast at 3%+ Ca +K | 13.0 | 9.9 | 9.5 | 8.01 | 5.50 | 5.10 | 3.10 | 3.00 | 0.0 | 0.0 | 5.9 | 6.5 | 9.5 | 10.5 | 14.5 | 14.9 |
| yeast at 3%+ K + B | 12.9 | 9.7 | 9.20 | 7.90 | 5.45 | 5.10 | 2.30 | 2.20 | 0.0 | 0.0 | 6.2 | 7.1 | 10.2 | 11.5 | 20.8 | 21.9 |
| yeast at 3%+ Ca + K + B | 13.5 | 10.1 | 9.5 | 8.50 | 5.65 | 6.10 | 3.60 | 3.50 | 0.0 | 0.0 | 5.5 | 6.5 | 9.2 | 10.2 | 20.5 | 22.5 |
| L.S.D at 5% | 0.721 | 0.572 | 0.785 | 0.688 | 0.485 | 0.385 | 0.076 | 0.182 | -- | -- | 0.161 | 0.227 | 0.551 | 0.527 | 0.889 | 1.107 |

**Decay percentage during room storage :**

Results in Table (6) indicated that decay percentage was increased with prolonging the storage period, in both seasons of study. Moreover, the decay percentage of control fruits was higher than those treated with yeast and nutrients at the end of storage period. In this respect, the most effective treatment was the combined treatment calcium, potassium and boric acid followed by potassium & boric acid and calcium & boric acid spray. The obtained results are in agreement with the findings of Ashour (2000) on Anna

apples; El-Ansary *et al.* (1999) on Thompson seedless grapes Bramlage *et al.* (1974) reported that calcium may be a major contributing factor to decay resistance. This effect of $CaCl_2$ may be due to the formation of cross-bridge between uronic acids which may make the cell wall less accessible to enzymes in the fruit that cause softening or to cell wall degrading enzymes produced by fungal pathogens (Sams *et al.*, 1993).

**Total loss percentage during room storage :**

Data in Table (6) indicated that total loss percentage was gradually increased with prolonged storage in all treatments. Furthermore, yeast treatment (control) gave significant increase in total loss percentage as compared with other treatments. Since, spraying with calcium, potassium and boric acid decreased the total loss percentage during the two seasons of study.

From the abovementioned results, it is clear that yeast application for banana plants improved the yield and fruit quality but decreased shelf life of fruits. Thus, spraying calcium, potassium and boric acid prolonged the shelf life of banana fruits by reducing weight loss, decay and total loss. Thus, it could be concluded that, increasing the shelf life of banana fruits from plants treated with yeast could be achieved by using some nutrient elements such as calcium, potassium and boric acid as foliar spray.

**Table (6) : Decay % and total loss % as affected by yeast and some mineral elements during room storage.**

| Treatment | Decay % | | | | | | | | Total loss % | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Zero day | | 3 | | 6 | | 9 | | Zero day | | 3 | | 6 | | 9 | |
| | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 | 2006 | 2007 |
| Control yeast at 3% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 100.0 | 0.0 | 0.0 | 8.1 | 9.2 | 12.5 | 13.5 | 100.0 | 100.0 |
| yeast at 3%+ Ca at 3 g/L | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.4 | 35.6 | 0.0 | 0.0 | 5.5 | 7.5 | 10.5 | 11.5 | 54.2 | 52.1 |
| yeast at 3%+ K at 3 g/L | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 44.3 | 42.3 | 0.0 | 0.0 | 7.1 | 8.2 | 11.3 | 12.1 | 62.3 | 62.1 |
| yeast at 3%+ Ca +K | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 35.5 | 30.2 | 0.0 | 0.0 | 5.9 | 6.5 | 9.5 | 10.5 | 58.8 | 57.2 |
| yeast at 3%+ K + B | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 31.4 | 32.5 | 0.0 | 0.0 | 8.2 | 7.1 | 10.2 | 11.5 | 52.2 | 54.4 |
| yeast at 3%+ Ca + K + B | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 27.2 | 26.6 | 0.0 | 0.0 | 5.5 | 6.5 | 9.2 | 10.2 | 47.7 | 49.1 |
| L.S.D at 5% | -- | -- | -- | -- | -- | -- | 5.045 | 3.812 | -- | -- | 0.587 | 0.698 | 0.722 | 0.997 | 3.843 | 3.768 |

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## تأثير بعض المعاملات على تحسين الصفات التسويقية للموز الهندي المعامل بالخميرة

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أجرى هذا البحث خلال موسمي ٢٠٠٦ و ٢٠٠٧ على الموز الهندي المنزرع في أرض طينية بمحافظة الدقهلية وذلك بغرض دراسة تأثير الإضافة الأرضية للخميرة النشطة بمعدل ٣ % ٣٠ جرام/نبات فى أبريل ويوليو وأكتوبر منفردة (مقارنة) أو بالإضافة إلى الرش بكلوريد الكالسيوم فى أغسطس وسبتمبر وأكتوبر أو سترات البوتاسيوم بمعدل ٣ جرام/لتر أو حمض البوريك بمعدل ٠,٢٥ جرام/لتر في نفس المواعيد السابقة أيضاً على المحصول وخواص الثمار وسلوك الثمار أثناء التخزين لمدة ٩ أيام على درجة حرارة الغرفة.

أوضحت النتائج الآتي :

- على الرغم من أن إضافة الخميرة قد أدت إلى زيادة المحصول وتحسين خواص الثمار أثناء الحصاد إلا أنها أدت إلى زيادة الفاقد وتقليل مدة عرض الثمار.
- وجد أن الإضافة الأرضية للخميرة النشطة بالإضافة إلى الرش بكلوريد الكالسيوم أو سترات البوتاسيوم أو حمض البوريك أدى إلى زيادة محتوى الأوراق من هذه العناصر.
- كما وجد أن المعاملة بالخميرة + الرش بالعناصر أدى إلى زيادة المحصول وتحسين خواص الثمار.
- أدى الرش بالعناصر + الإضافة الأرضية للخميرة النشطة إلى زيادة نسبة المواد الصلبة الذائبة والسكريات الكلية والنشا ولون القشرة والصلابة.
- على الجانب الآخر أدت المعاملات إلى تقليل الفقد في الوزن ونسبة التالف مما أدى إلى زيادة الفترة التسويقية للثمار.

من خلال النتائج المتحصل عليها يمكن التوصية بأنه في حالة إضافة الخميرة النشطة إلى نباتات الموز فإن الرش ببعض العناصر مثل كلوريد الكالسيوم أو سترات البوتاسيوم أو حمض البوريك يكون ضروري في تحسين خواص الثمار وكذلك زيادة مدة تسويق هذه الثمار.