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RESPONSE OF EWAISE MANGO TREES TO SOME BIOFERTILIZERS

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ABSTRACT

The influence of biofertilization with nitrobiene at ٥٠, ١٠٠ and ٢٠٠ g/tree, phosphorene at ٥, ١٠ and ٢٠ g/tree and potassine at ٢٥٠, ٥٠٠ and ١٠٠٠ ppm on leaf mineral content, yield, physical and chemical properties of Ewaise mango fruits were studied during ٢٠٠٩ and ٢٠١٠ seasons.

Results showed that all biofertilizers were very effective in enhancing the nutritional status of the trees, yield, physical and chemical characters of the fruits. The best results with regard to nutritional status of the trees, yield and fruit quality were obtained when Ewaise mango trees were biofertilized twice with nitrobiene at ٢٠٠ g/tree or phosphorene at ٢٠ g/tree and once or three times with potassine at ١٠٠٠ ppm.

INTRODUCTION

Biofertilization of fruit crops drew the attention of pomologists and in the last few decades became an effective alternative to chemical fertilizers. Biofertilizers are very safe for human, animal and environment (Abd-Elmotty *et al*., ١٩٩٦). Nitrobiene is a biofertilizer product contained beneficial bacteria which live in soil as autotrophy

and has the ability to fix atmospheric N in their cells. Phosphorene is a biofertilizer product containing phosphate solubilizing bacteria it play a fundamental role in converting the fixed form to be soluble ready for plant nutrition. Breakdown of organic soil matter by microorganisms is associated with an increased CO_2 production that possibly increases the solubility of soil phosphate (Quastel, ١٩٦٥).

Application of biofertilizers i.e. nitrobiene (Subba Rao, ١٩٨٤ and Ahmed *et al*., ١٩٩٧). Phosphorene (Kurtsidze, ١٩٨٤; Boutros *et al*., ١٩٨٧; Haggag *et al*., ١٩٩٥ and Ahmed *et al*., ١٩٩٥a & ١٩٩٥b and potassine (Banik *et al*., ١٩٩٧ and Abd-Elmotty *et al*., ١٩٩٦) were favorable in improving growth, nutritional status of the trees, yield of as well as physical and chemical characteristics of different fruit crops.

The present study was designed to elucidate the beneficial effect of using three biofertilizers namely nitrobiene, phosphorene and potassine on Ewaise mango trees.

MATERIALS AND METHODS

This study was conducted during the two successive seasons of ٢٠٠٩ and ٢٠١٠ seasons on Ewaise mango trees (*Mangifera indica* L.) planted in a private orchard situated at Sahel-Salem district (El-Aml Farm), Assiut Governorate. Thirty healthy and uniform in vigour ١٢-years old Ewaise mango trees onto seedling rootstock and planted at ٧x٧ m. apart were selected. Soil texture is loamy and analysis was done according to the standard methods outlined by Wilde *et al*. (١٩٨٥) and the data are listed in Table ١.

Table ١: Some physical and chemical properties of soil (٠-٩٠ cm deep) of the experimental site.

Soil property	Value*
Sand %	٨٦.١٠
Silt %	٥.٤٠
Clay %	٨.٥٠
Texture grade	**Loamy**
pH	٧.٨
EC (dS m^{-1})	١.٠٥

$CaCO_3$ %	٤.٧٣
O.M. %	٢.٠٠
Total N %	٠.١٢
Soluble P (ppm, olsen)	٥.٣٠
Soluble K (ppm, ammonium acetate)	٣١٢.٧٠

* Each value represents the mean of ٣ samples.

The experiment included ١٠ treatments:

١- Control (No added biofertilizer).
٢- Addition of Nitrobiene at ٥٠ g/tree.
٣- Addition of Nitrobiene at ١٠٠ g/tree.
٤- Addition of Nitrobiene at ٢٠٠ g/tree.
٥- Addition of Phosphorene at ٥ g/tree.
٦- Addition of Phosphorene at ١٠ g/tree.
٧- Addition of Phosphorene at ٢٠ g/tree.
٨- Foliar application of Potassine at ٢٥٠ ppm.
٩- Foliar application of Potassine at ٥٠٠ ppm.
١٠- Foliar application of Potassine at ١٠٠٠ ppm.

Each treatment was replicated three times, one tree per each and received the half recommended rate of mineral fertilization of ammonium sulphate, super phosphate and potassium sulphate (٦٢٥, ٥٠٠ and ٥٠٠ g/tree, respectively).

Nitrobiene contains two non-symbiotic nitrogen-fixing bacteria: Azotobacter chrococcum and Azospirillum barasilence carried on peat moss, vermiculite and plant charcoal (Shalan *et al*., ٢٠٠١). It was applied twice at ١٥ March and ١٥ April around each tree.

Phosphorene contains phosphate dissolving bacteria Vesicular Arbusular Mycrorrhiza and Silicane bacteria (Abd-Alla *et al*., ٢٠٠١). It was applied once which ٥, ١٠ or ٢٠ g/tree was mixed with ½ kg super phosphate before application and the mixture was broadcasted around each tree (١st week of February).

Potassiene (٣٠٪ K_2O) at ٢٥٠, ٥٠٠ and ١٠٠٠ ppm was sprayed three times: after full bloom, after fruit setting and ٣٠ days later.

In late July at each seasons, samples comprised from twenty leaves of six month old from non-fruiting shoots were selected at random from each replicate to determine N%, P% and K% content according to Wilde *et al*., (١٩٨٥).

At harvest time according to the prevailing conditions (mid August), yield expressed in weight (kg) and number of fruits per tree was recorded.

Response of ewaise mango trees to some biofertilizers

To study the fruit quality, five fruits at uniform stage of maturity were picked at random from all directions of each tree (replicate) just before harvest of each season. All fruit samples were tested for physical and chemical characteristics as follows:

The physical characteristics included:

a) Fruit weight (g) b) Seed weight (g) c) Pulp/seed ratio

· The chemical properties included:

a) Total soluble solids percentage (TSS%) was estimated by using the hand refractometer.

b) Total acidity was determined by direct titration against ٠.١ N NaOH using phenolphthalein as an indicator and expressed as citric acid/١٠٠g fruit pulp, according to A.O.A.C. (١٩٨٥).

c) Ascorbic acid content as mg vitamin C/١٠٠g fruit pulp was evaluated using of ٢,٦-dichlorophenol indophenol as outlined in A.O.A.C., ١٩٨٥.

Complete randomized block design was followed.

All data obtained were statistically analyzed according to Mead *et al*. (١٩٩٣) using L.S.D. test to recognize the significancy between various biofertilizer treatments.

RESULTS AND DISCUSSION

Effect of biofertilization on leaf minerals content:

It is clear from the data in Table ٢ that biofertilization through using nitrobiene at ٥٠ to ٢٠٠ g/tree, phosphorene at ٥.٠ to ١٥.٠ g/tree and potassine at ٢٥٠ to ١٠٠٠ ppm significantly stimulated percentages of N, P and K in the leaves of Ewaise mango trees comparing with control trees. The increase in these macronutrients was associated with increasing the rates of nitrobiene, phosphorene and potassine. Meaningless promotion on these elements was observed using the higher two levels of nitrobeien (١٠٠ and ٢٠٠ g/tree), phosphorene (١٠ and ١٥ g/tree) and potassine (٥٠٠ and ١٠٠٠ ppm).

The beneficial effect of these biofertilizers on increasing the availability of nutrients through reducing soil pH and increasing organic matter could resulted in enhancing these nutrients. These

results are in agreement with those obtained by Abd E-Moumen (١٩٩٤), Haggag *et al*. (١٩٩٥), Ragab (١٩٩٩) and Abd-Elmotty *et al*. (٢٠٠٥).

Table ٢: Effect of biofertilization with nitrobiene, phosphorene and potassine on leaf minerals content (%) of Ewaise mango trees in ٢٠٠٩ and ٢٠١٠ seasons.

Biofertilization treatments	N%			P%			K%		
	٢٠٠٩	٢٠١٠	Avg.	٢٠٠٩	٢٠١٠	Avg.	٢٠٠٩	٢٠١٠	Avg.
Control	٠.٩٨	٠.٩٦	٠.٩٧	٠.١٢	٠.١٠	٠.١١	٠.٥٦	٠.٦٤	٠.٦٠
Nitrobiene at ٥٠ g/tree	١.٢٨	١.٣٨	١.٣٣	٠.١٢	٠.١٤	٠.١٣	٠.٦٦	٠.٧٠	٠.٦٨
Nitrobiene at ١٠٠ g/tree	١.٥٤	١.٦٠	١.٥٧	٠.٢٠	٠.١٨	٠.١٩	٠.٨٠	٠.٧٨	٠.٧٩
Nitrobiene at ٢٠٠ g/tree	١.٩٠	١.٨٢	١.٨٦	٠.٢٢	٠.٢٤	٠.٢٣	٠.٨٨	٠.٩٤	٠.٩١
Phosphorene at ٥ g/tree	١.١٢	١.٠٦	١.٠٩	٠.٢٠	٠.١٨	٠.١٩	٠.٩٠	٠.٩٠	٠.٩٠
Phosphorene at ١٠ g/tree	١.٢٤	١.٢٠	١.٢٢	٠.٣٤	٠.٣٠	٠.٣٢	١.٠٠	٠.٩٨	٠.٩٩
Phosphorene at ٢٠ g/tree	١.٣٢	١.٣٦	١.٣٤	٠.٣٨	٠.٤٠	٠.٣٩	١.٠٨	١.٠٦	١.٠٧
Potassine at ٢٥٠ ppm	١.٠٦	١.١٤	١.١٠	٠.١٦	٠.١٤	٠.١٥	١.٠٦	١.٠٨	١.٠٧
Potassine at ٥٠٠ ppm	١.٢٨	١.٣٠	١.٢٩	٠.١٨	٠.١٦	٠.١٧	١.١٨	١.٢٠	١.١٩
Potassine at ١٠٠٠ ppm	١.٣٨	١.٣٦	١.٣٧	٠.١٩	٠.١٩	٠.١٩	١.٢٨	١.٣٢	١.٣٠
LSD at ٥٪	٠.١١	٠.١٣		٠.٠٤	٠.٠٣		٠.١١	٠.١٢	

Effect of biofertilization on yield attributes:

Data of yield expressed in weight (kg) and number of fruits per tree of Ewaise mango trees in response to biofertilization with nitrobiene, posphorene and potassine are presented in Table ٣. Yield and number of fruits per tree were positively affected by biofertilization the trees with nitrobiene, posphorene and potassine. Biofertilization significantly improved the yield of Ewaise mango cv. than the control. Increasing levels of nitrobiene from ٥٠ to ٢٠٠ g/tree, phosphorene from ٥.٠ to ١٥.٠ g/tree and potassine from ٢٥٠ to ١٠٠٠ ppm was followed by a gradual promotion on yield and number of

fruits per tree. Significant differences on yield were observed between all levels and concentrations of the three biofertilizers. The best results were obtained with using potassine biofertilizer.

The essential role of K on enhancing growth and total carbohydrates synthesis that was responsible for producing more flowers could explain the present results. The positive action of biofertilization on stimulating the uptake of essential nutrients, building organic foods and enhancing growth characters could explain the present results. These results are in agreement with those obtained by Abd El-Moumen (١٩٩٤), Shata *et al*. (١٩٩٦) and Abd Elmotty *et al*. (٢٠٠٥).

Table ٣: Effect of biofertilization with nitrobiene, phosphorene and potassine on No. of fruit/tree and yield (kg/tree) of Ewaise mango trees in ٢٠٠٩ and ٢٠١٠ seasons.

Biofertilization treatments	No. of fruit/tree			Yield (kg/tree)		
	٢٠٠٩	٢٠١٠	Avg.	٢٠٠٩	٢٠١٠	Avg.
Control	١٩٠.٧	١٨١.٣	١٨٦.٠٠	٤٢.٥٠	٣٩.٦٦	٤١.٠٨
Nitrobiene at ٥٠ g/tree	٢١٥.٠	٢٠٣.٦	٢٠٩.٣٠	٤٤.٨١	٤٠.٦٣	٤٢.٧٢
Nitrobiene at ١٠٠ g/tree	٢٢٨.٦	٢١٠.٠	٢١٤.٣٠	٤٩.٤٢	٤٦.٦٢	٤٨.٠٢
Nitrobiene at ٢٠٠ g/tree	٢٣٩.٩	٢٢٤.٧	٢٣٢.٣٠	٥٣.٧٤	٥٠.٠٠	٥١.٨٧
Phosphorene at ٥ g/tree	٢٠٠.٥	١٩٥.٠	١٩٧.٧٥	٤٤.٢٠	٤٢.٦٦	٤٣.٤٣
Phosphorene at ١٠ g/tree	٢٠١.٦	١٩٧.٢	١٩٩.٩٠	٤٥.٨٨	٤٣.٨٢	٤٤.٨٥
Phosphorene at ٢٠ g/tree	٢١٩.٧	٢١٢.	٢١٦.٠	٤٧.٠٦	٤٥.٩٢	٤٤.٩٩

		٣	٠			
Potassine at ٢٥٠ ppm	٢٢٦.٨	٢١٩.٦	٢٢٣.٢٠	٤٨.٩٦	٤٧.٠٤	٤٨.٠٠
Potassine at ٥٠٠ ppm	٢٣١.٠	٢٢٨.٨	٢٢٩.٩٠	٥٢.٠٠	٥١.٦٦	٥١.٨٣
Potassine at ١٠٠٠ ppm	٢٤٦.٨	٢٣٦.٢	٢٤١.٥٠	٥٥.٠٥	٥٣.٦٣	٥٤.٣٤
LSD at ٥٪	٨.٩	٧.٨		٢.٠١	١.٩٨	

Effect of biofertilization on physical and chemical properties of the fruits:

Data in Tables ٤ and ٥ clearly show that biofertilization with nitrobiene, phosphorene and potassine resulted in improving fruit quality in terms of increasing fruit weight, pulp/seed ratio, total soluble solids % and vitamin C content (mg/١٠٠ g pulp) and decreasing total acidity % compared with the control.

Significant differences on fruit quality were observed among all rates of each biofertilizer. The effect of biofertilization on enhancing the accumulation and translocation of carbohydrates in fruits was accompanied with accelerating fruit maturity.

The promotion on fruit quality in response to biofertilization was supported by the results of Abd El-Moumen (١٩٩٤), Banik *et al*. (١٩٩٧) and Abd Elmotty *et al*. (٢٠٠٥).

Table ٤: Effect of biofertilization with nitrobiene, phosphorene and potassine on some physical properties of Ewaise mango fruits in ٢٠٠٩ and ٢٠١٠ seasons.

Biofertilization treatments	Fruit weight (g)			Seed weight (g)			Pulp/seed ratio		
	٢٠٠٩	٢٠١٠	Avg.	٢٠٠٩	٢٠١٠	Avg.	٢٠٠٩	٢٠١٠	Avg.
Control	٢٠٠.٠	٢٠٠.٠	٢٠٠.٠	٢٧.٥	٢٧.١	٢٧.٣	٦.١٢	٦.٣٠	٦.٢١

	٧	٥	٦						
Nitrobiene at ٥٠ g/tree	٢٠٨.٢	٢٠٧.٨	٢٠٨.٠	٢٦.٩	٢٧.٧	٢٦.٨	٦.٣٢	٦.٤٤	٦.٣٨
Nitrobiene at ١٠٠ g/tree	٢١٣.٨	٢١٤.٦	٢١٤.٢	٢٦.٧	٢٦.٩	٢٦.٨	٦.٤٦	٦.٤٠	٦.٤٣
Nitrobiene at ٢٠٠ g/tree	٢١٧.٣	٢١٩.٣	٢١٨.٣	٢٧.٣	٢٧.٥	٢٧.٤	٦.٥٣	٦.٧٧	٦.٦١
Phosphorene at ٥ g/tree	٢٠٦.٥	٢٠٨.٧	٢٠٧.١	٢٧.٦	٢٧.٨	٢٧.٧	٦.٢٩	٦.٣٣	٦.٣١
Phosphorene at ١٠ g/tree	٢١٢.٩	٢١٣.٣	٢١٣.١	٢٧.٩	٢٧.٩	٢٧.٩	٦.٥٠	٦.٧٢	٦.٦١
Phosphorene at ٢٠ g/tree	٢١٤.٨	٢١٥.٧	٢١٥.٣	٢٦.٨	٢٧.٠	٢٦.٩	٦.٨٢	٦.٩٠	٦.٨٦
Potassine at ٢٥٠ ppm	٢١٠.١	٢١١.٩	٢١١.٠	٢٧.٠	٢٧.٢	٢٧.١	٦.١٧	٦.٣٣	٦.٢٥
Potassine at ٥٠٠ ppm	٢١٧.٤	٢١٦.٢	٢١٦.٨	٢٧.٣	٢٧.١	٢٧.٢	٦.٦٠	٦.٧٢	٦.٦٦
Potassine at ١٠٠٠ ppm	٢٢٢.٥	٢٢٠.٣	٢٢١.٤	٢٧.٩	٢٧.٧	٢٧.٨	٦.٨٢	٦.٩٨	٦.٩٠
LSD at ٥٪	٨.١	٧.٨		٠.٨٣	٠.٧٩		٠.٢٧	٠.٢٩	

Table ٥: Effect of biofertilization with nitrobiene, phosphorene and potassine on some chemical properties of Ewaise mango fruits in ٢٠٠٩ and ٢٠١٠ seasons.

Biofertilization treatments	**TSS%**			**Total acidity %**			**V.C (mg/١٠٠g pulp)**		
	٢٠٠٩	٢٠١٠	**Avg.**	٢٠٠٩	٢٠١٠	**Avg.**	٢٠٠٩	٢٠١٠	**Avg.**
Control	١٨.٩	١٨.٧	١٨.٨	٠.٥٢٦	٠.٤٨٤	٠.٥٠٥	٤٢.٠	٤١.٦	٤١.٨
Nitrobiene at ٥٠ g/tree	١٩.٢	١٩.٠	١٩.١	٠.٤٨٣	٠.٤٦٧	٠.٤٧٥	٤٤.٧	٤٣.٥	٤٤.١

Nitrobiene at ١٠٠ g/tree	١٩.٩	١٩.٧	١٩.٨	٠.٤٤١	٠.٤٢١	٠.٤٣١	٤٥.٣	٤٤.٨	٤٥.١
Nitrobiene at ٢٠٠ g/tree	٢٠.٥	٢٠.٩	٢٠.٧	٠.٤١٢	٠.٤١٤	٠.٤١٣	٤٧.٥	٤٨.٣	٤٨.٠
Phosphorene at ٥ g/tree	١٩.٦	١٩.٤	١٩.٥	٠.٤٧٣	٠.٤٥٥	٠.٤٦٤	٤٦.٠	٤٧.٤	٤٦.٧
Phosphorene at ١٠ g/tree	٢٠.٤	٢٠.٨	٢٠.٦	٠.٤١٢	٠.٣٩٠	٠.٤٠١	٤٧.٨	٤٨.٢	٤٨.٠
Phosphorene at ٢٠ g/tree	٢١.٢	٢٠.٨	٢١.٠	٠.٣٦٣	٠.٣٨٧	٠.٣٧٥	٤٩.٢	٤٨.٨	٤٩.٠
Potassine at ٢٥٠ ppm	٢٠.٦	٢٠.٤	٢٠.٥	٠.٤٠٦	٠.٣٨٦	٠.٣٩٦	٤٨.٧	٤٩.٦	٤٩.٢
Potassine at ٥٠٠ ppm	٢١.٨	٢١.٦	٢١.٧	٠.٣٦٠	٠.٣٤٦	٠.٣٥٣	٥٠.٣	٥١.٥	٥٠.٩
Potassine at ١٠٠٠ ppm	٢٢.٠	٢٢.٤	٢٢.٢	٠.٣٣٥	٠.٣١٣	٠.٣٢٤	٥١.٦	٥٢.٢	٥١.٩
LSD at ٥٪	٠.٤	٠.٤		٠.٠٤٣	٠.٠٤١		١.٦٣	١.٠١	

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استجابة أشجار المانجو العويس لبعض الأسمدة الحيوية

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أجريت هذه الدراسة علي أشجار المانجو صنف "عويس" المنزرعة ببستان خاص بمنطقة ساحل سليم بمحافظة أسيوط خلال موسمين متتاليين ٢٠٠٩ ، ٢٠١٠ وذلك بهدف دراسة تأثير التسميد الحيوي باستخدام النتروبين بمعدل ٥٠ ، ١٠٠ ، ٢٠٠ جرام/شجرة والفوسفورين بمعدل ٥ ، ١٠ ، ٢٠ جرام/شجرة والبوتاسين بمعدل ٢٥٠ ، ٥٠٠ ، ١٠٠٠ جزء في المليون علي التركيب المعدني للورقة والمحصول والخصائص الطبيعية والكيميائية لثمار المانجو العويس.

وقد أشارت النتائج المتحصل عليها أن جميع الأسمدة الحيوية كانت فعالة جداً في تحسين الحالة الغذائية للأشجار والمحصول والخصائص الطبيعية والكيميائية لثمار المانجو العويس.

ولقد أمكن الحصول علي أفضل النتائج من حيث الحالة الغذائية للأشجار والمحصول وخصائص الجودة للثمار لأشجار المانجو العويس التي تم تسميدها حيوياً باستخدام النتروبين مرتين بمعدل ٢٠٠ جم للشجرة أو استخدام الفوسفورين بمعدل ٢٠ جرام للشجرة مرة واحدة أو استخدام البوتاسين بمعدل ١٠٠٠ جزء في المليون ثلاث مرات.