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Using the Organic and Bio-fertilizers as a Partial Substitute for Mineral-N in Williams Banana Orchards

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Abstract

This study was carried out during two consecutive seasons of 2013/2014 and 2014/2015 on the third and fourth ration of Williams banana plants. The plants are grown in a private Orchard located at Kom Ombo city, Aswan Governorate, Egypt. The compost as an organic fertilizer, enriched with EM or bio-mex was used as a partial replacement for the mineral-N fertilizer. The experiment was set up as a complete randomized block design.

The results revealed that using the recommended dose of nitrogen (RDN) via 25% as a mineral source and 25 to 50% as an organic one enriched with 50 or 25% of EM or bio-mex significantly enhanced the length and circumference of pseudostem, leaf area and total leaf area/plant as well as percentage of N, P and K of leaves compared to use the RDN only as a mineral N fertilizer.

Also, the N fertilization with a combination of mineral and organic N sources with a bio-fertilizer significantly increased the bunch weight and hand weight consequently increased the yield/plant, as well as improved the fruit quality compared to use the RDN only as a mineral source. The promotion on such growth and fruiting traits was associated with increasing percentage of bio-form from 25 to 50%. The organic fertilizer enriched with bio-mex significantly stimulated these traits more than its use with EM.

It is evident that such N fertilization program is very important for the banana fruit production. It improve the nutrient status, yield and fruit quality of banana plants. In addition, it minimizes the production costs and environmental pollution which could be occurred with using chemical fertilizers.

Keywords: *Organic, bio-fertilization, Banana, yield, nutrient status, environmental pollution.*

Introduction

Banana (*Musa* sp.) is the fourth largest fruit crop in the world, following grapes, citrus and apple. It plays an important role in tropical economics as cash export and as complementary food in local sets. Bananas have a great economic importance as one of the most popular fruits in Egypt for its high nutritive value, cheap source of energy i.e. high starch content vitamins and other minerals with traces of fat (Abdel-Moniem *et al*., 2008). The total area of banana increased to 60090 feddan produced 1158224 tons with average of 19.28 ton/ feddan according to Statistics of Ministry of Agriculture (2013).

Williams banana is excellent performance since the large bunch with longer fingers and the excellent taste. It owing to its large size and rapid growth rate require relatively large amount of nutrients to maintain high production of good quality fruits (Saleh, 1996). So, the major problems

facing banana growers are the high costs of excessive manufactured fertilizers needs. Besides, these chemical fertilizers are considered as air, soil and water polluting agents during their production and utilization (Abdel-Moniem *et al*., 2008 and Kuttimani *et al*., 2013).

A combination of mineral, organic and bio-fertilizers is necessary to sustain and improve crop. Fertilization is one of the important tools to improve the soil fertility and increase crop yield. Nitrogen is known to be one of the most elements for plant nutrition and development. It plays an important role as a constituent of all proteins, nucleic acids and enzymes (Nijjar, 1985 and Marschner, 1996). Nitrogen fertilization effects depend upon the nutrient status of the soil, applied amount, sources and methods of N application. The nitrogen fertilizer efficiency under field and surface irrigation conditions rarely exceeds 50% and it ranges between 30 and 40% (Saharawat, 1979). A principal goal of the nature farming is producing healthy fruits without the use of chemical fertilizers synthetic auxins and pesticides and without causing adverse effects on the natural environment (Verna, 1990; Dahama, 1999 and El-Salhy, 2004). Using organic fertilizers are responsible for stimulating soil fertility and biological activity, formation of natural hormones, antibiotics and B vitamins and developments of roots as well as to avoiding all forms of pollution that may result from conventional agriculture techniques. Most organic fertilizers depends on using recycled animal manure and farm residues to produce a compost (Russo and Perlyn, 1990; Yagodin, 1990 and Dahama, 1999). Bio-fertilization are beneficial in enhancing biological activity due to its highest own from microorganism. It is responsible in suppresses of plant pathogens and diseases conservation of energy in plant, solubilization of mineral in the soil and promotion of photosynthetic efficiency and biological N fixation. Nitrogen fixing cyanobacteria and the effective microorganisms (EM) are used in order to improve soil fertility, fertilizer efficiency and productivity of fruit trees (Higa and Wididana, 1991; El-Haddad *et al*., 1993; Myint, 1999; Kannaiyan, 2002 and El-Salhy *et al*., 2006).

Many authors previously mentioned that adjusting the amount of N as well as using the suitable amount of N via inorganic, organic and bio-fertilizers sources were very beneficial in enhancing growth and fruiting of different banana cvs as compared to use mineral-N alone (Ahmed *et al*., 1996 and 1997; El-Shamaa, 2001; Soliman, 2001; Kamel, 2002; Abdel-Monaem and Radwan, 2003; Hammam, 2003; Ahmed *et al*., 2003; Hammam *et al*., 2003; Roshdy, 2004; Gobara, 2004; El-Shenawi and Hassouna, 2004; Sayed, 2004; El-Sawy, 2005; El-Shenawi *et al*., 2008; Bhalerao *et al*., 2009; Roshdy, 2010; Badgujar *et al*., 2010; Barakat *et al*., 2011 and Kuttimani *et al*., 2013).

Therefore, the objective of this study was to examine the possibility of reducing mineral-N of banana orchards, as well as, to select the optimum proportion of fertilizers.

Materials and Methods

This study was carried out during two consecutive seasons of

2013/2014 and 2014/2015 seasons on the third and fourth rations of Williams banana plants. The plants are grown in a private orchard located at Kom Ombo region, Aswan Governorate, where the soil has a clay texture with a water table depth not less than two meters deep. Analysis of the tested soil was made according to the procedures outlined by Wilde *et al*. (1985) and the date are shown in Table (1). The plants were spaced at 3.5x3.5 meters apart. All plants were similar in age, growth and received the recommended agricultural practices, except N fertilization in all sources in the orchard was carried out as usual.

Table 1. Some physical and chemical properties of the soil of the experimental site.

Soil property	Value	Soil property	Value
Sand (%)	15.43	Total N (%)	0.16
Silt (%)	33.22	$NaHCO_3$-extractable P (mg/kg)	21.61
Clay (%)	51.35	NH_4AOC-extractable K (mg/kg)	401.33
Texture	Clay	DTPA extractable Fe (mg/kg)	13.19
$CaCO_3$ (%)	3.66	DTPA extractable Mn (mg/kg)	15.16
Organic matter (%)	1.32	DTPA extractable Zn (mg/kg)	2.35
pH (1:1 suspension)	8.10	DTPA extractable Cu (mg/kg)	2.11
Ece (dS/m^{-1})	2.69		

The present experiment involved seven treatments as follow:

1- Application of the recommended dose of nitrogen (RDN) of 600 g/plant/year (1.8 kg ammonium nitrate/plant/year) as mineral N form (T_1)

2- Application of the RDN as 25% mineral-N and 50% organic plus 25% bio (EM) fertilizers (T_2).

3- Application of the RDN as 25% mineral-N and 25% organic plus 50% bio (EM) fertilizers (T_3).

4- Application of the RDN ass 25% mineral-N and 50% organic plus 25% bio (bio-mex) fertilizers (T_4).

5- Application of the RDN as 25% mineral-N and 25% organic plus 50% bio (bio-mex) fertilizers (T_5).

6- Application of the RDN as 50% organic and 50% bio (EM) fertilizers (T_6).

7- Application of the RDN as 50% organic and 50% bio (bio-mex) fertilizers (T_7).

The experiment was set up as a complete randomized block design, each treatment was replicated three times, one stool per each. Nitrogen source was ammonium nitrate (33.5% N) and it was splitted into 14 equal batches and added twice per each month that started on April and ended on October during each season. The organic fertilizer (compost, 4.9% N) was added once in second week of Dec. in holes 15 cm depth around each plant and covered with soil after the addition. Bio-mex and EM were added in two equal batches once at growth start and one month later. Bio-fertilizer was added by making digs around each plant and putting the specific amount them irrigation. Effective microorganisms (EM) as a bio-fertilizer that contains a mixed of photosynthetic and lactic acid bacteria as well as actinomyces, yeasts and fungi. Similar bio-mex has contains the previously contantes plus humic and folvic acids.

Regular agricultural and horticultural practices which were followed in the orchard including hoeing, fertilization with P and K, irrigation with Nile water as well as pathogens, pests and weed control were carried out as usual. The following measurements were taken on selected plants.

1- Vegetative characteristics:

After the emergence of the inflorescence (3rd week of July for both the third and fourth ratoons), the following parameters were studies vegetative characters. Data on the vegetative characteristics included pseudostem length and its circumference diameter in (cm), number of green leaves per plant at bunch shooting and leaf area (m^2) using the third full sized leaves according to Murry (1960) and calculated as follows:

Leaf area (m^2) = Length x Width x 0.8

2- Leaf mineral contents:

Leaf samples were taken from the third upper leaf from the top of the plant after bunch shooting in September of each season. A sample of 10x10 cm from the middle part of the leaf blade was used as recommended by Hewitt (1955). Samples were oven dried at 70°C and digested. The clear digestion was quantitatively transferred to 100 ml volumetric flask. In this solution, the following nutrients were determined according to Wilde *et al*. (1995).

a) Total N was determined by using micro-kjeldahl method.

b) Phosphorus was determined by using Olsen method.

c) Potassium was determined by using flame photometer.

3- Yield and fruit quality:

The bunches were harvested when the fingers reached the full mature stage as well as when the top hands and fingers become roundish and turned slightly yellow according to Nolin (1985). Before artificial ripening weights of bunch and hand were recorded. Six hands were taken from the base, middle and distal end of bunch as a composite sample for different characters. The chosen hands were wrapped with newspaper and arranged in closed wooden boxes with a glass surface to achieve artificial ripening and after the fingers were ripened, the following physical and chemical characters were determined:

a) Finger weight (g) and pulp %.

b) Percentages of total soluble solids, total and reducing sugars and total acidity (as malic acid/100 g pulp) were determined according to A.O.A.C. methods (1995).

All the obtained data were tabulated and statistically analyzed. The differences between various treatment means were compared using L.S.D. test at 5% according to Gomez and Gomez (1984) and Mead *et al*. (1993).

Results

1- Effect of vegetative growth and percentage of N, P and K in leaves:

Data presented in Tables (2 & 3) show the effect of different nitrogen fertilization sources on length and circumference of pseudostem and number of green leaves/plant as well as leaf area, total leaf area/plant and percentage of N, P and K in leaves of Williams banana plants during 2013/2014 and 2014/2015 seasons. It is obvious from the data that the results took similar trend during the

two studied seasons. Such data show that application of the required N through 25% of the recommended dose of nitrogen (RDN) along with using 25 to 50% organic enriched with either effective microorganisms (EM) or bio-mex as a bio-fertilizer at 50 or 25% significantly increased such traits compared to using RDN via mineral-N fertilizer only. The promotion on such growth traits was associated with increasing percentage of bio-form from 25 to 50%. Moreover, there were insignificant difference in these studied traits due to fertilize with 50 organic plus either 50% EM (T_6) or 50% bio-mex (T_7) compared to use RDN completely via mineral-N (T_1, check treatment).

Applications of the RDN via 25% mineral-N beside bio-mex significantly stimulated the pseudostem length and its circumference, leaf area and number of green leaves as well as total leaf area/plant and N, P and K rather than application of mineral-N along EM. The maximum values of length and its circumference of pseudostem and leaf traits were recorded on the plants that fertilized with the required N via 25% mineral-N along 25% organic plus 50% bio-mex as a bio-fertilizer (T_5). On other hand, the lowest values were recorded on the plants that fertilized with 100% mineral-N (check plants trees, T_1). The recorded total leaf area/plant was (15.78, 17.37, 18.68, 17.81, 19.60, 15.07 & 15.52 m^2) and (16.91, 18.82, 20.18, 19.21, 21.24, 16.12 & 16.74 m^2) due to 100% mineral-N (T_1), 25% mineral-N and 50% organic plus 25% EM (T_2), 25% mineral-N and 25% organic plus 50% EM (T_3), 25% mineral-N and 50% organic plus 25% bio-mex (T_4) and 25% mineral-N and 25% organic plus 50% bio-mex (T_5), 50% organic plus 50% EM) (T_6) and 50% organic plus 50% bio-mex (T_7) during the two studied seasons, respectively. Then, the increment percentage attained (10.07, 18.37, 12.86 & 24.21) and (11.29, 19.34, 13.60 & 25.61%) due to T_2, T_3, T_4 and T_5 over the T_1 (check treatments) during the two studied seasons, respectively. Therefore, fertilizing with mixed fertilization significantly increased the total leaf surface area, nutritional status and vegetative growth of plants. This clearly ensured the beneficial effect of using organic enriched with bio-fertilizers on improving growth and nutritional status of the banana plants.

2- Effects on bunch weight:

It is clear from the data in Table (4) that fertilizing of Williams banana plants by combination of mineral-N with organic and bio-form significantly increased the bunch weight and hand weight compared to use the RDN via mineral-N source only (check treatment, T_1). The promotion in the bunch weight and hand weight was associated with increasing percentage of bio-form from 25 to 50% of RDN. Using bio-mex as bio-fertilizer significantly increased the bunch weight and hand weight rather than using EM. In addition, there were insignificantly difference in the bunch weight due to using 50% organic form plus either 50% EM (T_6) or bio-mex (T_7) compared to using RDN completely via mineral-N (T_1, check treatment). The heaviest weight of bunch and hand were recorded on the plants that fertilized by 25% mineral-N plus 25% organic and 50%

bio-mex. The recorded bunch weight was (25.10, 26.50, 29.25, 26.80, 29.90, 24.65 & 24.95 kg) and (25.80, 27.10, 30.10, 27.40, 31.15, 25.70 & 25.30 kg) due to use T_1, T_2, T_3, T_4, T_5, T_6 and T_7 during the two studied seasons, respectively. The increment percentage of bunch weight was attained (5.58, 16.53, 6.77 & 19.12) and (5.04, 16.67, 6.20 & 20.74%) due to T_2, to T_5 over T_1 during the two studied seasons, respectively. Therefore, it is clear that fertilization using mineral-N and organic plus bio-fertilizer have beneficial effects on the bunch weigh of Williams banana plants.

3- Effects on fruit quality:

It is evident from the data in Tables (4 and 5) that using N as 25% mineral plus 25 to 50% organic enriched with 50 or 25% of EM or bio-mex significantly improving fruit quality in terms of increasing finger weight, pulp %, T.S.S.% and sugar contents and decreasing the total acidity compared to use the recommended dose of nitrogen (RDN) via mineral-N source only. Moreover, using RDN via 50% organic-form plus either 50% EM (T_6) or bio-mex (T_7) insignificantly effect on finger weight and pulp % but it significantly in fruit chemical properties compared to using mineral-N only (T_1, check treatment). Fertilize via 25% mineral-N along 25 to 50 organic-N enriched with 50 or 25% bio-mex significantly improving the fruit quality compared to fertilize by 25% mineral-N plus 25 to 50% organic-N enriched with 50 or 25% EM. Treating the plants with the RDN via 25% mineral-plus 25% organic enriched with 50% bio-mex gave the highest values of fruit traits.

Table 2. Effect of nitrogen fertilization at different sources on vegetative growth of Williams banana plants during 2013/2014 and 2014/2015 seasons.

Charact. / Treatments	Pseudostem hight (cm)		Pseudostem circumference (cm)		Green leaf/plant		Leaf area (cm^2)	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
T_1	284.8	288.0	69.3	70.1	9.8	10.5	1.61	1.61
T_2	295.8	296.3	71.8	72.3	10.4	11.2	1.67	1.68
T_3	313.3	311.5	74.0	74.6	10.8	11.6	1.73	1.74
T_4	299.3	301.8	72.3	73.9	10.6	11.3	1.68	1.70
T_5	326.3	327.0	74.6	76.8	11.2	12.0	1.75	1.77
T_6	278.8	280.5	67.7	69.3	9.6	10.2	1.57	1.58
T_7	280.0	281.8	68.0	68.8	9.7	10.4	1.60	1.61
LSD 5%	**9.16**	**8.45**	**1.86**	**2.11**	**0.4**	**0.5**	**0.05**	**0.06**

1- Application of the recommended dose of nitrogen (RDN) of 600 g/plant/year (1.8 kg ammonium nitrate/plant/year) as mineral N form (T_1)
2- Application of the RDN as 25% mineral-N and 50% organic plus 25% bio (EM) fertilizers (T_2).
3- Application of the RDN as 25% mineral-N and 25% organic plus 50% bio (EM) fertilizers (T_3).
4- Application of the RDN ass 25% mineral-N and 50% organic plus 25% bio (bio-mex) fertilizers (T_4).
5- Application of the RDN as 25% mineral-N and 25% organic plus 50% bio (bio-mex) fertilizers (T_5).
6- Application of the RDN as 50% organic and 50% bio (EM) fertilizers (T_6).
7- Application of the RDN as 50% organic and 50% bio (bio-mex) fertilizers (T_7).

Table 3. Effect of nitrogen fertilization at different sources on total leaf area/plant, N, P and K (%) in leaves of Williams banana plants during 2013/2014 and 2014/2015 seasons.

Charact.	Total leaf area/plant (cm^2)		N (%)		P (%)		K (%)	
Treatments	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
T_1	15.78	16.91	2.44	2.49	0.209	0.220	2.86	2.91
T_2	17.37	18.82	2.58	2.59	0.227	0.236	3.01	3.05
T_3	18.68	20.18	2.63	2.64	0.231	0.241	3.09	3.14
T_4	17.81	19.21	2.60	2.61	0.225	0.235	3.02	3.06
T_5	19.60	21.24	2.69	2.68	0.234	0.242	3.12	3.17
T_6	15.07	16.12	2.40	2.46	0.210	0.218	2.82	2.86
T_7	15.52	16.74	2.42	2.18	0.213	0.320	2.85	2.88
LSD 5%	**0.83**	**0.95**	**0.05**	**0.04**	**0.013**	**0.011**	**0.11**	**0.13**

Table 4. Effect of nitrogen fertilization at different sources on bunch and finger properties of Williams banana during 2013/2014 and 2014/2015 seasons.

Charact.	Bunch weight (kg)		Hand weight (kg)		Finger weight (g)		Pulp (%)	
Treatments	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
T_1	25.10	25.80	1.74	1.81	88.4	91.3	65.38	85.75
T_2	26.50	27.10	1.86	1.91	92.4	95.8	68.52	68.91
T_3	29.25	30.10	2.10	2.15	99.8	105.3	73.18	72.55
T_4	26.80	27.40	1.88	1.95	93.6	96.3	68.89	69.18
T_5	29.90	31.15	2.10	2.20	104.3	108.2	73.48	73.76
T_6	24.65	25.70	1.72	1.78	86.9	89.6	64.36	69.61
T_7	24.95	25.30	1.73	1.78	87.8	90.8	64.70	64.93
LSD 5%	**1.06**	**0.91**	**0.06**	**0.08**	**3.71**	**4.34**	**1.88**	**1.73**

Table 5. Effect of nitrogen fertilization at different sources on some chemical finger properties of Williams banana during 2013/2014 and 2014/2015 seasons.

Charact.	T.S.S.		Reducing (%)		Total sugar (%)		Acidity (%)	
Treatments	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
T_1	18.8	19.1	7.28	7.35	16.70	16.95	0.35	0.37
T_2	20.1	20.4	7.75	7.83	17.93	18.08	0.31	0.33
T_3	20.6	21.0	7.90	7.96	18.36	18.50	0.30	0.32
T_4	20.2	20.5	7.70	7.82	18.02	18.31	0.31	0.32
T_5	21.0	21.4	8.10	7.94	18.73	18.69	0.29	0.30
T_6	19.8	20.1	7.56	7.69	17.60	17.78	0.32	0.33
T_7	20.1	20.6	7.68	7.78	17.88	12.10	0.31	0.33
LSD 5%	**0.43**	**0.48**	**0.26**	**0.22**	**0.48**	**0.56**	**0.02**	**0.03**

The recorded finger weight was (88.4, 92.4, 99.8, 93.6, 104.3, 86.9 & 87.8 g) and (91.3, 95.8, 105.3, 96.3, 108.2, 89.6 & 90.8 g) due to T_1, T_2, T_3, T_4, T_5, T_6 and T_7 during the two studied seasons, respectively. The corresponding TSS% (18.8, 20.1, 20.6, 20.2, 21.0, 19.9 & 20.1%) and (19.1, 20.4, 21.0, 20.5, 21.4, 20.1 & 20.6%) during the two studied seasons, respectively. Hence, the increment percentage of finger weight at-

tained (4.52, 12.89, 5.88 & 17.99%) and (4.93, 15.33, 5.48 & 18.51%) due to T_2, T_3, T_4 and T_5 over T_1 (check treatment) during the two seasons, respectively. Whereas, the increment percentage of TSS% was attained (6.91, 9.57, 7.45, 11.17, 5.85 & 6.91%) and (6.81, 9.94, 7.33, 12.04, 5.24 & 7.85%) due to T_2 to T_6 compared to T_1 (check treatment) during the two studied seasons, respectively.

Hence, the cost wise evaluation of the application of these N sources is in favour of three forms 25% mineral plus 25% organic enriched with 50% bio whatever EM or bio-mex. Such fertilization program is very important for the production of banana fruits, since the improve of the fruit quality induce an increase in packable yield. In addition, such fertilization treatments reduce the cost of production and environmental pollution.

Discussion and Conclusion

1- Discussion

Fertilization of nitrogen is considered an important and limiting factor for growth and productivity of different banana plants. Bananas owing to its large size and rapid growth rate require relatively large amounts of nitrogen to get high yield with good fruit quality (Nijjar, 1985). Pollution is one of the most problems that affect human health especially when the edible part of the plant is polluted with any of the pollutants. Using mineral-N fertilizers cause accumulation of harmful residual substances in the pulp of the fruits.

The organic fertilization has a positive action in increasing the activity of micro flora, water holding capacity, soil structure aggregation, soil organic matter, soil humus content and the availability of most nutrients. Such stimulation on the uptake of nutrients leads to enhancing the biosynthesis of organic foods and cell division (Miller *et al.,* 1990). Biofertilization has an important role on biological, physical and chemical soil properties, as well as, on facilitating the fixation of atmospheric N, activating the availability and uptake of the nutrients and reducing the incidence of soil born diseases, and then improving the soil fertility (Subba Rao, 1984; Kannaiyan, 2002; El-Salhy *et al*., 2006). In addition, the yeast strains have high content of nutrients particularly N, P and K, proteins, vitamin B and cytokinins. It was also release CO_2 which improves net photosynthesis. Moreover, the importance of yeasts, as well-known produces of organic acid and their high survival rate under extreme soil conditions, in transformation of rock phosphates and insoluble carbonates leading to increases in available phosphorus, Fe and other micronutrients (Vassileva *et al*., 2000).

Continuous application of organic and bio-fertilizers is promising in the long run of banana, as sources of organic matter, essential nutrients, amino acids, natural hormones, antibiotics and vitamins. Also, improving both physical and chemical characters of soil.

Hence, it could be concluded that the fertilization using organic and bio sources effective in improving the plant vigour expressed as an increase in leaf surface expansion and its nutrient status. These findings emphasize the vital importance of these fertilization sources in order to overcome

the losses of nutrients by leaching, volatilization and mobility of movement elements. These sources also, improve the soil fertility due to the highest values of the residual nutrients, the enhanced solubility of nutrients and the increased activity of microorganisms. In addition, the importance of such fertilization treatments is considered for the organic farming production.

The results were in agreement with those achieved by El-Shamaa (2001), Soliman (2001), Kamel (2002), Hammam *et al*. (2003), Ahmed *et al*. (2003), Gobara (2004), Sayed (2004), El-Sawy (2005), El-Shenawi *et al*. (2008), Bhalerao *et al*. (2009), Roshdy (2010), Badgujar *et al*. (2010), Barakat *et al*. (2011) and Kuttimani *et al*. (2013). They concluded that application in either organic or bio-form along mineral-N sources was effective on improving growth vigour and nutrient status of banana plants in favour of improving the fruiting.

2- Conclusion

Therefore, it could be concluded that using three fertilization sources improve the plant nutrients status, yield and fruit quality leading to an increase in the packable yield. In addition, it minimizes the production costs and environmental pollution which could be occurred by excess of chemical fertilizers.

These advantages will eventually enable growers to obtain high yield with good fruit quality. Furthermore, using organic and bio-fertilization sources improve the soil fertility and reduce the added fertilizer requirements. Thus, the growers are able to produce organic farming products.

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استخدام الأسمدة العضوية والحيوية كبديل جزئي للأسمدة الآزوتية المعدنية في بساتين الموز وليامز

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الملخص

أجريت هذه الدراسة خلال موسمي ٢٠١٣/٢٠١٤ ، ٢٠١٤/٢٠١٥ بمزرعة خاصة تقع في مدينة كوم أمبو – محافظة أسوان – مصر – وذلك لدراسة تأثير الاستبدال الجزئي للتسميد الآزوتي المعدني بخليط من الأسمدة العضوية والحيوية علي النمو الخضري والحالة الغذائية والمحصول وخصائص ثمار الموز الوليامز – حيث تم إضافة السماد المعدني (نترات الأمونيوم) علي ١٤ دفعة نصف شهرية بداية من شهر أبريل بينما أضيف السماد الحيوي (EM أو Bio-mex) مرتين في بداية النمو وبعد شهر كما أضيف السماد العضوي (الكمبوست) دفعة واحدة في منتصف ديسمبر.

وقد أوضحت النتائج الآتي:

- أدي استخدام الجرعة السمادية الآزوتية الموصي بها من خلال ثلاث مصادر (معدني + عضوي + حيوي) إلي زيادة جوهرية في طول وقطر الساق الكاذبة وعدد الأوراق الخضراء ومساحة الورقة ومحتواها من العناصر الغذائية (NPK) مقارنة باستخدام الجرعة السمادية علي صورة معدنية فقط.
- سببت جميع المعاملات السمادية زيادة في وزن الكف والسباطة وبالتالي وزن المحصول / نبات وكذلك تحسين خصائص الثمار من حيث وزن الأصبع ونسبة اللب وكذلك محتوي الثمار من المواد الصلبة الذائبة الكلية والسكريات مع نقص الحموضة مقارنة باستخدام السماد المعدني فقط.
- ارتبطت زيادة النمو الخضري والحالة الغذائية للنباتات وبالتالي تحسين المحصول وخصائص الثمار بزيادة نسبة السماد الحيوي في المخلوط السمادي المعدني والعضوي المستخدم.
- أدي استخدام السماد الحيوي Bio-mex إلي نتائج أفضل مقارنة باستخدام السماد الحيوي EM.

من نتائج هذه الدراسة يمكن التوصية باستبدال ٧٥% من الجرعة السمادية الآزوتية الموصي بها بالأسمدة العضوية والحيوية حيث يتكون مخلوط السماد من ٢٥% معدني + ٢٥% معدني + ٥٠% حيوي حيث يؤدي ذلك إلي تحسين النمو الخضري والحالة الغذائية لنباتات الموز الوليامز مع إنتاج محصول عال ذو خصائص ثمرية جيدة فضلاً عن تقليل تكاليف التسميد والتلوث الناشئ عن زيادة استخدام الأسمدة المعدنية وإمكانية إنتاج ثمار موز عضوية.