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ADJUSTING THE BEST SOURCE AND PROPORTION OF MINERAL, ORGANIC AND BIO NITROGEN FERTILIZERS FOR GRANDE NAINE BANANAS

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ABSTRACT

During ٢٠٠٩/ ٢٠١٠ and ٢٠١٠/ ٢٠١١ seasons, Grande Naine banana plants were fertilized with the suitable N (٥٦٠ g/ plant/ year) via different sources and proportions. The goal was selecting the best source and proportion of these fertilizers that were responsible for improving yield quantitively and qualitatively of Grande Naine bananas.

Results showed that using ammonium sulphate was preferable than application of ammonium nitrate in improving growth characters, yield as well as physical and chemical characteristics of the fruits. Application of N through different sources surpassed the application of one or two sources of N in enhancing growth and productivity of the plants. Using inorganic N along with compost was favourable than using mineral N aside from Biogen. Chemical characteristics of the fruits were gradually enhanced with increasing percentages of Biogen and compost and reducing the percentages of inorganic N.

For improving the yield quantitively and qualitatively of Grande Naine banana plants, it is advised to fertilize the plants with N at ٥٦٠ g N/ tree/ year via ٥٠ % ammonium sulphate plus ١٢.٥ % compost and ١٢.٥ % Biogen.

INTRODUCTION

It is well known that banana needs large amounts of N fertilizers (Stover and Simmonds, ١٩٨٧). Application of N completely via inorganic N especially at higher rates causes severe pollution in our environment and human being. For avoiding pollution, the application of the suitable N through different sources namely inorganic, or organic and bioforms should be arise. This is due to the essential roles of organic and biofertilization on reducing pollution, enhancing soil fertility as well as helping in production of natural hormones. B-vitamins and antioxidants (Subba- Rao, ١٩٨٤; Nijjar, ١٩٨٥ and Kannaiyan, ٢٠٠٢).

Previous studies showed that using the suitable N through inorganic, organic and bioforms at the optimum rates was very effective in promoting the yield of bananas (Abd El- Naby and Gomaa, ٢٠٠٠; Moustafa, ٢٠٠٠, Zake *et al*., ٢٠٠٠; El- Shamaa, ٢٠٠١; Phirke *et al*., ٢٠٠١; Kamel, ٢٠٠٢; Abd El- Moniem- Eman and Radwan, ٢٠٠٣; Ahmed *et al*., ٢٠٠٣; Sabarad *et al*., ٢٠٠٤; Sayed-Shren, ٢٠٠٤; Ali, ٢٠٠٥; El- Shenawi and Hassouna, ٢٠٠٤; El-Shenawi and El- Sayed ٢٠٠٥; El- Sawy, ٢٠٠٦; Abd El- Moniem-Eman *et al*., ٢٠٠٨; Fornowitz *et al*., ٢٠٠٧; Salah and Boshra, ٢٠٠٨; Njero *et al*., ٢٠٠٨; Gaikwad *et al*., ٢٠٠٩; Selvamani and Manivannan, ٢٠٠٩; Roshdy, ٢٠١٠; Memon *et al*., ٢٠١٠; Mahfouz, ٢٠١١ and Merwad, ٢٠١١).

This study was conducted to suggest the optimum sources and proportions of inorganic, organic and bioforms of N for improving yield quantitively and qualitatively of Grande Naine banana plants grown under Aswan region

MATERIALS AND METHODS

This study was carried out during ٢٠٠٩/ ٢٠١٠ (first ratoons) and ٢٠١٠/ ٢٠١١ (second ratoons) seasons on Grande Naine banana plants (*Musa cavendishii* L.). The plants are grown in a private orchard situated at Kom Ombo district, Aswan Governorate. The plants are grown in silty clay soil under flood irrigation system, irrigated by Nile water. Sixty stools planted at ٤ x ٤ m apart, each containing three

plants were selected as experimental plants. The results of orchard soil analysis (according to Chapman and Pratt, ١٩٧٥) were given in Table (١).

Table ١: Analysis of the tested soil:

Particle size distribution	Values
Sand %	١٠.٦
Silt %	٥٨.٠
Clay %	٣١.٤
Texture	Silty clay
pH(١:٢.٥ extract)	٨.٠
EC (١: ٢.٥ extract) mmhos/١cm/٢٥^{o}C	٠.٦٩
O.M. %	٢.٠٩
$CaCO_3$ %	١.٢٢
Total N %	٠.١١
P (ppm, Olsen method)	٥.٦
K (ppm/ ammonium acetate)	٤١٠

Regular orchard management except N fertilization sources (inorganic, organic and bioforms) was followed.

This experiment included two factors (A& B). The first factor (A) consisted of two inorganic sources namely a_1) Ammonium nitrate (٣٣.٥ % N) and a_2) Ammonium sulphate (٢٠.٦ % N). The second factor (B) included the following ten treatments from various proportions of inorganic, organic and bioforms of N.

b_1) Application of N (٥٦٠ g N/ plant/ year) via ١٠٠ % inorganic N.

b_2) Application of N via ٧٥ % inorganic N + ٢٥ % Biogen (١٤٠ g/ plant/ year).

b_3) Application of N via ٥٠ % inorganic N + ٥٠ % Biogen (٢٨٠ g/ plant/ year).

b_4) Application of N via ٢٥ % inorganic N + ٧٥ % Biogen (٤٢٠ g/ plant/ year).

b_5) Application of N via ٧٥ % inorganic N + ٢٥ % Compost (٧.٠ kg/ plant/ year).

b_6) Application of N via ٥٠ % inorganic N + ٥٠ % Compost (١٤.٠ kg/ plant/ year).

$b_{٧}$) Application of N via ٢٥ % inorganic N + ٧٥ % Compost (٢١.٠ kg/ plant/ year).

$b_{٨}$) Application of N via ٧٥ % inorganic N + ١٢.٥ % Biogen (٧٠ g/ plant/ year) + ١٢.٥ % Compost (٣.٥ kg/ plant/ year).

$b_{٩}$) Application of N via ٥٠ % inorganic N + ٢٥ % Biogen (١٤٠ g/ plant/ year) + ٢٥ % Compost (٧.٠ kg/ plant/ year).

$b_{١٠}$) Application of N via ٢٥ % inorganic N + ٣٧.٥ % Biogen (٢١٠ g/ plant/ year) + ٣٧.٥ % Compost (١٠.٥ kg/ plant/ year).

Therefore, the experiment included twenty treatments. Each treatment replicated three times, one stool per each. Thereupon, sixty stools of Grande Naine banana plants were devoted for achieving this study. All the selected plants received N at fixed rate namely ٥٦٠ g/ plant/ year (Sayed- Shren, ٢٠٠٤). Compost (٢ % N) as a source of organic N was added once at the first week of Jan., during both seasons. Both inorganic N sources (ammonium nitrate and Ammonium sulphate) were divided into fourteen equal doses started on the first week of April and at two week intervals ended at the last week of Oct.

The experiment was set up in completely randomized block design in split- plot arrangement for the two seasons of inorganic N. The ten proportions of inorganic, organic and bioforms of N occupied the main and sub plots, respectively.

After the emergence of the inflorescences (early of Sept.), the following two growth characters were recorded:

١. Pseudostem height (cm.) from the soil surface up to the petiole of the last emerged leaf.
٢. Pseudostem girth (cm.) in the base, middle and top of the pseudostem, then the average was calculated.

Leaf samples were taken from the third upper leaf in the descending leaves from the top of the plant after bunch shooting in the mid. of Sept. during both seasons. A sample of ١٠ x ١٠ cm. area from the middle part of the leaf blades as recommended by Martin- Prevel (١٩٧٧) was taken for determining the percentages of N, P and K according to the procedures reported by Chapman and Pratt (١٩٧٥).

The bunches were picked at the last week of Oct., then bunch weight (kg.) was recorded. Six hands (from the base, middle and distal end of the bunch) were taken for measuring hand weight (kg.). After artificial ripening, fruit weight (g.), total soluble solids %, total and reducing sugars % and total acidity (as g. malic acid/ ١٠٠ g pulp) were determined according to A.O.A.c.(١٩٩٥).

The obtained data were tabulated and were subjected to the proper statistical analysis and the differences between different treatment means were compared using new L.S.D test at ٥ % according to Gomez and Gomez (١٩٨٤).

RESULTS AND DISCUSSION

١- Height and girth of pseudostem:

It is clear from the data in Table (٢) that fertilization of Grande Naine banana plants with N via ammonium sulphate significantly stimulated the two growth characters namely height and girth of pseudostem comparing with using ammonium nitrate during ٢٠٠٩/ ٢٠١٠ and ٢٠١٠/ ٢٠١١ seasons.

Application of N via ٥٠ to ٧٥ % inorganic form plus ١٢.٥ to ٥٠ % Biogen or compost significantly stimulated such two growth traits comparing with using N completely via inorganic form or when inorganic N was applied at percentages lower than ٥٠ %. Reducing percentages of inorganic N from ١٠٠ to ٥٠ % and at the same time increasing percentages of Biogen or compost from ٠.٠ to ٥٠ % caused a gradual and significant promotion on the height and girth of pseudostem. Application of N via ٢٥ to ٧٥ % inorganic plus ١٢.٥ to ٧٥ % compost surpassed the application of the same percentages of inorganic N plus Biogen at ١٢.٥ to ٧٥ %. A significant reduction on such two growth characters was observed with reducing inorganic N to ٢٥ % even with the application of organic and biofertilizers. Application of inorganic N at ٥٠ to ٧٥ % of the suitable N plus both compost and Biogen each at ١٢.٥ to ٢٥ % was superior than application of inorganic N at the same percentages with Biogen or compost in stimulating such two growth characters.

Table ٢: Effect of different sources and proportions of inorganic, organic and bioforms of nitrogen on the pseudostem, height (cm.) and girth (cm.) of Grande Naine banana plants during ٢٠٠٩/ ٢٠١٠ and ٢٠١٠/ ٢٠١١ seasons.

Character Proportions of inorganic, organic and bioforms of N (B)	Pseudostem height (cm.)						Pseudostem girth (cm.)					
	٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١			٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١		
	Sources of mineral N (A)											
	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)
b_1 ١٠٠ % inorganic (inorg.)	٢٨١.٦	٢٨٣.٧	٢٨٢.٧	٢٨٣.٠	٢٨٥.١	٢٨٤.١	٦٨.٩	٧١.٩	٧٠.٤	٧٠.٠	٧٣.١	٧١.٥
b_2 ٧٥ % inorg. + ٢٥ % Biogen (Bio.)	٢٨٤.٩	٢٨٧.٩	٢٨٦.٤	٢٨٦.٤	٢٨٨.٣	٢٨٧.٤	٧١.٩	٧٥.٠	٧٣.٥	٧٣.٠	٧٦.١	٧٤.٦
b_3 ٥٠ % inorg. + ٥٠ :% Bio.	٢٨٨.٩	٢٩٢.٦	٢٩٠.٨	٢٩٠.٥	٢٩٢.٨	٢٩١.٧	٧٥.٠	٧٨.٣	٧٦.٧	٧٦.١	٧٩.٥	٧٧.٨
b_4 ٢٥ % inorg. + ٧٥ % Bio.	٢٧١.٠	٢٧٤.٠	٢٧٢.٥	٢٧٢.٥	٢٧٤.٩	٢٧٣.٧	٥٩.١	٦٢.١	٦٠.٦	٦٠.٢	٦٣.٢	٦١.٧
b_5 ٧٥ % inorg. + ٢٥ % compost (com.)	٢٩٥.٦	٣٠٠.٠	٢٩٧.٨	٢٩٧.٠	٢٩٩.٩	٢٩٨.٥	٧٨.٠	٨١.٥	٧٩.٨	٧٩.١	٨٢.٦	٨٠.٩
b_6 ٥٠ % inorg. + ٥٠ % com.	٢٩٩.٧	٣٠٤.٠	٣٠١.٩	٣٠١.٥	٣٠٢.٩	٣٠٢.٢	٨٠.٩	٨٤.٢	٨٢.٦	٨٢.١	٨٥.٢	٨٣.٧
b_7 ٢٥ % inorg. + ٧٥ % com.	٢٧٣.٠	٢٧٦.٠	٢٧٤.٥	٢٧٤.٦	٢٧٦.٩	٢٧٥.٨	٦٢.١	٦٥.٩	٦٤.٠	٦٣.٣	٦٧.٠	٦٥.٢
b_8 ٧٥٪ inorg. +١٢.٥٪ Bio+١٢.٥٪ com.	٣٠١.٠	٣٠٤.٠	٣٠٢.٥	٣٠٢.٥	٣٠٤.٧	٣٠٣.٦	٨٣.٠	٨٦.٢	٨٤.٦	٨٤.١	٨٧.٥	٨٥.٨
b_9 ٥٠ % inorg. + ٢٥ % Bio. + ٢٥ % com.	٣١١.٩	٣١٥.٠	٣١٣.٥	٣١٣.٥	٣١٨.٨	٣١٦.٢	٨٥.٠	٨٩.٩	٨٧.٥	٨٦.٣	٩١.٢	٨٨.٨
b_{10} ٢٥٪ inorg.+٣٧.٥٪ Bio.+٣٧.٥٪ com.	٢٧٦.١	٢٧٩.٠	٢٧٧.٦	٢٧٧.٥	٢٧٩.٩	٢٧٨.٧	٦٥.٧	٦٨.٦	٦٨.٦	٦٦.٨	٦٩.٧	٦٨.٣
Mean (A)	٢٨٨.٤	٢٩١.٦		٢٩٠.٠	٢٩٢.٤		٧٣.٠	٧٦.٤		٧٤.١	٧٧.٥	
L.S.D at ٥ %	A	B	AB	A	B	AB	A	B	AB	A	B	AB
	١.٨	٢.٠	٢.٨	٢.٠	٢.١	٢.٩	١.٦	١.٨	٢.٥	١.٥	١.٧	٢.٤

a_1 = Ammonium nitrate (٣٣.٥ % N)

a_2= Ammonium sulphate (٢٠.٦ % N)

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The highest values were recorded on the plants that received the suitable N via ٥٠ % inorganic + ٢٥ % Biogen + ٢٥ % compost. Treating the plants with N via ٢٥ % inorganic + ٧٥ % Biogen gave the lowest values.

Supplying Grande Naine banana plants with the suitable N through ٥٠ % ammonium sulphate + ٢٥ % Biogen + ٢٥ % compost gave the tallest and thickest plants. These results were similar during both seasons.

The beneficial effect of organic and biofertilization on enhancing soil fertility, fixation of atmospheric N, B vitamins, antioxidants, natural hormones and antibiotics (Subba- Rao, ١٩٨٤; Nijjar, ١٩٨٥ and Kannaiyan,٢٠٠٢) positively reflected on enhancing growth characters.

These results are in harmony with those obtained by Kamel (٢٠٠٢); Ahmed *et al.*, (٢٠٠٣); Ali (٢٠٠٥); El- Sawy (٢٠٠٦) and Mahfouz (٢٠١١).

٢- Percentages of N, P and K in the leaves:

It is clear from the data in Tables (٣& ٤) that supplying the plants with ammonium sulphate was significantly favourable in enhancing the percentages of N, P and K in the leaves rather than using ammonium nitrate during both the two experimental seasons.

Supplying the plants with the suitable N through ٥٠ to ٧٥ % inorganic plus ١٢.٥ to ٥٠ % Biogen and/ or compost significantly enhanced the percentages of N, P and K in the leaves rather than using N via inorganic N alone or when the inorganic N was applied at percentages lower than ٥٠ %. The promotion on the three nutrients was associated with reducing inorganic N from ١٠٠ to ٥٠ % and increasing percentages of Biogen and/ or compost from ٠.٠ to ٥٠ %. Application of compost along with inorganic N at ٥٠ to ٧٥ % seem to be preferable than using Biogen at the same percentages of inorganic N in increasing the percentages of nutrients. Application of both Biogen and compost besides inorganic N significantly increased these nutrients comparing with using Biogen or compost with inorganic fertilization. The maximum values were recorded with using N via ٥٠ % inorganic + ١٢.٥ % Biogen + ١٢.٥ % compost. The lowest values

were recorded on the plants that received N through ٢٥ % inorganic + ٧٥ % Biogen.

Table ٣: Effect of different sources and proportions of inorganic, organic and bioforms of nitrogen on the percentages of N and P in the leaves of Grande Naine banana plants during ٢٠٠٩/ ٢٠١٠ and ٢٠١٠/ ٢٠١١ seasons.

Character Proportions of inorganic, organic and bioforms of N (B)	Leaf N %						Leaf P %					
	٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١			٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١		
	Sources of mineral N (A)											
	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)
b_1 ١٠٠ % inorganic (inorg.)	٢.٣٣	٢.٤٠	٢.٣٧	٢.٣٥	٢.٤٢	٢.٣٩	٠.١٧	٠.٢٢	٠.٢٠	٠.١٩	٠.٢٤	٠.٢٢
b_2 ٧٥ % inorg. + ٢٥ % Biogen (Bio.)	٢.٤٤	٢.٥١	٢.٤٨	٢.٤٦	٢.٥٣	٢.٥٠	٠.٣٦	٠.٤٢	٠.٣٩	٠.٣٨	٠.٤٣	٠.٤١
b_3 ٥٠ % inorg. + ٥٠ :% Bio.	٢.٥٥	٢.٦٣	٢.٥٩	٢.٥٧	٢.٦٤	٢.٦١	٠.٤١	٠.٤٧	٠.٤٤	٠.٤٢	٠.٤٨	٠.٤٥
b_4 ٢٥ % inorg. + ٧٥ % Bio.	١.٩٩	٢.٠٧	٢.٠٣	٢.٠١	٢.٠٩	٢.٠٥	٠.٢٢	٠.٢٧	٠.٢٥	٠.٢٤	٠.٢٧	٠.٢٦
b_5 ٧٥ % inorg. + ٢٥ % compost (com.)	٢.٦٥	٢.٧٤	٢.٧٠	٢.٦٨	٢.٧٦	٢.٧٢	٠.٤٦	٠.٥١	٠.٤٩	٠.٤٨	٠.٥٣	٠.٥١
b_6 ٥٠ % inorg. + ٥٠ % com.	٢.٧٤	٢.٨٣	٢.٧٩	٢.٧٦	٢.٨٥	٢.٨١	٠.٥١	٠.٥٦	٠.٥٤	٠.٥٣	٠.٥٧	٠.٥٥
b_7 ٢٥ % inorg. + ٧٥ % com.	٢.١١	٢.٢٠	٢.١٦	٢.١٣	٢.٢٢	٢.١٨	٠.٢٦	٠.٣١	٠.٢٩	٠.٢٨	٠.٣٣	٠.٣١
b_8 ٧٥٪ inorg. +١٢.٥٪ Bio+١٢.٥٪ com.	٢.٨٥	٢.٩٤	٢.٩٠	٢.٨٦	٢.٩٥	٢.٩١	٠.٥٧	٠.٦٣	٠.٦٠	٠.٥٩	٠.٦٥	٠.٦٢
b_9 ٥٠ % inorg. + ٢٥ % Bio. + ٢٥ % com.	٢.٩٧	٣.٠٦	٣.٠٢	٢.٩٩	٣.١١	٣.٠٥	٠.٦٣	٠.٧٢	٠.٦٨	٠.٦٥	٠.٧٣	٠.٦٩
b_{10} ٢٥٪ inorg.+٣٧.٥٪ Bio.+٣٧.٥٪ com.	٢.٢٢	٢.٣١	٢.٢٧	٢.٢٥	٢.٣٧	٢.٣١	٠.٣١	٠.٣٦	٠.٣٦	٠.٣٣	٠.٣٧	٠.٣٥
Mean (A)	٢.٤٩	٢.٣٧		٢.٥١	٢.٥٩		٠.٣٩	٠.٤٥		٠.٤١	٠.٤٦	
	A	B	AB	A	B	AB	A	B	AB	A	B	AB
L.S.D at ٥ %	٠.٠٦	٠.٠٧	٠.١٠	٠.٠٦	٠.٠٧	٠.١٠	٠.٠٤	٠.٠٥	٠.٠٧	٠.٠٤	٠.٠٥	٠.٠٧

a_1 = Ammonium nitrate (٣٣.٥ % N)

a_2= Ammonium sulphate (٢٠.٦ % N)

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Table ٤: Effect of different sources and proportions of inorganic, organic and bioforms of nitrogen on the percentage of K in the leaves and bunch weight (kg.) of Grande Naine banana plants during ٢٠٠٩/ ٢٠١٠ and ٢٠١٠/ ٢٠١١ seasons.

Character Proportions of inorganic, organic and bioforms of N (B)	Leaf K %						Bunch weight (kg.)					
	٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١			٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١		
	Sources of mineral N (A)											
	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)
b_1 ١٠٠ % inorganic (inorg.)	١.٦٩	١.٧٥	١.٧٢	١.٧٢	١.٧٩	١.٧٦	٢٣.٠	٢٤.١	٢٣.٦	٢٣.٣	٢٤.٤	٢٣.٩
b_2 ٧٥ % inorg. + ٢٥ % Biogen (Bio.)	٢.١٥	٢.٢١	٢.١٨	٢.١٧	٢.٢٥	٢.٢١	٢٤.٠	٢٥.١	٢٤.٦	٢٤.٥	٢٥.٤	٢٥.٠
b_3 ٥٠ % inorg. + ٥٠ :% Bio.	٢.٢٥	٢.٣١	٢.٢٨	٢.٢٨	٢.٣٥	٢.٣٢	٢٥.٢	٢٦.٣	٢٥.٨	٢٥.٥	٢٦.٦	٢٦.١
b_4 ٢٥ % inorg. + ٧٥ % Bio.	١.٧٩	١.٨٥	١.٨٢	١.٨٢	١.٨٨	١.٨٥	١٨.٠	١٩.٣	١٨.٧	١٨.١	١٩.٦	١٨.٩
b_5 ٧٥ % inorg. + ٢٥ % compost (com.)	٢.٣٦	٢.٤٢	٢.٣٩	٢.٣٩	٢.٤٥	٢.٤٢	٢٦.٣	٢٧.٥	٢٦.٩	٢٦.٥	٢٧.٩	٢٧.٢
b_6 ٥٠ % inorg. + ٥٠ % com.	٢.٥٠	٢.٥٦	٢.٥٣	٢.٥٣	٢.٥٥	٢.٥٤	٢٧.٥	٢٨.٧	٢٨.١	٢٧.٧	٢٩.٠	٢٨.٤
b_7 ٢٥ % inorg. + ٧٥ % com.	١.٩٠	١.٩٧	١.٩٤	١.٩٣	١.٩٥	١.٩٤	١٩.٥	٢١.٠	٢٠.٣	١٩.٧	٢١.٦	٢٠.٧
b_8 ٧٥٪ inorg. +١٢.٥٪ Bio+١٢.٥٪ com.	٢.٦١	٢.٦٨	٢.٦٥	٢.٦٤	٢.٦٧	٢.٦٦	٢٨.٥	٢٩.٤	٢٩.٠	٢٨.٩	٣٠.٠	٢٩.٥
b_9 ٥٠ % inorg. + ٢٥ % Bio. + ٢٥ % com.	٢.٧٢	٢.٧٩	٢.٧٦	٢.٧٥	٢.٧٩	٢.٧٧	٢٩.٠	٣١.٠	٣٠.٠	٢٩.٠	٣٠.٥	٢٩.٨
b_{10} ٢٥٪ inorg.+٣٧.٥٪ Bio.+٣٧.٥٪ com.	٢.٠١	٢.٠٦	٢.٠٨	٢.٠٤	٢.٠٧	٢.٠٦	٢١.٥	٢٢.٦	٢٢.١	٢١.٨	٢٣.٠	٢٢.٤
Mean (A)	٢.٢٠	٢.٢٦		٢.٢٢	٢.٢٨		٢٤.٣	٢٥.٥		٢٤.٥	٢٥.٨	
L.S.D at ٥ %	A	B	AB	A	B	AB	A	B	AB	A	B	AB
	٠.٠٥	٠.٠٧	٠.١٠	٠.٠٤	٠.٠٦	٠.٠٨	٠.٩	١.٠	١.٤	١.٠	١.١	١.٥

a_1 = Ammonium nitrate (٣٣.٥ % N)

a_2= Ammonium sulphate (٢٠.٦ % N)

Supplying the plants with N through ٥٠ % ammonium sulphate + ١٢.٥ % Biogen + ١٢.٥ % compost gave the maximum values of the three nutrients namely N, P and K during both seasons.

The beneficial effect of organic and biofertilization on reducing soil pH and enhancing soil fertility and organic matter may posssitively reflected on enhancing the uptake of these nutrients (Subba- Rao, ١٩٨٤ and Nijjar, ١٩٨٥).

These results are in harmony with those obtained by Roshdy (٢٠١٠); Mahfouz (٢٠١١) and Merwad (٢٠١١).

٣- Weights of bunch and hand:

One can state that supplying the plants with ammonium sulphate was significantly improved weights of bunch and hand in relative to the application of ammonium nitrate fertilizer during both seasons.

Varying N management caused significant differences on the weights of bunch and hand. Using the suitable N through ٥٠ to ٧٥ % inorganic and/ or Biogen and compost at ١٢.٥ % significantly improved weights of bunch and hand comparing with using N completely via inorganic form or when inorganic N was applied at ٢٥ % out of the suitable N. Using N completely via inorganic form significantly increased weights of bunch and hand in relative to using N as inorganic N at percentages lower than ٥٠ % even with the application of organic and biofertilization. There was a gradual and significant promotion on the weights of bunch and hand with reducing percentages of inorganic N from ١٠٠ to ٥٠ % and at the same time increasing both Biogen and compost percentages from ٠.٠ to ٥٠ %. Application of compost along with inorganic N was preferable than using Biogen with mineral N in improving weights of bunch and hand. The best results were obtained with using N via inorganic, organic and bioforms at ٥٠ %, ٢٥ % and ٢٥ %, respectively (Tables ٤& ٥).

Fertilizing of Grande Naine banana plants with N through ٥٠ % ammonium sulphate + ٢٥ % Biogen + ٢٥ % compost gave the best results with regard to weights of bunch and hand. Under such promised treatment, bunch weight reached ٣١ and ٣٠.٥ kg in relative to ٢٣.٠ and ٢٣.٣ kg produced by plants received N completely via ammonium nitrate during both seasons, respectively.

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The positive action of organic and biofertilization on growth and nutritional status of the plants seem to be possitively reflected on improving production of the plants.

These results are in agreement with those obtained by El-Shenawi and El- Sayed (٢٠٠٥); El- Sawey (٢٠٠٦); Salah and Boshra (٢٠٠٨) and Mahfouz (٢٠١١).

٤- Fruit characteristics:

It is obvious from the data in Tables (٥& ٦ & ٧) that fertilization with ammonium sulphate significantly improved fruit characteristics in terms of increasing finger weight, total soluble solids % as well as total and reducing sugars % and reducing total acidity % in relative to using ammonium nitrate during both seasons.

Fruit characteristics were significantly varied among the various N management treatments. Application of N through ٢٥ to ٧٥ % inorganic and/ or Biogen or compost each at ١٢.٥ to ٧٥ % significantly improved fruit quality in terms of increasing finger weight, total soluble solids % total and reducing sugars %, and reducing total acidity % rather than application of N via inorganic form alone. Improving quality of the fruits was associated with reducing inorganic N from ١٠٠ to ٢٥ % and increasing percentages of organic and bioforms of N from ٠.٠ to ٧٥ %. Application of the three sources of N seem to be more effective than using one or two sources in improving fruit quality. Using compost was superior than using Biogen when both was applied with inorganic N in improving fruit quality. The best results with regard to fruit quality were obtained with using N via ٢٥٪ inorganic + ٣٧.٥ % organic (compost) + ٣٧.٥ % bioform (Biogen).

Supplying the plants with N through ٢٥ % ammonium sulphate + ٣٧.٥ % Biogen + ٣٧.٥ % compost gave favourable effects on both physical and chemical characteristics of the fruits.

Table ٥: Effect of different sources and proportions of inorganic, organic and bioforms of nitrogen on weights of hand

and finger of Grande Naine banana plants during ٢٠٠٩/ ٢٠١٠ and ٢٠١٠/ ٢٠١١ seasons.

Character Proportions of inorganic, organic and bioforms of N (B)	Hand weight (kg.)						Finger weight (g.)					
	٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١			٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١		
	Sources of mineral N (A)											
	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)
b_1 ١٠٠ % inorganic (inorg.)	٢.١٨	٢.٢٦	٢.٢٢	٢.١٢	٢.٢٠	٢.١٦	٩٢.٩	٩٥.٠	٩٤.٠	٨٥.٠	٨٨.٨	٨٦.٩
b_2 ٧٥ % inorg. + ٢٥ % Biogen (Bio.)	٢.٢٥	٢.٢٣	٢.٢٩	٢.١٩	٢.٢٦	٢.٢٣	٩٥.٠	٩٧.٤	٩٦.٢	٨٧.١	٩١.٠	٨٩.١
b_3 ٥٠ % inorg. + ٥٠ :% Bio.	٢.٣٣	٢.٤١	٢.٣٧	٢.٢٦	٢.٣٥	٢.٣١	٩٧.١	٩٩.٤	٩٨.٣	٨٩.٣	٩٣.٨	٩١.٦
b_4 ٢٥ % inorg. + ٧٥ % Bio.	١.٩٢	٢.٠٠	١.٩٦	١.٨٦	١.٩٤	١.٩٠	٨٥.٠	٨٧.٥	٨٦.٣	٩٢.٩	٩٦.٣	٩٤.٦
b_5 ٧٥ % inorg. + ٢٥ % compost (com.)	٢.٤٠	٢.٤٩	٢.٤٥	٢.٣٤	٢.٤٣	٢.٣٩	٩٩.٣	١٠٢.٠	١٠٠.٧	٩٥.٠	٩٨.٧	٩٦.٩
b_6 ٥٠ % inorg. + ٥٠ % com.	٢.٤٨	٢.٥٦	٢.٥٢	٢.٤٢	٢.٥٠	٢.٤٦	١٠٤.٠	١٠٦.٥	١٠٥.٦	٩٧.١	١٠٠.٨	٩٩.٠
b_7 ٢٥ % inorg. + ٧٥ % com.	٢.٠٠	٢.٠٨	٢.٠٤	١.٩٤	٢.٠٢	١.٩٨	٨٧.١	٨٩.٥	٨٨.٣	٩٩.٣	١٠٣.٥	١٠١.٤
b_8 ٧٥٪ inorg. + ١٢.٥ % Bio+١٢.٥٪ com.	٢.٦٠	٢.٦٩	٢.٦٥	٢.٥٤	٢.٦٣	٢.٥٩	١٠٦.٥	١٠٩.٠	١٠٧.٨	١٠٤.٠	١٠٧.٨	١٠٥.٩
b_9 ٥٠ % inorg. + ٢٥ % Bio. + ٢٥ % com.	٢.٦٩	٢.٧٧	٢.٧٣	٢.٦٣	٢.٧٠	٢.٦٧	١٠٩.٠	١١٢.٩	١١١.٠	١٠٦.٥	١١٠.٤	١٠٨.٥
b_{10} ٢٥ % inorg. +٣٧.٥٪ Bio.+٣٧.٥ % com.	٢.٠٩	٢.١٧	٢.١٣	٢.٠٣	٢.١٠	٢.٠٨	٨٩.٣	٩١.٥	٩٠.٤	١٠٩.٠	١١٤.٠	١١١.٨
Mean (A)	٢.٢٩	٢.٣٧		٢.٢٣	٢.٣١		٩٦.٥	٩٩.١		٩٧.٧	١٠٠.٥	
L.S.D at ٥ %	A	B	AB	A	B	AB	A	B	AB	A	B	AB
	٠.٠٧	٠.٠٨	٠.١٢	٠.٠٦	٠.٠٧	٠.١١	١.٩	٢.٠	٢.٨	١.٨	٢.٠	٢.٨

a_1 = Ammonium nitrate (٣٣.٥ % N)

a_2= Ammonium sulphate (٢٠.٦ % N)

Table ٦: Effect of different sources and proportions of inorganic, organic and bioforms of nitrogen on the percentages of

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total soluble solids and total sugars in the fruits of Grande Naine banana plants during ٢٠٠٩/ ٢٠١٠ and ٢٠١٠/ ٢٠١١ seasons.

Character Proportions of inorganic, organic and bioforms of N (B)	Total soluble solids %						Total sugars %					
	٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١			٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١		
	Sources of mineral N (A)											
	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)
b_1 ١٠٠ % inorganic (inorg.)	١٩.٠	١٩.٥	١٩.٣	١٨.٨	١٩.٣	١٩.١	١٥.٠	١٥.٦	١٥.٣	١٥.٢	١٥.٧	١٥.٥
b_2 ٧٥ % inorg. + ٢٥ % Biogen (Bio.)	١٩.٥	٢٠.١	١٩.٨	١٩.٤	١٩.٩	١٩.٧	١٥.٦	١٦.٢	١٥.٩	١٥.٨	١٦.٣	١٦.١
b_3 ٥٠ % inorg. + ٥٠ :% Bio.	١٩.٩	٢٠.٥	٢٠.٢	١٩.٧	٢٠.٣	٢٠.٠	١٦.٠	١٦.٦	١١.٣	١٦.١	١٦.٨	١٦.٥
b_4 ٢٥ % inorg. + ٧٥ % Bio.	٢٠.٤	٢٠.٩	٢٠.٧	٢٠.٢	٢٠.٧	٢٠.٥	١٦.٥	١٧.١	١٦.٨	١٦.٧	١٧.٣	١٧.٠
b_5 ٧٥ % inorg. + ٢٥ % compost (com.)	٢٠.٩	٢١.٦	٢١.٣	٢٠.٦	٢١.٤	٢١.٠	١٧.٠	١٧.٥	١٧.٦	١٧.١	١٧.٨	١٧.٥
b_6 ٥٠ % inorg. + ٥٠ % com.	٢١.٣	٢٢.٠	٢١.٧	٢١.٠	٢١.٨	٢١.٤	١٧.٤	١٨.٠	١٧.٧	١٧.٦	١٨.٣	١٨.٠
b_7 ٢٥ % inorg. + ٧٥ % com.	٢١.٨	٢٢.٤	٢٢.١	٢١.٦	٢٢.٠	٢١.٨	١٨.٠	١٨.٥	١٨.٣	١٨.١	١٨.٦	١٨.٤
b_8 ٧٥٪ inorg. +١٢.٥٪ Bio+١٢.٥٪ com.	٢٢.٣	٢٢.٨	٢٢.٦	٢٢.٠	٢٢.٦	٢٢.٣	١٨.٤	١٩.٠	١٨.٧	١٨.٥	١٩.٣	١٨.٩
b_9 ٥٠ % inorg. + ٢٥ % Bio. + ٢٥ % com.	٢٢.٨	٢٣.٣	٢٣.١	٢٢.٥	٢٣.٠	٢٢.٨	١٩.٠	١٩.٨	١٩.٤	١٩.١	٢٠.١	١٩.٦
b_{10} ٢٥٪ inorg. +٣٧.٥٪ Bio.+٣٧.٥ % com.	٢٣.٩	٢٤.٩	٢٤.٤	٢٣.٧	٢٤.٣	٢٤.٠	١٩.٥	٢٠.٢	١٩.٩	١٩.٦	٢٠.٨	٢٠.٢
Mean (A)	٢١.٢	٢١.٨		٢١.٠	٢١.٥		١٧.٢	١٧.٩		١٧.٤	١٨.١	
L.S.D at ٥ %	A	B	AB	A	B	AB	A	B	AB	A	B	AB
	٠.٤	٠.٥	٠.٧	٠.٥	٠.٥	٠.٧	٠.٤	٠.٥	٠.٧	٠.٤	٠.٥	٠.٧

a_1 = Ammonium nitrate (٣٣.٥ % N)

a_2= Ammonium sulphate (٢٠.٦ % N)

Table ٧: Effect of different sources and proportions of inorganic, organic and bioforms of nitrogen on the percentages of reducing sugars and total acidity in the fruits of Grande

Naine banana plants during ٢٠٠٩/ ٢٠١٠ and ٢٠١٠/ ٢٠١١ seasons.

Character Proportions of inorganic, organic and bioforms of N (B)	Reducing sugars %						Total acidity %					
	٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١			٢٠٠٩/ ٢٠١٠			٢٠١٠/ ٢٠١١		
	Sources of mineral N (A)											
	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)	a_1	a_2	Mean (B)
b_1 ١٠٠ % inorganic (inorg.)	٧.١	٧.٤	٧.٣	٧.٣	٧.٧	٧.٥	٠.٣٠٠	٠.٢٩٠	٠.٢٩٥	٠.٣٠٧	٠.٢٩٦	٠.٣٠٢
b_2 ٧٥ % inorg. + ٢٥ % Biogen (Bio.)	٧.٤	٧.٧	٧.٦	٧.٦	٨.٠	٧.٨	٠.٢٧٠	٠.٢٦٠	٠.٢٦٥	٠.٢٧٦	٠.٢٦٥	٠.٢٧١
b_3 ٥٠ % inorg. + ٥٠ :% Bio.	٧.٧	٨.٠	٧.٨	٨.٠	٨.٢	٨.١	٠.٢٤٠	٠.٢٣٠	٠.٢٣٥	٠.٢٤٦	٠.٢٣٥	٠.٢٤١
b_4 ٢٥ % inorg. + ٧٥ % Bio.	٨.٠	٨.٣	٨.٢	٨.٢	٨.٥	٨.٤	٠.٢٠٩	٠.٢٠٠	٠.٢٠٥	٠.٢١٦	٠.٢٠٤	٠.٢١٠
b_5 ٧٥ % inorg. + ٢٥ % compost (com.)	٨.٣	٨.٦	٨.٥	٨.٦	٩.٠	٨.٨	٠.١٩٠	٠.١٧٩	٠.١٨٥	٠.١٩٦	٠.١٨٤	٠.١٩٠
b_6 ٥٠ % inorg. + ٥٠ % com.	٨.٥	٨.٨	٨.٧	٨.٨	٩.١	٩.٠	٠.١٨١	٠.١٧٠	٠.١٧٦	٠.١٨٨	٠.١٧٣	٠.١٨١
b_7 ٢٥ % inorg. + ٧٥ % com.	٨.٩	٩.٣	٩.١	٩.٢	٩.٥	٩.٤	٠.١٧٠	٠.١٦٠	٠.١٦٥	٠.١٧٧	٠.١٦٤	٠.١٧١
b_8 ٧٥٪ inorg. +١٢.٥٪ Bio+١٢.٥ % com.	٩.٢	٩.٥	٩.٤	٩.٦	٩.٩	٩.٨	٠.١٥٢	٠.١٤٢	٠.١٤٧	٠.١٦٠	٠.١٤٦	٠.١٥٣
b_9 ٥٠ % inorg. + ٢٥ % Bio. + ٢٥ % com.	٩.٤	٩.٧	٩.٦	٩.٧	١٠.٠	٩.٩	٠.١٤٠	٠.١٣٠	٠.١٣٥	٠.١٤٩	٠.١٣٥	٠.١٤٢
b_{10} ٢٥٪ inorg. +٣٧.٥٪ Bio.+٣٧.٥ % com.	٩.٨	١٠.١	١٠.٠	١٠.١	١٠.٤	١٠.٣	٠.١٢٧	٠.١٢٠	٠.١٢٤	٠.١٣٤	٠.١٢٣	٠.١٢٩
Mean (A)	٨.٤	٨.٧		٨.٧	٩.٠		٠.١٩٨	٠.١٨٨		٠.٢٠٥	٠.١٩٣	
L.S.D at ٥ %	A	B	AB	A	B	AB	A	B	AB	A	B	AB
	٠.٢	٠.٣	٠.٤	٠.٢	٠.٣	٠.٤	٠.٠١٠	٠.٠١١	٠.٠١٥	٠.٠١٠	٠.٠١١	٠.٠١٥

a_1 = Ammonium nitrate (٣٣.٥ % N)

a_2= Ammonium sulphate (٢٠.٦ % N)

Unfavourable effects on fruit quality were detected when N was applied completely via inorganic form namely ammonium nitrate. These results were similar during both seasons.

These results might be attributed to the beneficial effects of organic and biofertilization on supplying the plants with their requirements from sugars. Generally, organic and biofertilization are responsible for controlling the absorption of N by plants, consequently saving organic foods especially carbohydrates for fruit development.

The previous positive effects of ammonium sulphate on fruiting characters might be attributed to its essential effect on lowering soil pH in favour of increasing the availability of most nutrients (Nijjar, ١٩٨٥).

These results are in agreement with those obtained by El-Shenawi and El- Sayed (٢٠٠٥); El- Sawy (٢٠٠٦); Salah and Boshra (٢٠٠٨) and Mahfouz (٢٠١١).

As a conclusion, the best results with regard to yield and fruit characteristics of Grande Naine banana plants were obtained with supplying the plants with N (٥٦٠ g N/ plant/ year) via ٥٠ % ammonium sulphate + ٢٥ % Biogen + ٢٥ % compost.

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Adjusting the best source, mineral, organic and bio nitrogen fertilizers for banan

تحديد أفضل مصدر ونسبة من الأسمدة النيتروجينية المعدنية والعضوية والحيوية للموز الجراندنان

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تم تنفيذ التجربة خلال موسمي ٢٠٠٩/ ٢٠١٠، ٢٠١٠/ ٢٠١١ حيث تم تسميد نباتات الموز الجراندنان بالكمية الموصي بها من النيتروجين (٥٦٠ جرام نيتروجين للنبات في السنة) خلال العديد من المصادر والنسب وكان الهدف هو اختيار أفضل مصدر ونسبة من هذه الأسمدة وذلك لأجل تحسين المحصول كما ونوعا.

أشارت نتائج الدراسة إلي أن استخدام سلفات الأمونيوم كان مفضلا عن استخدام نترات الأمونيوم وذلك لتحسين خصائص النمو الخضري وكمية المحصول والخصائص الطبيعية والكيميائية للثمار ولقد تفوق استخدام النيتروجين في جميع صوره عن استخدام صورة أو صورتين منه في تحسين خصائص النمو والإنتاجية وكان استخدام الصورة الغير عضوية للنيتروجين مع الكمبوست أفضل عن استخدام الصورة المعدنية مع البيوجين وكان هناك تحسن تدريجي في الخصائص الكيميائية للثمار مع زيادة النسبة المئوية للكمبوست والبيوجين وفي نفس الوقت تقليل الكمية المستخدمة من السماد النيتروجيني الغير عضوي.

لأجل تحسين المحصول كما ونوعا في نباتات الموز الجراندنان فإنه ينصح بتسميد النباتات بالنيتروجين بمعدل ٥٦٠ جرام للنبات في السنة علي هيئة ٥٠ % سلفات أمونيوم جنبا إلي جنب مع إضافة ١٢.٥ % كمبوست، ١٢.٥ % بيوجين.