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YIELD AND SOME CHEMICAL CONSTITUENTS OF ONION AS INFLUENCED BY ORGANIC MANURES

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ABSTRACT

Two field experiments were carried out at the extension fields of Ministry of Agriculture at Bini Sweef and Minia Governorate in 1998/1999 seasons. The aim of these experiments were to study the response of onion plant to different sources (Cattle, Chicken, and Pigeon) of organic nitrogen fertilizers at different rates (120, 150 and 180 N units/fed.). The important obtained results are as following:

The addition of pigeon and/or chicken manures had the vigor onion plant (as expressed by length of plant, leaves number/plant, fresh and dry weight of whole plant and its leaves and bulb) and the total bulbs yield as will as exportable bulbs .On the contrary the application of cattle manure gave the lowest values of the above mentioned parameters. Also, the chemical constituents of bulb tissues (N, P, K, Mn, Zn and Cu) followed the same pattern of change. However, the statistical analysis of the obtained data recorded no significant differences within using chicken and/or pigeon manure, regarding to the most of the vegetative growth criteria's. However, the percentages of marketable and exportable bulbs recorded their highest values with using cattle manure if compared with other organic nitrogen sources.

With increasing the rate of organic fertilizer addition, the vegetative plant growth characters and total bulbs yield recorded their highest values. On the contrary the poorest plant growth was noticed with that onion plants which supplied the lowest rate (120 N units/fed.). Moreover, the highest exportable bulbs yield as tons/fed. was associated with the addition of lowest rate of organic manures in both experiments.

The addition of organic manures at rate of 150 - 180 N units/fed. obtained that bulbs which contained the highest values of the nutritional elements (N, P, K, Mn, Zn, and Cu), but with using rates of 120 N. unites/fed. resulted a decrease in the chemical bulb constituents.

INTRODUCTION

Nowadays after construction of the High Dam, the Egyptian soils had suffered from insufficient organic matter content as well as macro and micro nutrients alongside with the relatively low availability of these elements. Moreover, growers began to neglect organic fertilization due to an excessive use of mineral fertilizers. All those reasons negatively affected not only the vegetables production but also the quality of the product. There is no doubt that mineral fertilizers are essential in most cropping system if maximum yields are to be ralized. However, in long-term field experiments where mineral fertilizers have only been used, soil structure has been deteriorated and crop yield steadily decreased.

Application of organic manures to the soil whether alone or in a combination with mineral fertilizers has been a successful practice to improve the physical, chemical and biological properties of the soil as well as its productivity (Abdel-Aty, 1997 and Fattah-Allah, *et al.* 1997).

In Egypt, the organic fertilizer are multivarous such as cattle manure and town refuse compost which are considered pour fertilizers, and chicken, pigeon and sheep manures as well as composted yard wastes which are considered rich fertilizers.

So, the aim of this study is to investigate the response of onion plant to different organic nitrogen sources and rates (cattle, chicken and pigeon at 120,150 and 180 N units/fed. for each).

MATERIALS AND METHODS

Two field experiments were carried out at the extension fields of Ministry of Agriculture at Bini Sweef and Minia Governorate in 1998 and 1999 seasons, to study the response of onion plant to different sources (Cattle, Chicken and Pigeon manure) and rates (120, 150 and 180 N units/fed.) of organic nitrogen fertilizers on the growth and yield of onion plants. The texture of the experimental soils are loamy in both sites. The physical and chemical properties of soil as well as the organic manures which used are presented in Tables (1) for the two experiments.

Onion seedling cv. Giza 20 were sown on 1st and 4th of November, 1998 at Bini Sweef and Minia experiments respectively, at distance of 20 cm apart within the rows and 15 cm within the plants.

Each experiment included 9 treatments which resulted from the interaction between 3 sources and rates or organic nitrogen fertilizers. Whereas, the organic fertilizers were added during preparing the soil for plantation.

A split-plot design with three replicates was used where; sources of organic fertilizers were allocated to the main plots, while the different rates were randomly assigned to the sub-plot. Each sub- plot consisted of four rows, each of 5 meters in length and 3.2 m in width and the plot area was 20 m^2.

Table (1): The chemical analysis of the experimental soil and the used organic manure in Bini Sweef and Minia field.

Characters	Bini Sweef				Minia			
	Soil	Cattle manure	Chicken manure	Pigeon manure	Soil	Cattle manure	Chicken manure	Pigeon manure
pH	7.97	8.11	9.30	8.45	7.97	7.92	9.75	8.16
Salinity(mmhos/cm)	0.43	3.24	8.93	6.01	0.48	4.95	5.85	6.15
Carbonate (%)	3.04	-	-	-	2.06	-	-	-
Available N(ppm)	215	0.41	2.71	2.87	0.12	0.33	3.21	3.09
Available P (ppm)	0.16	0.66	0.75	0.50	0.11	0.60	0.55	0.73
Available K (ppm)	0.06	0.40	0.76	0.56	0.51	0.35	0.55	0.71
Iron (ppm)	17.1	948	487	730	68	8240	7320	7500
Manganese (ppm)	2.00	589	312	216	11	105	102	93
Cupper (ppm)	4.30	53	124	30	21	37	28	31
Zinc (ppm)	1.20	78	30	88	18	31	39	55

The normal cultural practices used for the onion production, i.e. irrigation and pest control were followed according to the traditional cultivation in the experimental location.

Plant growth expressed as plant length (cm), number of leaves per plant, diameter (cm) of neck and bulb, as well as fresh and dry weight of leaves, neck and bulb as g./plant were recorded in representative samples (5 plants) which were taken randomly from every experimental plot at 90 days after planting in both investigated areas.

At harvesting time, fresh onion yield and its components were calculated in terms of total bulbs yield, marketable yield, exportable yield and culls bulbs as tons/fed., as well as Marketable and exportable bulbs yield as percentages in both two experimental fields.

The chemical constituents as nutritional values, i.e. N, P, K, Fe, Mn, Zn and Cu in bulbs tissue were estimated where total nitrogen, phosphorus and potassium were determined according to the methods which described by Pregl (1945), Troug and Mayer (1939) and Brown and Lilleland (1946), respectively. As well as Fe, Mn, Zn and Cu concentration were determined using flame ianigation atomic absorption, spectrometer of Chapman and Pratt (1978).

The obtained data were subjected to the analysis variance procedure and treatments mean were compared to the L.S.D. Test according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

A. Plant growth:

1. Effect of organic nitrogen sources:

Tables (2 and 3) show the response of onion plant growth to different organic manure sources in both extension field of Bini sweef and Minia. The obtained data reveals that onion plant length, leaves number per plant, whole fresh weight of plant and its bulbs and dry weight, all of them recorded a significant variation within the different organic nitrogen application in both Bini Sweef and Minia experiments. However, the statistical analysis of the obtained data showed that, the differences within using chicken and pigeon manures failed to reach the 5 % level of significant. These were true in both two experimental sites as well as for most plant growth parameters. Generally the application of cattle manure caused a slow growth if compared with using chicken and/or pigeon manures.

It could be concluded that, the best growth characters of onion plants were detected when chicken manure added as an organic nitrogen fertilizer, followed with no great difference by the application of pigeon manure. So, the last one is no available by the big quantity which required for the commercial production, also due to the high price of pigeon compared by the chicken manure, for these reason, it could recommended that, the using chicken manure is more available for obtained the better onion plant growth. Also, due to the chemical constituents of pigeon manure which contains a more soluble elements, so most of them my be lose with irrigation water within a short period. It means that the using pigeon manure, its availability and solubility is more than pigeon. The obtained results which carried by many investigators such Resenade *et al.*, 2000; Ristimki *et al.*, 2000; Rizk, Fatma, *et al.*, 1997 are supported that which written here .

2. Effect of organic manure rates:

The obtained data (Tables 2 and 3) show clearly that, the increasing addition of organic manure within the range of 120 up to 180 N units/fed. resulted an enhancement in plant growth characters of onion plant in both two experiment sites. Whereas, the statistical analysis of the obtained data recorded a significant differences within the different organic manure treatments. These were true with the average diameter of bulb, the fresh and dry weight of whole onion plant and its different organs in Bini Sweef and Minia extension fields.

It could be concluded that, the vigor plant growth of onion was associated with that plants which received the highest organic nitrogen rate, i.e. 180 units/fed. Its know that, with increasing the rate of fertilizer addition, the soluble and available nutritional elements increase in rooting zone of plant, consequently their absorption increase. Also, it is worth to mention that, good effect of organic nitrogen treatment in increasing plant growth parameters may be due to improving root rhizosphere condition, i.e. soil structure and moisture content (Awad *et al.*, 1993).

In addition, adding organic nitrogen had beneficial return to increase population of microorganisms especially in the surface layer-root rhizosphere that produce substances which stimulate plant growth. The obtained data are in a good accordance with those which obtained by many other investigators (El-Sheikh and Salama, 1997 and Fatma, 2002).

3. Effect of the interaction between sources and rates of the organic nitrogen fertilizers:

The results obtained from Tables (2 and 3) illustrate effect of the interaction within different sources and rates of organic nitrogen fertilizers on the plant growth parameters of onion plant in two experiments at Bini Sweef and Minia. The statistical analysis of the obtained data reveals that diameter of bulb, total fresh and dry weight of whole plant and its leaves as well as fresh weight of bulbs, all of these criterias varied significantly by the interaction treatments. These findings hold good in the two experiments. Generally, the highest bulb diameter, fresh and dry weight of whole onion plant as well as its leaves and bulbs were found with that plants which received the organic nitrogen fertilizer in form of pigeon at rate of 180 kg N/fed. However, the obtained data no recorded significant variation within using pigeon and/or chicken..

B. Total bulbs yield and its components:

1. Effect of organic nitrogen sources:

Table (4) shows clearly that, the total bulbs yield of onion plants and its components as responsed by different organic nitrogen sources in each of Bini sweef and Minia fields. Whereas, the addition of pigeon and/or chicken manure in Bini Sweef and Minia respectively had the heaviest tonnage of total bulb yield (8.64 in Bini Sweef and 7.52 in Minia). But the statistical analysis of the obtained data reveal no significant differences within the two previous organic sources in both experimental sites.

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The higher total bulbs yield obtained form using the pigeon and/or chicken as organic source of nitrogen for onion plants may be due to the increase in one or more of the estimated attributes either in leaves number, fresh and/or dry weight of plants. However, the picture reflected increase in their parameters.

In addition, the cull bulbs of onion followed the same pattern of change like that of total yield of bulbs in the two experiments. The marketable yield of bulbs as tons/fed. as well as exportable bulbs (Diameter within 4.0 – 6.0 cm), these two components of bulb yield responsed no significantly at 5 % in two experiments.

In spite of the addition of cattle organic nitrogen fertilizer resulted the lowest total bulbs yield and its different components, but the highest percentage of marketable and exportable yield were recorded. These findings were true in Bini Sweef and Minia experiments. The statistical analysis of the obtained data showed a significant variation within organic sources in the two sites concerning to the percentage of marketable yields, but was only in Bini Sweef regarding to the exportable yield.

It could be summarized that, in spite of the highest total bulbs yield which obtained with applying pigeon manure, but it resulted the heaviest weight of cull bulbs, lowest percentages of marketable as well as exportable yield. However, usually the exported bulbs depend on the high quality, so, if any factor affect one or more of the bulb characteristics, it will in turn affect this item. Among these factors the organic sources, since pigeon manure may be improved the bulb size and increasing the proportion of the larger grade consequently it will be no available for exporting.

2. Effect of organic manure rates:

Raising the rate of organic nitrogen application for onion plants in the experimental areas within 120 up to 180 kg N./fed. resulted a significant increase in total bulbs yield and marketable bulbs weight, but resulted no significant increase for the exportable and cull bulbs weight. This increasing amounted by 2.31 and 1.71 ton/fed. for total bulbs yield, 1.31 and 1.23 ton/fed. for marketable yield, and 1.0 and 0.83 ton/fed. for exportable bulbs yield, respectively in Bini Sweef and Minia experiments. The obtained results mean that, the lowest weight of total yield and its components recorded when the addition of 120 kg N./fed. Were supplied. Also, the data of Table (4) clearly showed that, the cull bulbs increased with increasing the organic nitrogen rate.

Regarding to the percentages of marketable and exportable bulbs weight, the obtained data indicated that, the highest values were associated with supplying 150 kg N./fed. On the contrary, the lowest values of the exportable yield as percentage recorded when 180 kg N/fed. was added. These findings are true in both experiments.

3. Effect of the interaction between sources and rates of organic nitrogen fertilizer:

Generally, the results of Table (4) indicate that, the addition of chicken manure at rate of 150 – 180 kg N/fed. resulted the heaviest tonage of

marketable as well as exportable bulbs yield in both sites of experiments. However, that onion plants which received 180 N. units/fed. gave the heaviest tonage of total bulbs yield. Whereas, the cattle manure if added at rate of 180 kg N/fed. had the highest percentage of exportable bulbs yield. On the contrary, the addition of pigeon manure at rate of 180 kg N/fed. gained the heaviest cull bulbs. These results held good in each Bini Sweef and Minia experiments.

C. Nutritional value of onion bulbs:

1. Effect of organic nitrogen sources:

The content of N, P, K, Fe, Mn, Zn and Cu as affected by organic nitrogen sources are presented in Table (5). Generally in two experimental area, the lowest values of elemental nutrition were detected with the applying of cattle manure as a source of organic nitrogen. Whereas, the resulted data shows that, using each of chicken and/or pigeon manures gave a better nutritional values if compared with cattle manure. Regarding the highest value of the nutritional elements the data in Table (5) indicates that, it flactuated within the two experiments, where in Bini Sweef, the highest values of N, P, K and Fe resulted when chicken manure is applied, but in Minia experiment, the highest values of the above mentioned elements were with addition of pigeon manure. The obtained results are in good accordance with those which obtained by Awad *et al.*, 1993 and Rizk, Fatma, *et al.*, 2002.

Table (5): Effect of different sources of organic nitrogen fertilizers on the nutritional status of onion bulb tissues at Bini Sweef and Minia experiments.

Treatments	Bini Sweef			Minia		
Characters	Cattle manure	Chicken manure	Pigeon manure	Cattle manure	Chicken manure	Pigeon manure
Nitrogen %	1.08	1.55	1.37	1.31	1.77	1.91
Phosphorus %	0.26	0.34	0.24	0.51	0.61	0.75
Potassium %	1.65	2.12	1.69	1.75	1.91	2.17
Iron (ppm)	483	490	438	741	865	883
Manganese (ppm)	23.6	31.7	25.3	36.0	41.0	39.0
Zinc (ppm)	46.0	43.6	35.0	55.0	56.0	51.0
Cupper (ppm)	8.4	6.4	5.1	16.0	13.0	11.0

Table (6): Effect of different rates of organic nitrogen fertilizers kg N/fed. on nutritional status of onion bulb during 1998 and 1999 on Bini Sweef and Minia.

Treatments	Bini Sweef			Minia		
Characters	120	150	180	120	150	180
Nitrogen %	1.22	1.45	1.33	1.08	1.71	1.83
Phosphorus %	0.27	0.29	0.28	0.31	0.33	0.36
Potassium %	1.72	1.87	1.82	1.31	1.61	1.65
Iron (ppm)	399	643	521	651	6.91	736
Manganese (ppm)	25.3	28.4	25.9	41	44	47
Zinc (ppm)	40.4	41.7	39.2	97	46	47
Cupper (ppm)	6.3	7.2	6.0	11	13	14

2. Effect of organic nitrogen rates:

Table (6) clearly shows that, with increasing the addition rate of organic nitrogen fertilizer in the range of 120 up to 180 kg N./fed. resulted an

increase in the nutritional values of onion bulb tissues. It means that, the highest content of N, P,K, Fe, Mn, Zn and Cu were associated with that plants which supplied by the highest rate, i.e. 180 kg N./fed. The results of Batalha *et al.*, 1985 and Fatma, 2002 supported the obtained data.

3. Effect of the interaction between organic nitrogen sources and rates:

Insignificant effect of interaction between different sources and rates of organic nitrogen fertilizers on the nutritional values, i.e., N, P, K, Fe, Mn, Zn and Cu of onion bulb tissues in both experiments. Consequently the data were excluded. Such results indicate that the effect of each factor was independent in effecting the above previous trails in onion.

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تأثير التسميد العضوى على النمو والمحصول والمحتوى الكيماوى لنبات البصل

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اجريت تجربتان حقليتان بالحقل الارشادى الزراعى بمحافظة بنى سويف ومحافظة المنيا خلال موسم 1998 / 1999 . بهدف دراسة تأثير مصادر مختلفة من السماد العضوى (الماشية – الدواجن – زرق الحمام) تحت ثلاثة معدلات (120 ، 150، 180 وحدة نتروجين/ف) على النمو والمحصول ومكوناته لنبات البصل .

وتضمنت اهم نتائج الدراسة مايلى :

1- ادى استخدام سماد زرق الحمام وسماد الدواجن الى الحصول على افضل صفات للنمو الخضرى معبرا عنه بطول النبات ، عدد الاوراق للنبات ، الوزن الطازج والجاف الكلى للنبات والاوراق والابصال ومن ناحية اخرى ادى اضافة سماد الماشية الى الحصول على اقل قيم لصفات النمو .

2- محصول الابصال الصالح للتصدير (الحجم المتوسط للابصال) سجل اعلى قيم للوزن (5.26 ، 3.98 طن/فدان بالمعاملة بسماد الدواجن وسماد زرق الحمام لكل من بنى سويف والمنيا على التوالى) . كما ادى اضافة سماد الماشية الحصول على اقل قيم للمحصول الكلى للابصال ومحصول الابصال النقضة فى كل تجارب بنى سويف والمنيا وعلى العكس من ذلك حيث سجلت اعلى نسبة لمحصول الابصال الصالحة للتسويق وكذلك الصالحة للتصدير مع استعمال سماد المواشى مقارنة بمصادر السماد العضوى الاخرى وذلك فى التجربتين .

3- ادت زيادة معدل التسميد العضوى الى الحصول على اعلى قيم لصفات النمو الخضرى وسجلت اقل قيم للنمو عند اضافة المعدل المنخفض من السماد 120 وحدة نتروجين /ف .

4- ادى اضافة اقل معدل من السماد العضوى الى الحصول على اعلى نسبة للمحصول الصالح للتصدير بينما ادى اضافة المعدل 180 وحدة نتروجين /ف الى الحصول على اقل نسبة للمحصول القابل للتصدير .

5- ادى تسميد نباتات البصل بالسماد العضوى (الدواجن وسماد زرق الحمام) الى زيادة فى محتوى الابصال من العناصر (النتروجين – الفوسفور – البوتاسيوم – الحديد - المنجنيز) بالمقارنة فى حين ان اضافة سماد الماشية كسماد عضوى ادى الى الحصول على اقل قيم.

6- اوضحت النتائج ان اضافة السماد العضوى بمعدل 150- 180 وحدة نتروجين /ف ادى الى الحصول على اعلى قيم للمحتوى الكيماوى للابصال من العناصر (النتروجين – الفوسفور – البوتاسيوم - المنجنيز – الزنك – النحاس) بينما اقل معدل اضافة ادى الى الحصول على اقل قيم من المحتوى الكمياوى للابصال .

Table (2): Effect of different sources and rates of organic nitrogen fertilizers on the onion plant growth character at Bini Sweef.

Characters Treatments		Length of plant cm	No. of leaves plant	Diameter, cm		Fresh weight, g./plant				Dry weight, g./plant			
N. Source	N. rates kg/fed.			Neck	Bulb	Leaves	Neck	Bulb	Total	Leaves	Neck	Bulb	Total
Cattle	120	45	9.7	1.5	5.1	26.00	14.5	69.8	110.3	3.86	2.92	12.34	19.12
	150	48	9.7	1.3	5.3	18.30	11.3	69.5	99.1	2.99	1.35	20.5	24.84
	180	53	9.2	1.9	5.5	29.30	18.0	107.5	154.8	3.67	2.49	25.53	31.69
	Mean	48.7	9.5	1.6	5.3	24.5	14.6	82.27	121.37	3.51	2.25	19.46	25.22
Chicken	120	53	9.2	1.8	5.4	21.70	19.5	76.0	117.2	4.37	3.35	16.33	24.05
	150	55	8.5	1.5	5.2	22.30	14.75	73.8	114.1	3.48	2.13	22.32	27.93
	180	58	10.0	2.1	5.9	30.75	22.0	109.5	162.75	3.99	3.11	28.60	55.70
	Mean	55.3	9.2	1.8	5.5	24.9	18.8	86.4	131.19	3.95	2.86	22.42	35.89
Pigeon	120	45	8.0	1.7	5.4	18.70	13.8	85.8	118.3	2.22	2.53	11.20	15.95
	150	53	9.0	1.8	5.3	26.30	14.75	76.5	117.55	3.17	1.80	18.06	23.03
	180	50	10.5	1.9	6.7	31.2	19.75	114.5	165.45	5.15	2.01	35.86	43.02
	Mean	49.3	9.2	1.8	5.8	25.4	16.1	92.27	133.77	3.51	2.11	21.71	27.33
Average of	120	47.7	8.97	1.7	5.3	22.1	15.93	77.2	115.27	3.48	2.93	13.29	19.71
	150	52.0	9.07	1.5	5.3	22.3	13.6	73.27	110.25	3.21	1.76	20.29	25.27
	180	53.7	9.90	1.97	6.03	30.4	19.92	110.5	160.83	4.27	2.54	30.00	43.47
L.S.D. at 5 % level for	Source	2.5	0.31	N.S	N.S	N.S	3.1	8.4	6.45	N.S	N.S	4.7	4.33
	Levels	3.4	N.S	N.S	0.47	4.3	2.1	8.0	21.8	1.90	N.S	N.S	11.4
	Interaction	N.S	N.S	N.S	0.64	5.75	N.S	18.95	11.7	1.91	0.75	4.33	8.65

Table (3): Effect of different sources and rates of organic nitrogen fertilizers on the onion plant growth character at Minia.

Characters Treatments		Length of plant cm	No. of leaves plant	Diameter, cm		Fresh weight, g./plant				Dry weight, g./plant			
N. Source	N. rates kg/fed.			Neck	Bulb	Leaves	Neck	Bulb	Total	Leaves	Neck	Bulb	Total
Cattle	120	63.0	7.8	2.2	4.1	21.5	35.5	57.0	114.0	1.95	2.66	6.93	11.54
	150	51.0	5.2	2.0	4.6	29.0	32.3	62.0	123.3	2.97	2.93	7.31	13.21
	180	55.0	7.5	2.1	5.0	35.0	31.0	67.0	142.0	3.67	3.82	7.90	14.39
	Mean	56.3	6.8	2.1	4.57	28.5	32.9	62.0	126.4	2.86	2.80	7.38	13.05
Chicken	120	68.0	8.0	2.4	4.3	37.0	37.0	62.0	136.0	3.52	3.45	7.7	14.67
	150	67.0	9.2	2.1	4.9	34.0	41.8	67.0	142.8	3.22	3.63	8.4	15.35
	180	67.0	8.3	2.0	5.0	37.0	38.5	85.0	160.5	3.80	3.39	8.6	15.70
	Mean	67.3	8.5	2.3	4.7	36.0	39.1	71.3	146.4	3.52	3.49	8.2	15.29
Pigeon	120	67.0	8.8	2.1	5.0	32.0	26.0	120.0	3.43	3.43	2.31	7.5	13.23
	150	65.0	8.0	2.1	5.3	36.0	69.0	137.3	2.65	3.65	2.19	8.1	12.94
	180	65.0	8.5	2.8	6.0	37.5	89.0	166.5	4.18	4.18	3.15	8.3	15.62
	Mean	65.7	8.43	2.3	5.3	35.2	31.9	73.0	141.3	3.42	2.55	7.97	13.93
Average of	120	66.0	8.2	2.23	4.5	30.2	32.8	60.3	123.33	2.97	2.81	7.38	13.15
	150	61.0	7.5	2.07	4.9	33.0	35.5	66.0	134.47	2.95	2.92	7.94	13.80
	180	62.3	8.1	2.30	5.3	35.7	35.7	80.3	156.33	3.88	3.12	8.27	15.27
L.S.D. at 5 % level for	Source	3.15	2.1	N.S	0.35	6.21	N.S	4.65	6.3	N.S	N.S	N.S	1.55
	Levels	N.S	N.S	N.S	0.35	1.71	2.15	12.75	27.3	0.66	N.S	1.31	2.55
	Interaction	N.S	1.33	N.S	0.83	6.13	N.S	9.51	7.33	0.67	N.S	N.S	1.31

Table (4): Effect of different sources and rates of organic nitrogen fertilizers on the onion yield character at Bini Sweef and Minia.

Characters / Treatments		Bini Sweef						Minia					
N. Source	N. rates kg/fed.	Total yield (ton/fed.)	Marketable yield (ton/fed.)	% Marketable yield	Exportable yield (ton/fed.)	% Exportable/ total yield	Culls bulbs (ton/fed.)	Total yield (ton/fed.)	Marketa-ble yield (ton/fed.)	% Marketable yield	Exportable yield (ton/fed.)	% Exportable/ yield	Culls bulbs (ton/fed.)
Cattle	120	5.68	4.88	85.9	3.65	64.4	0.80	5.17	3.79	73.4	2.66	51.5	1.38
	150	6.54	6.02	92.1	4.61	70.6	0.52	6.164	4.90	79.6	3.83	62.2	1.26
	180	7.82	6.47	82.8	5.69	85.6	1.35	6.494	5.28	81.4	3.78	71.6	1.21
	Mean	6.68	5.79	86.9	4.65	73.5	0.89	5.943	4.66	78.1	3.42	61.8	1.28
Chicken	120	6.84	4.72	69.0	4.41	79.8	2.12	6.27	3.80	61.2	3.00	64.4	2.42
	150	8.94	6.73	75.3	6.12	68.5	2.21	7.48	5.39	72.1	4.39	58.8	2.09
	180	9.36	6.12	65.4	5.25	56.1	3.24	8.86	5.77	65.2	4.45	50.2	3.09
	Mean	8.38	6.86	69.9	5.26	68.1	2.52	7.538	4.98	66.17	3.95	57.8	2.53
Pigeon	120	7.60	4.64	61.1	4.35	70.4	2.96	6.67	4.38	65.7	41.0	61.5	2.29
	150	8.42	4.91	85.4	4.16	61.3	3.51	7.14	4.77	66.8	3.82	53.6	2.37
	180	9.90	5.55	56.1	4.47	55.3	4.35	7.85	46.2	58.9	4.01	51.1	3.23
	Mean	8.64	5.03	67.5	4.33	62.3	3.61	7.22	4.59	63.8	3.98	55.4	26.3
Average of	120	6.71	4.75	72.0	4.14	71.5	1.96	6.097	3.99	66.8	3.25	59.1	2.03
	150	7.97	5.89	84.3	4.96	66.8	2.08	6.928	5.02	72.8	4.01	58.2	1.91
	180	9.03	6.05	68.1	5.14	65.7	2.98	7.735	5.22	68.5	4.08	57.6	2.51
L.S.D. at 5 % level for	Source	0.66	N.S	-	1.15	-	6.51	0.55	N.S	-	0.85	-	N.S.
	Levels	1.35	0.81		0.36		3.34	0.66	0.75		N.S		2.91
	Interaction	2.017	1.33		1.76		1.235	1.333	1.511		1.22		0.931