

NITROGEN MANAGEMENT OF ONION IN THE PRESENCE OF SYNTHETIC NITROGEN AND ORGANIC FERTILIZERS^a

I-VEGETATIVE CHARACTERS

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Abstract

This study was carried out at the Experimental Farm, Faculty of Agric, Assiut University, Assiut, during three consecutive winter seasons of 2005-2008. The study aimed to find out the performance of onion cv. Giza 6 under different combinations of synthetic nitrogen and organic fertilizers.

The obtained results after 70 days from transplanting showed that plants received the whole N doses as ammonium nitrate produced the highest average plant length and greater number of leaves per plant. The highest average leaves fresh weight and the heaviest average neck fresh weight were obtained with plants received full dose of the N fertilizer as ammonium nitrate plus full amounts of N as chicken manure.

However, after 110 days from transplanting, plants received whole N doses as farmyard manure had the least values of bulbing ratio. The greatest bulb diameter and the heaviest average bulb fresh weight were obtained with plants received half of the N doses in the form of ammonium nitrate plus the other half as chicken manure. Applying one quarter of the N doses in the form of ammonium nitrate plus the other three quarters as chicken manure produced the highest values of percentage of bulb dry matter.

INTRODUCTION

In vegetable production as indicated by Kelly (1990) and observed by practical experiences there has been a dramatic increase in the use of synthetic agrochemicals, especially N fertilizers. Along with such a trend, there is growing and popular press and organizations campaign against the use of these synthetic compounds. However, Porter (1975) stated that, the most pressing reason for reducing rates of inorganic fertilizers is the pollution of ground water with nitrate.

Because of the increasing costs of chemical N fertilizers and the dangerous of increasing soil salinity as well as pollution of the agricultural environment, scientists are aware of its level in soil and its effects on animal and people. Therefore, nitrate level in plant tissues

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should not exceed certain level. The accumulation of NO_3 in edible plant part is of concern in the health of humans and ruminants (Maynard *et al*, 1976).

Onion (*Allium cepa* L.) is one of the most important vegetable crops in Egypt for both exportation and local consumption. Egyptian farmer used to apply excessive amounts of N fertilization in order to guarantee higher yields. Onion plants response to fertilization, in general and with N in partial (Mahmoud 2006 and Hafiz *et al* 2008). However, many researchers. (Blay *et al* 2002, Abbey and Kanton 2003, Mahmoud 2006 and Shaheen *et al* 2007) were focused upon the possibility of partial substitution of inorganic by organic sources of fertilization in onion production. The present work was carried out to study the response of onion plant cv. Giza 6 vegetative growth characteristics when grown under combination and/or sole fertilization of different sources of N fertilization.

MATERIALS AND METHODS

This study was carried out at the Experimental Farm of Faculty of Agriculture, Assiut University, Assiut, during the three consecutive winter plantings of 2005/2006, 2006/2007 and 2007/2008 seasons. The study aimed to find out growth performance of onion cv. Giza 6 under minimal synthetic nitrogen fertilization and using organic fertilizers.

For onion transplants establishment, seeds were sown to the nursery on Sept 18, 10 and 15 during 2005/2006, 2006/2007 and 2007/2008 seasons, respectively. Sowing was done on both sides of ridges 50 cm apart. Normal cultural practices for transplants establishment were followed as recommended for commercial fields. Onion seedlings were transplanted on December 1, 5 and 3 for 2005/2006/, 2006/2007 and 2007/2008 seasons, respectively. Three types of organic fertilizer, i.e., farmyard manure (A), chicken manure (B) in comparison with town refuse manure (C) (produced by factory of organic fertilizers at Bani-Ghaleb, Assiut) as organic sources of nitrogen were tested.

Chemical analysis of the soil at the experimental site and the tested organic fertilizers used in the present study are shown in Table (1).

Table 1 . Chemical analysis of the soil and organic fertilizer used in the study.

Treatments	O.M.% *	Total N %	Total P %	Total K%	Soluble K%	pH
Soil	1.368	0.25	8.45	1.064	0.041	8.03
Farmyard manure, A	44.39	0.42	0.33	0.95	0.47	8.57
Chicken manure, B	44.03	3.00	0.59	0.70	0.28	6.58
Town refuse manure, C C	35-43.6	1.25	0.60	0.42	0.42	6.2

*O.M = Organic matter.

Based on data presented in Table 1, amounts of organic manure added were calculated resulting in rates of 26.5, 4.0 and 9.5 ton/feed, for farmyard, chicken and town refuse manures, respectively. Inorganic nitrogen fertilizer as ammonium nitrate (N) 33.5% nitrogen at the rate of 350 kg/feed was also applied alone and/or in combinations with the previously mentioned organic fertilizers at various tested treatment. The experiment was laid out as randomized complete block design with three replicates, where each replicate included 13 treatments as follows :- $T_1 = N$, $T_2 = A$, $T_3 = N+A$, $T_4 = 1/2N+1/2A$, $T_5 = 1/4N+3/4A$, $T_6 = B$, $T_7 = N+B$, $T_8 = 1/2N+B$, $T_9 = 1/4N+3/4B$, $T_{10} = C$, $T_{11} = N+C$, $T_{12} = 1/2N+1/2C$ and $T_{13} = 1/4N+3/4C$, where N = 350 Kg ammonium nitrate.

The plot area was 9.0m² consisting of 20 rows each of 3m in length and 15 cm width. Within row spacing was 5-7 cm between plants. On the other hand, inorganic fertilizers were added as follows: For nitrogen, the rate of 120 kg N/feed was added in two equal doses after 50 and 70 days from transplanting. The of phosphorus fertilizer (45 kg P₂O₅/fed) as calcium super phosphate (15% P₂O₅) was added during soil preparation. Potassium fertilizer in this experimental was added at the rate of 48 kg K₂O/feed as potassium sulphate (48% K₂O), after 70 days from transplanting.

Data were recorded on the following :

After 70 days from transplanting, random samples - 3 plants each- were taken from each plot on which the data were recorded and averaged to obtain: - average fresh weight of leaves, average plant length, and average number of leaves per plant and average fresh weight of neck.

Also, after 110 days from transplanting on three plants random samples from each plot, data were recorded and averaged to estimate the average bulb diameter, average bulb weight, bulbing ratio and percentage of bulb dry matter.

Data were subjected to statistical analysis methods as illustrated by Gomez and Gomez (1984). Treatment means were compared using the Duncan's multiple range test at 0.05 level of probability.

RESULTS AND DISCUSSION

I After 70 days from transplanting

Results concerning, data recorded after 70 days from transplanting about the effect of the various fertilization treatments are illustrated in Fig 1, 2.

I. a Average fresh weight of leaves/plant (g)

As shown in Fig. 1 A, plants received full dose of N as ammonium nitrate plus full dose of N using farm yard manure (FYM) and those received full dose of N as ammonium nitrate plus full dose N from chicken manure significantly surpassed most

of the other treatments and producing higher average fresh weight of leaves/plant. Such results are on line with those reported by Shafeek *et al* (2003) who showed that, the highest whole plant fresh and dry weight of the onion plant was associated with the addition of organic fertilizer in the form of chicken manure.

I. b Average plant length (cm)

Plots received the whole N doses as ammonium nitrate gave higher average plant length (75.60, 67.70 and 88.10 cm/plant for 2005/2006, 2006/2007 and 2007/2008 seasons, respectively) during the three seasons of study (Fig. 1 B). However, during 2005/2006 and 2006/2007 seasons such treatment did not significantly differ (regarding plant length) from that obtained from plants grown in plots received N requirements as a quarter of N doses in the form of ammonium nitrate plus the other three quarters as FYM. On the other hand, during the three seasons of study the lowest average plant length was obtained from plots received one quarter of the N dose in the form of ammonium nitrate plus the other three quarters as town refuse manure (58.40, 55.20 and 69.90 cm/plant for 2005/2006, 2006/2007 and 2007/2008 seasons, respectively) up to 70 days from transplanting. However, previous work of Gupta *et al* (1999) showed that FYM along with ammonium sulfate increased growth of onion plant and improved some bulb characters. Also, Blay *et al* (2002) reported that a combination of poultry manure and NPK fertilization increased plant height. Our findings are also in agreement with those obtained by Abbey and Kanton (2003) who mentioned that FYM increased plant height.

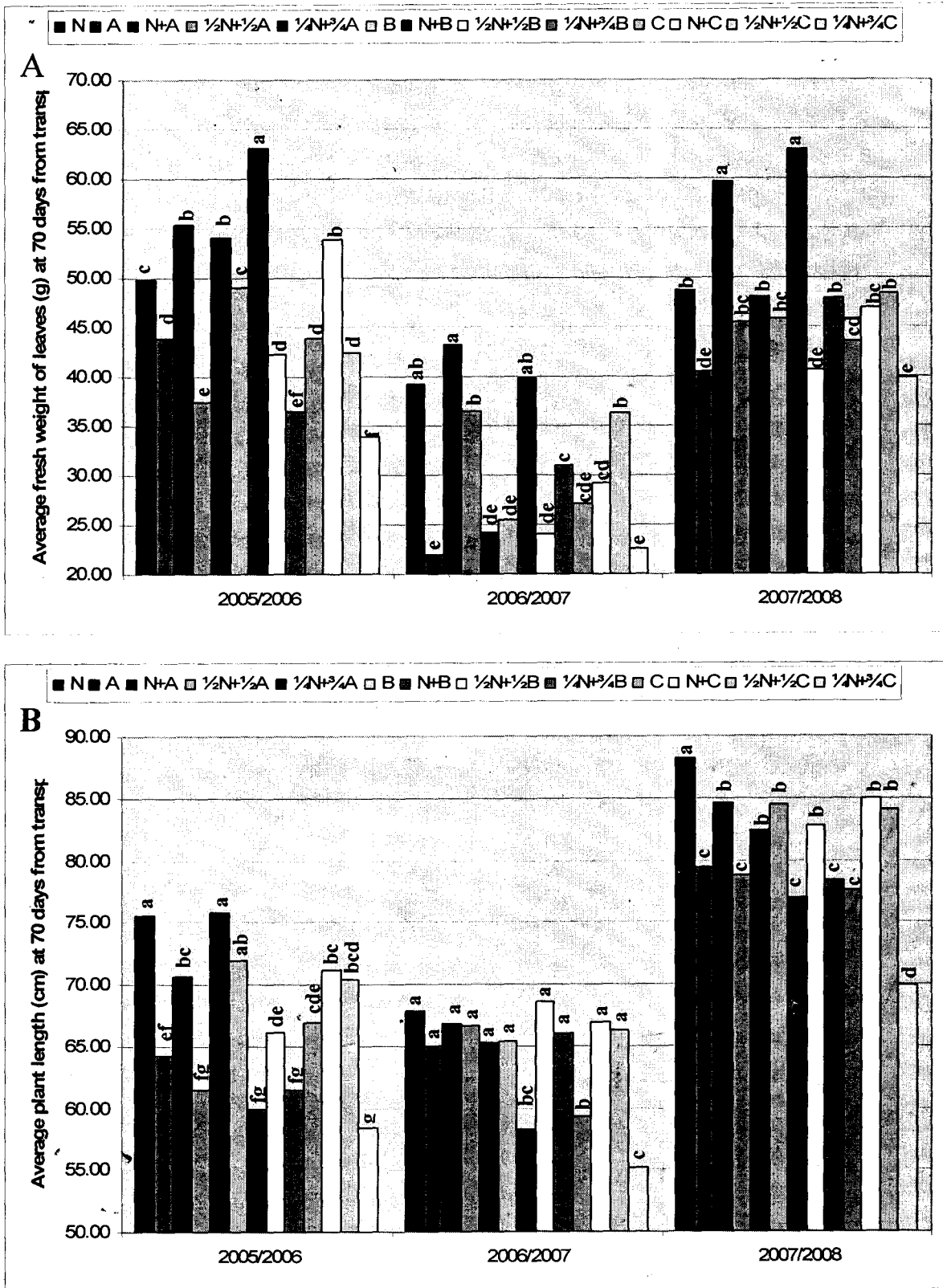


Fig. 1. Effect of fertilizer treatments on average fresh weight of leaves (g) (A) and average plant length (cm) (B) at 70 days from transplanting during 2005/2006, 2006/2007 and 2007/2008 seasons. In each figure, within each season, means of each trait following by the same letter or letters are not significantly different at the 0.05 level.

I. c Average number of leaves/plant

Data illustrated in Fig. 2 A indicate that, plots received the whole N doses as ammonium nitrate revealed plants having the greatest number of leaves (8.81, 8.10 and 10.00 for 2005/2006, 2006/2007 and 2007/2008 seasons, respectively) during the three seasons of this study. Results of Blay *et al* (2002) with onion plant showed that applying poultry manure at 40 t/ha in combination with NPK at 600 Kg/ha increased number of leaves/plant. Similar results were also reported by Jayathilake *et al* (2002), Lal *et al* (2002) and Abbey and Kantone (2003).

I. d Average fresh weight of neck (g)

Plants received full doses of N as ammonium nitrate plus full dose of N as chicken manure produced the highest average fresh weight of neck (29.91, 22.44 and 32.29 g for 2005/2006, 2006/2007 and 2007/2008 seasons, respectively) (Fig. 2 B). The lowest in this respect was given by plants grown in plots received N requirements as half of the N doses in the form of ammonium nitrate plus the other half as FYM. These results are on line with the general trend reported by many investigators (Gupta *et al* 1999, Shafeek *et al* 2003 and Shaheen *et al* 2007). They mentioned that application of sole organic fertilization or in combination with inorganic fertilization improved many of onion plant growth parameters.

II After 110 days from transplanting

Data recorded after 110 days from transplanting about the effect of the tented fertilization treatments are illustrated in Fig. 3, 4.

II. a Average bulb diameter (cm)

Plants received half of the N dose in the form of ammonium nitrate plus the other half from chicken manure gave the largest bulbs (4.96, 5.95 and 6.10 cm for 2005/2006, 2006/2007 and 2007/2008 seasons, respectively), as expressed in average bulb diameter (Fig. 3 A). These results in agreement with, Abby and Kantone (2003) who reported that the application of FYM along with NPK fertilizers revealed the highest values for bulb diameter.

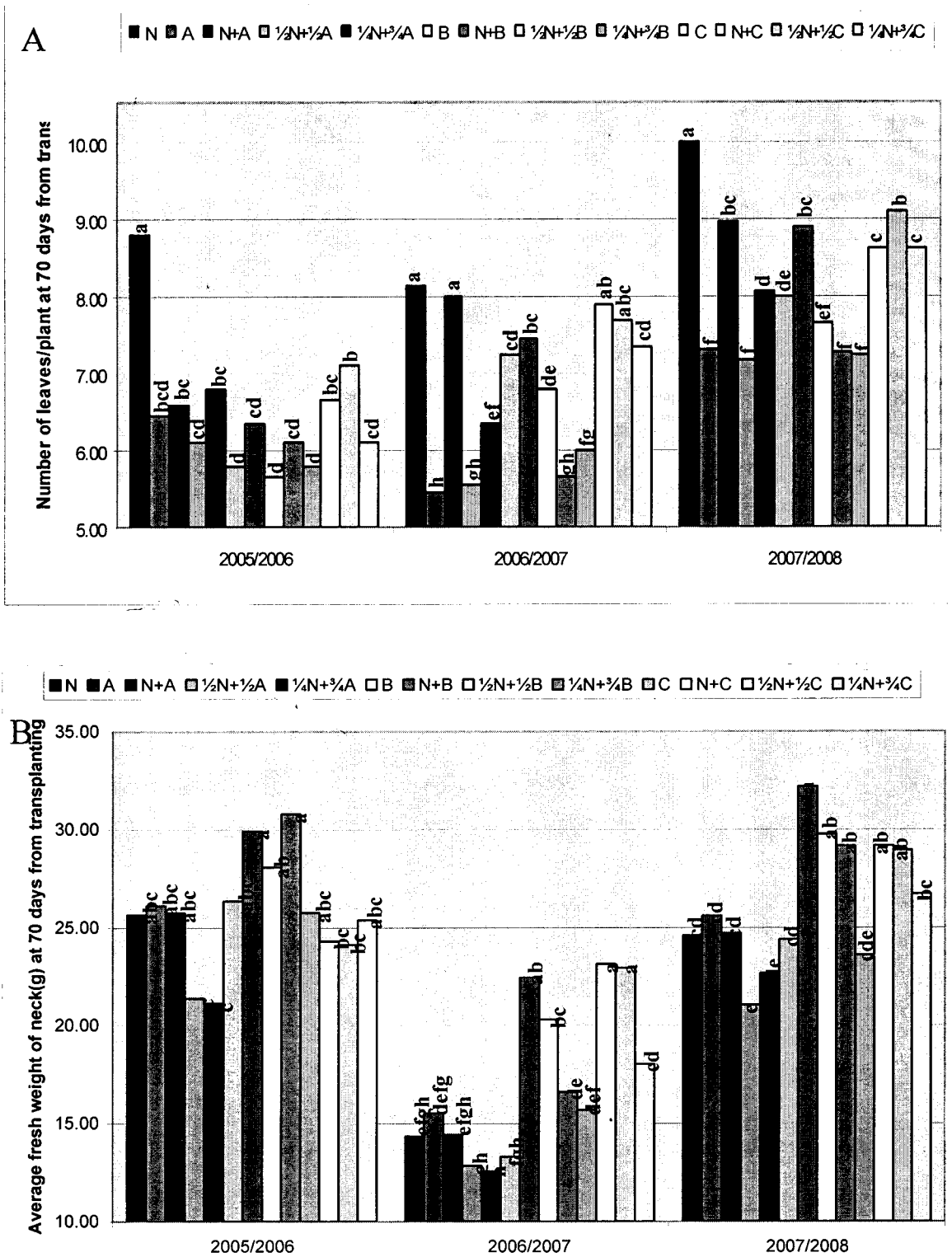


Fig. 2. Effect of fertilizer treatments on number of leaves/plant (A) and average fresh weight of neck (g) (B) at 70 days from transplanting during 2005/2006, 2006/2007 and 2007/2008 seasons. In each figure, within each season, means of each trait following by the same letter or letters are not significantly different at the 0.05 level.

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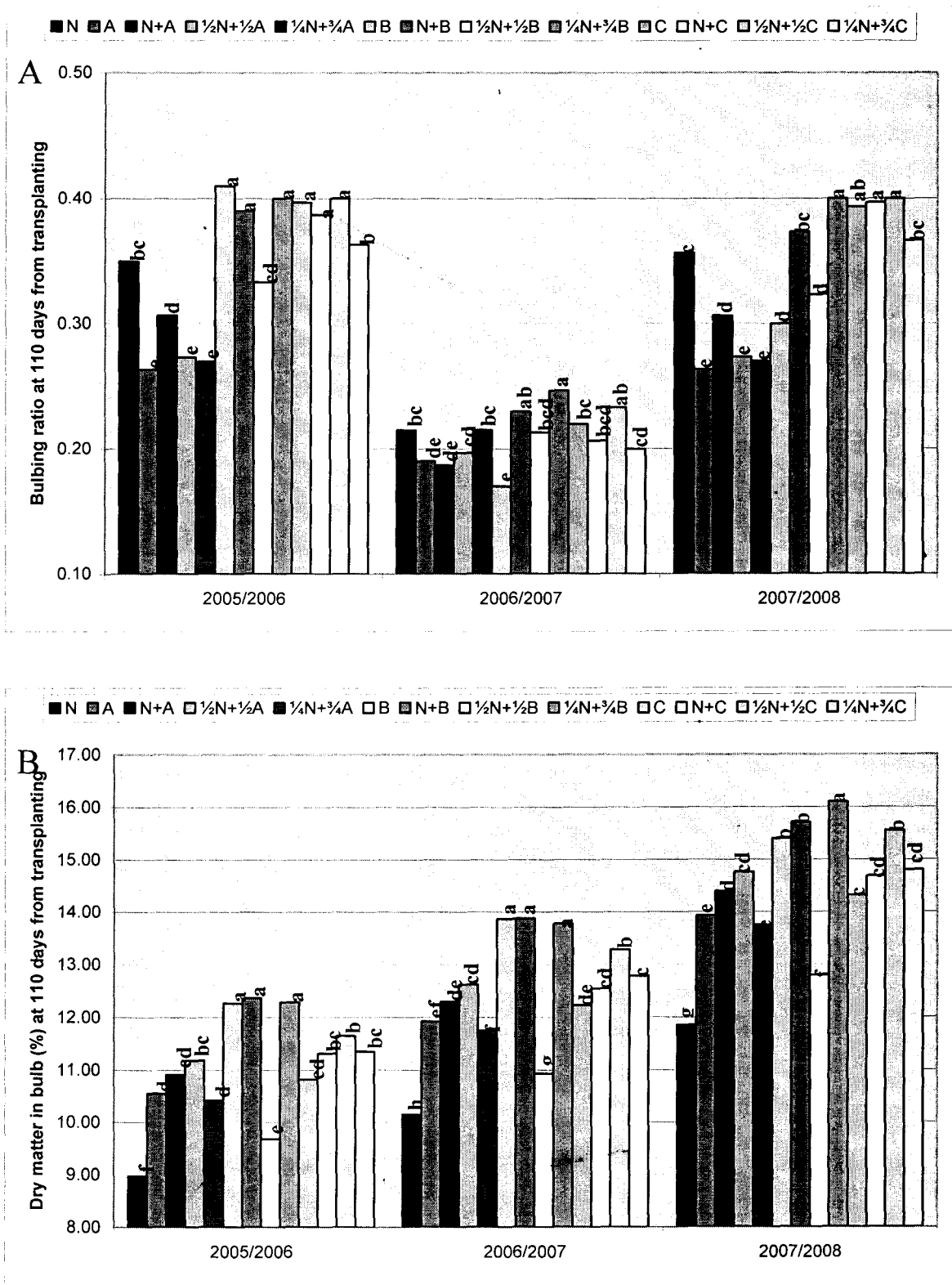


Fig. 4. Effect of fertilizer treatments on bulbing ratio (A) and dry matter in bulb (%) (B) at 110 days from transplanting during 2005/2006, 2006/2007 and 2007/2008 seasons. In each figure, within each season, means of each trait following by the same letter or letters are not significantly different at the 0.05 level.

II. d Percentage of dry matter in bulb

Results of this trait are illustrated in Fig. 4 B. During the three seasons of this study, plants received one quarter of the N doses in the form of ammonium nitrate plus the other three quarters as chicken manure gave the highest values (12.37, 13.88 and 16.10 % for 2005/2006, 2006/2007 and 2007/2008 seasons, respectively) for percentage of bulb dry matter. On the other hand, data revealed that, the lowest percentage of bulb dry matter (8.97, 10.15 and 11.85 % for 2005/2006, 2006/2007 and 2007/2008 seasons, respectively) were obtained from plots received the full N doses as ammonium nitrate.

On line with the present findings, Krishnamurthy and Sharanappa (2005) found that dry matter production by the onion plant were significantly higher by the integrated use of green biomass, poultry waste compost and urea fertilizer at 125 Kg N. However, Mahmoud (2006) showed that, application of organic fertilizer (chicken manure) combined with inorganic (ammonium sulfate) in sandy calcareous soil increased fresh and dry bulb weights after 100 days from transplanting. In contrary, Blay *et al* (2002) found that inorganic fertilizer alone or in combination with poultry manure decrease bulb dry matter content.

It could be concluded that chicken manure might be used successfully in replacing a part of the inorganic N. Results showed that, the greatest bulb diameter and the heaviest average bulb fresh weight were obtained by applying half of the N doses in the form of ammonium nitrate plus the other half from chicken manure. However, applying one quarter of the N doses in the form of ammonium nitrate plus the other three quarters as chicken manure produced the highest values of percentage of bulb dry matter.

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إدارة التسميد الأزوتي باستخدام الأسمدة المعدنية و العضوية ١- الصفات الخضرية

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١ . المعمل المركزي للزراعة العضوية- مركز البحوث الزراعية

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أجريت هذه الدراسة في مزرعة الخضر البحثية ، كلية الزراعة ، جامعة أسيوط ، أسيوط ، خلال ثلاث مواسم شتوية متتالية خلال الفترة من ٢٠٠٥ - ٢٠٠٨ لإختبار أداء صنف البصل جيزة ٦ تحت ظروف التسميد الأزوتي بالجرعة الموصى بها باستخدام معدلات مختلفة من السماد الأزوتي المعدني وبعض الأسمدة العضوية بهدف الحد من التسميد الأزوتي المعدني . وقد أوضحت النتائج (بعد ٧٠ يوم من الشتل) أن تسميد النباتات بالجرعة الموصى بها من التسميد الأزوتي في صورة نترات أمونيوم أعطت أعلى النباتات طولاً وأعلى عدد أوراق . بينما أمكن الحصول على أعلى متوسط للوزن الطازج للأوراق/نبات و أعلى متوسط لوزن العنق/نبات بإضافة الجرعة الموصى بها من التسميد الأزوتي في صورة نترات أمونيوم مضافاً إليها جرعة مماثلة في صورة سماد مخلفات الدواجن .

وبعد ١١٠ يوم من الشتل أدى إستعمال الجرعة الموصى بها من التسميد الأزوتي في صورة مخلفات الماشية إلى أقل قيمة عددية لمعدل التبصيل.بينما أدى استعمال نصف الإحتياجات السمادية من الأزوت في صورة نترات أمونيوم والباقي في صورة سماد مخلفات الدواجن إلى أعلى متوسط لقطر البصلة وأعلى متوسط للوزن الطازج للإبصال . و أدى أستعمال ربع الإحتياجات السمادية من الأزوت في صورة نترات الأمونيوم مضافاً إليها ثلاث أرباع الإحتياجات السمادية من الأزوت في صورة سماد مخلفات الدواجن إلى أعلى قيمة في محتوى الأبصال من المادة الجافة .