Assiut Journal of Agricultural Science, Vol 37, No 3 , 2006

RESPONSE OF COTTON CULTIVAR GIZA 90 TO POPULATION DENSITY AND NITROGEN LEVELS

F.S. Hamed

Cotton Research Institute, Agric. Res. Cent. Giza, Egypt

Abstract : Two experiments were carried out at Shandweel Agric. Res. Station during 2003 and 2004 seasons to study the effect of population densities: i.e. 64600, 51700 and 43100 plants/faddan (20, 25 and 30 cm between hills) and nitrogen levels (45, 60 and 75 kgN/faddan), as well as their interactions on growth, yield and yield components of cotton cultivar Giza 90.

The results indicated that increasing plant population Produced the best values of the first fruiting branch node, number of plants/feddan at harvest and seed cotton yield/faddan. However, the plant height at harvest had significantly increased by increasing population density in 2003 season only. In the contrary, decreasing population density led to a significant increase in number of fruiting branches/plants, number of open bolls/plant, boll weight and seed cotton yield/plant in both seasons.

As for nitrogen levels, the plant height at harvest, number of fruiting branches/plant, number of open bolls/plant and seed cotton yield/plant increased significantly by increasing nitrogen levels in both seasons. However, the location of the first fruiting branch node and boll weight increased significantly by increasing nitrogen application in 2004 season only. While, seed cotton yield/faddan increased in 2003 season only. The interaction between population density and nitrogen levels had significant effect on seed cotton yield/plant in both seasons, and, plant height at harvest and seed cotton yield/faddan in 2003 season only. While, the effect on location of the first fruiting branche node, number of open bolls/plant and boll weight was affected in 2004 season only. Meanwhile, interaction between the two factors had insignificant effect on number of fruiting branches/plant in both seasons. It could be concluded that there was a response of Giza 90 cotton variety to population density (64600 plant/fad.) and nitrogen application up to 60 kg N/fad. (2003) and application of 75 Kg N/Fad. (2004), with an average yield of 11.58 and 11.23 K/fad. For 2003 and 2004 seasons respectively.

Key words: cotton, population density, nitrogen.

Introduction

Cotton is the main fiber crop in Egypt. Growth, earliness and seed cotton yield/faddan, are governed by many factors. Among such factors, Plant population and nitrogen fertilization are two of the most important ones, yet more information required concerning the effect of these factors are still needed El-Beily *et al.* (2001), Hamed (2002) and El-Sayed & El-Menshawi (2005) mentioned that plant the height at harvest increased significantly as plant density was increased. However, Hamed (2002), Saleh et al. (2004) and El-Sayed & El-Menshawi (2005) reported that decreasing population density significantly increased number of the fruiting branches/plant. El-Shahawy *et al.* (1997) and El-Sayed & El-Menshawi (2005) found that increasing population density significantly increased location of first fruiting branche node. Meanwhile, El-Beily et al. (2001), Hamed (2002), Saleh *et al.* (2004) and El-Sayed & El-Menshawi (2005) found that boll weight, number of open bolls/plant and seed cotton yield/plant increased significantly as population density was decreased. However, Ali *et al.* (1996), Abou-Zaid & Bisher (1997), El-Shahawy et al. (1997) and Hamed (2002) reported that increasing population density significantly increased number of plants/faddan and seed cotton yield/faddan.

In addition, nitrogen is considered the conventional nutritional element for monitoring cotton growth and development. Hamed (2002), Saleh *et al.* (2004) and El-Sayed & El-Menshawi (2005) declared that plant height at harvest increased significantly by increasing N level. However, Hamissa et al. (2000), Ali & El-Sayed (2001), Darwish (2001), El-Beilyt *et al.* (2001) Hamed (2002), Saleh *et al.* (2004) and El-Sayed & El-Menshawi (2005) found that number of fruiting branches/plant was significantly increased by nitrogen application. While, Abdel-Malik & El-Shahawy (1999), Ali & El-Sayed (2001), Hamed (2002) and El-Sayed & El-Menshawi (2005) found that the location of first fruiting node was significantly increased by nitrogen application. Meanwhile, Hamissa *et al.* (2000), Saleh *et al.* (2004) and El-Sayed & El-Menshawi (2005) reported that boll weight, number of open bolls/plant, seed cotton yield/plant and seed cotton yield/faddan had the same trend for nitrogen application.

This study aims to examine the effect of population density and nitrogen fertilizer levels on growth and yield of cotton cultivar Giza 90.

Materials and Methods

Two field experiments were carried out at Shandweel

Agricultural Research Station during 2003 and 2004 seasons to study the effect of population density, nitrogen levels and their interactions on growth, earliness, yield and its components of Giza 90 cotton variety. Cotton seeds were sown at the last week of March in both seasons. Mechanical and chemicals analysis of soil are presented in Table (1).

Table(1): Mechanical and chemical analysis of soil samples at 30 cm. depth from the surface in 2003 and 2004 seasons.

Soil characteristics	2003	2004
Texture	Clay loam	Loamy
Calcium carbonate %	1.49	1.24
Organic matter %	0.938	1.02
pH (1 : 2 : 5 suspension) NPK	7.40	7.20
Total N (ppm)	681	702
Available P (ppm)	8.1	9.4
Available K (ppm)	410	448

The experimental design was split-plot with four replications. The main plots were assigned for the three population densities, i.e. 64700 plants/faddan. (20 cm between hills), 51700 plants/faddan (25 cm between hills), 43100 plants/faddan (30 cm between hills). Thinning was done at 35 days after sowing leaving two plants per hill. Nitrogen levels (45, 60 and 75 kgN/faddan) occupied the sub-plots. The sub plot size was 19.5 m^2, 5 m x 3.9 m and contains 6 ridges, 65 cm wide and 5 m long. Nitrogen fertilizer was added in bands and divided in two equal portions, the first one was applied after thinning just before the second irrigation and the second portion was added before the third irrigation. Other practices were done as recommended in cotton production including a basic dose of 150 kg calcium supperphosphate (15.5% P_2O_5) at land preparation and 50 kg/feddan potassium sulphate (48% K_2O) before the fourth irrigation for all sub-plots. Five guarded hills were randomly chosen from the three inner rows in order to study the following characters :

A- Growth and Earliness :

1- Plant height at harvest (cm).

2- Number of the fruiting branches/plant.

3- Location of first fruiting node.

B- Yield and yield component :

1- Number of open bolls/plant.

2- Average boll weight in grams.

3- Average seed cotton yield in grams/plant.

4- Number of plants at harvest in thousand/faddan : Number of plants at harvest were recorded and transformed to thousands/faddan.

5- Seed cotton yield in kentars/faddan: seed cotton yield/plot in kilograms was recorded and transformed to kentars/faddan (one kentar: 157.5 kg).

The collected data were subjected to analysis of variance outlined by Snedecor and Cochran (1967) and the mean values were compared using L.S.D. at 5%.

Results and Discussion

A- Growth and earliness characters :

1- Plant height at harvest :

The presented data in Table (2) showed that in general, plant height at harvest increased as plant density was increased and this increase was significantly at the first season only. This increase might be due to the increase in main stem nodes length and it could be explained as a result of excessive shade which increase gibberelin content in plant tissues. Similar results were obtained by El-Beily et al. (2001), Hamed (2002) and El-Sayed & El-Menshawi (2005). Meanwhile, increasing nitrogen level significantly increased plant height at harvest in both seasons. These results could be ascribed on the fact that nitrogen is essential for active vegetative growth. Hamed (2002), Saleh et al. (2004) and El-Sayed & El-Menshawi (2005) came to the same conclusion. The interaction between population density and nitrogen level was significant in 2003 season. The data revealed that 20 cm spacing fertilized with 75 kgN /faddan produced the highest values.

2- Number of fruiting branches/plant :

The presented data in Table (3) showed that decreasing population density significantly increased number of the fruiting branches/ plant in both seasons. This increase might be due to the narrow spacing led to lower light intensity causing a reduction in the amount of metabolites synthesized. Furthermore, most of the synthesized metabolites were transported to terminal bud to help in elongation rather than being transported to fruiting buds. Similar findings were obtained by Hamed (2002), Saleh et al. (2004) and El-Sayed & El-Menshawi (2005). On the other hand, increasing nitrogen level significantly increased number of the fruiting branches/plant in both seasons. The previous trend might be due to soil being low in organic

matter and available nitrogen as presented in Table (1).

These results could be ascribed to the fact that nitrogen is essential for active vegetative growth, since the importance of nitrogen for many basic physiological processes in cotton such as photosynthetic rate and accumulation of carbohydrates.

These results are in good agreement with the results concluded by Hamissa et al. (2000), Ali & El-Sayed (2001), Darwish (2001), El-Beily et al. (2001), Hamed (2002), Saleh et al. (2004) and El-Sayed & El-Menshawi (2005).

The interaction of the population density and nitrogen levels did not show any significantly effect on this trait at 5% level of significance in both seasons.

3- Location of the first fruiting branch node :

The present data in Table (4) showed that increasing population density had significantly increased location of the first fruiting branch node in both seasons. This may be attributed mainly to the competition between plants for light. Similar results were obtained by El-Shahawy et al. (1997) and El-Sayed & El-Menshawi (2005). As well as, increasing nitrogen levels had significantly increased location of first fruiting branch node in 2004 season only.

These results could be ascribed to the fact that nitrogen is essential for active vegetative growth. Similar findings were mentioned by Abdel-Malik & El-Shahawy (1999), Ali & El-Sayed (2001), Hamed (2002) and El-Sayed & El-Menshawi (2005).

The involved interaction had significantly affected at the location of first fruiting branch node in 2004 season only. The data showed that 20 cm spacing and fertilized with 75 kg N/feddan gave the best location of the first fruiting branch node.

B- Yield and yield component :

The presented data in Tables (5, 6, 7, 8 and 9) showed that decreasing population density led to a significant increase in number of open bolls/plant, boll weight and seed cotton yield/plant in both seasons. These results might be due to decreasing population density encouraging cotton plants to form more heavy bolls and give the highest yield/plant. The previous reduction in number of open bolls/plant and boll weight at crowded plants on the consideration of unit ground area. Similar findings were obtained by El-Biely et al. (2001), Hamed (2002), Saleh et al. (2004) and El-Sayed & El-Menshawi (2005). However, increasing population density significantly increased number of plants/faddan and seed cotton yield/faddan in both seasons. This might be due to the increase in population density compensated the

forementioned trends and led to the highest yield/unit area. Similar findings were found by Ali et al. (1996), Abou-Zaid & Bisher (1997), El-Shahawy et al. (1997) and Hamed (2002).

Regarding to the effect of nitrogen fertilization, the results showed that increasing nitrogen level significantly increased number of open bolls/plant and seed cotton yield/plant in both seasons. However, boll weight and seed cotton yield/feddan were significant in the second and first seasons, respectively. These results might be explained on the basis that increasing nitrogen levels up to 60 kg/fad. gave cotton plants its requirements from nitrogen which provide the small formed bolls with its requirements, resulting in more setting of bolls and decrease the shedding of fruiting organs/plant which reflected on seed cotton yield/plant and feddan. Similar results were concluded by Hamissa et al. (2000), Saleh et al. (2004) and El-Sayed & El-Menshawi (2005).

It could be concluded that there was a response of Giza 90 cotton variety to population density (64600 plant/fad.) and nitrogen application up to 60 kg N/fad. (2003) and application 75 kg N/fad. (2004), with an average yield of 11.58 and 11.23 k/fad. for 2003 and 2004 seasons, respectively.

References

Abdel-Malik, R. R. and M. I. M. El-Shahawy (1999). Impact of plant population density through row and hill spacings under different nitrogen levels on Giza 89 cotton cultivar. Egypt. J. Agric. Res. 77 (3): 1287-1300.

Abou-Zaid, M. K. M. and M. A. Bishr (1997). Future of Egyptian cotton production in the new desert land of Egypt. 4-Influence of topping and plant density of cotton yield. Alex. Sci. Exch., 18 (2): 143-154.

Ali, S. A. and A. E. El-Sayed (2001). Effect of sowing dates and nitrogen levels on growth, earliness and yield of Egyptian cotton cultivar Giza 88. Egypt J. Appl. Sci., 11 (3): 66-72.

Ali, S. A., M. A. El-Biely and E. A. Makram (1996). Effect of hill spacing and nitrogen rates on Giza 45 cotton cultivar in early and late sowing dates. Egypt. J. Appl. Sci., 11 (3): 66-72.

Darwish, A. A. (2001). Effect of nitrogen fertilization and foliar application of calcium on growth, yield and quality of Egyptian cotton cultivar Giza 89. Minufiya. J. Agric. Res., 26 (2): 409-418.

El-Beily, M. A. A., W. M. O. El-Shazly, S. A. Ali and K. A. Ziadah (2001). Response of cotton cultivar Giza 85 to nitrogen rates and hill spacings under level of growth

regulation (Pix). Minufia. J. Agric. Res. 26 (1): 51-84.

El-Sayed, E. A. and M. El-Menshawi (2005). Response of the promising Hybrid cotton Giza 89 x 86 to hill spacing and nitrogen fertilizer level. J. Agric. Res. Tanta Univ., 31 (3): 436-456.

El-Shahawy, M. I. M., M. M. El-Razaz and M. A. El-Biely (1997). Response of Giza 87 cotton variety to plant population density and nitrogen fertilizer levels. J. Agric. Sci. Mansoura Univ., 22 (3): 689-695.

Hamed, F. S. (2002). Production of Egyptian cotton using modern systems of irrigation and fertilization under Newly Reclaimed Soil. Ph. D. Thesis, Fac. of Agric., Assiut Univ., Egypt.

Hamissa, A. M., K. A. Ziadah and M. F. El-Masry (2000). Response of cotton to biofertilizer and nitrogen fertilization. Minufiya. J. Agric. Res., 25 (2): 371-388.

Saleh, M. E., S. A. I. Ghanem, O. A. A. Zeiton and G. I. M. Reshed (2004). Effect of planting date, density and nitrogen fertilization on shedding, Earliness, yield and fibre quality of Egyptian cottn. Zagazig, J. Agric. Res., Vol. 31 No (6): 2597-2620.

Senedecor, D. M. and W. G. Cochran (1967). Statistical analysis. Methods. 6th Edition, Iowa state Univ. Ames-Iowa, U.S.A.

استجابة صنف القطن جيزة 90 للكثافة النباتية والتسميد الآزوتى

فكرى سيد حامد

معهد بحوث القطن – مركز البحوث الزراعية – الجيزة – مصر

أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بشندويل موسمى 2003، 2004م لدراسة تأثير الكثافات النباتية 64600 ، 51700 ، 43100 نبات/فدان (مسافات الجور 20سم، 25سم، 30سم) ومستويات الآزوتى (45، 60، 75 كجم/فدان) على النمو والمحصول ومكوناته لصنف القطن جيزة 90 وكانت النتائج كالآتى :

(1) أدت زيادة الكثافة النباتية إلى زيادة معنوية لموقع أول فرع ثمرى وعدد النبات/فدان وكذلك محصول القطن الزهر (قنطار/فدان) فى كلا الموسمين، بينما زاد طول النبات زيادة معنوية فى موسم 2003م فقط. وعلى العكس أدى نقص الكثافة النباتية إلى زيادة عدد الأفرع الثمرية/نبات، عدد اللوز المتفتح/نبات ومتوسط وزن اللوزة ومحصول النبات الفردى فى كلا الموسين .

(2) أدت زيادة مستويات التسميد الآزوتى إلى زيادة معنوية لطول النبات، عدد الأفرع الثمرية/نبات، عدد اللوز المتفتح/نبات، محصول النبات الفردى فى كلا الموسمين، بينما زاد معنوياً موقع أول فرع ثمرى ومتوسط وزن اللوزة فى موسم 2004م فقط، كما زاد معنوياً محصول القطن الزهر (قنطار/فدان) فى موسم 2003م فقط.

(3) كان التفاعل بين الكثافة النباتية والتسميد الآزوتى معنويا على محصول النبات الفردى فى كلا الموسمين، بينما كان التفاعل معنوياً لطول النبات ومحصول القطن الزهر (قنطار/فدان) حيث بلغ المتوسط 11.58 قنطار قطن زهر للفدان فى موسم 2003م فقط، وموقع أول فرع ثمرى وعدد اللوز المتفتح/نبات ومتوسط وزن اللوزة فى موسم 2004م فقط.

(4) لم يتأثر عدد الأفرع الثمرية/نبات معنوياً لكل من الكثافة النباتية ومستويات التسميد الأزوتى فى كلا الموسمين .