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EFFECT OF SOWING DATE AND PLANT DISTRIBUTION PATTERNS ON SEED YIELD OF SOME CHICKPEA VARIETIES

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ABSTRACT

Two field experiments were conducted at Agric. Exp. St., Fac. Agric., Cairo Univ., Giza, Egypt during 2003/2004 and 2004/2005 seasons. The major objective was studying the effect of four sowing dates (Oct. 20, Nov.10, Nov.30 and Dec.20) and three plant distribution patterns on yield of three chickpea varieties (Giza1, Giza195 and Giza531). Plants were arranged in three patterns, i.e., two plants per hill,10 cm apart on one side of ridge (D_1); one plant per hill, 10 cm apart on both sides of ridge (D_2) as well as two plants per hill, 20 cm apart on both sides of ridge (D_3).Results showed that sowing on Nov.10 gave the greatest values of chickpea seed yield/faddan and its attributes (number of full pods, number of seeds/plant and seed yield/plant) .While the lowest values of these traits obtained with late sowing (December, 20), in both seasons.

Planting one plant per hill, 10 cm apart on both sides of ridge surpassed the other distributions in number of seeds/plant, seed yield per plant and faddan in both seasons. Giza 531 variety surpassed other varieties in seed yield/fad in the first season. In the second season, Giza 195 and Giza 531 recorded the highest yield. A significant interaction between sowing dates x varieties and sowing dates x plant distribution patterns was observed on some studied characters, in both seasons. On contrary, varieties X distribution patterns interaction as well as sowing dates X varieties X distributions interaction didn't significantly affect all studied traits.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is self-pollinated, quantitative long day plant and is one of the most widely cultivated cool season food legumes (Davis *et al.*, 1990). Chickpea is an important brain legume crop containing cheap source of protein. Sowing date is an important factor, which affects the timing and duration of the vegetative and reproductive stages, since, environmental factors such as temperature and light differs with varying sowing dates. So, it is very important to determinate date of sowing for chickpea that achieving the optimum limits for these factors in order to get best yields

Results mentioned by many investigators in India revealed increasing in seed yield and its attributes of chickpea sown on first middle of November as compared with early sown (October) or late one (December). Also straw yield decreased with late sown (Dixit *et al.*,1993 ; Gill *et al.*,1993 ; Saini and Faroda,1997; Agrawal *et al.*, 2002).

In Egypt, Bastawisy *et al.* (1999) and Rabeia *et al.* (1999) declared that 10th November planting gave the best values of pods number/plant, seed weight/ plant and seed yield/fad as compared with 25 October and 25 November sowing. Seed index didn't significantly affect by sowing date. Gan *et al.* (2002) in Canada recorded that the early planted chickpea produced

more fertile pods per plant and seed yields than the late-planted chickpea. Anwar *et al.*(2003) in New Zland pointed out that the plant stand differed according to the sowing date, December sowing was about 7% higher than in the November sowing. Number of pods/plant and seed weight/plant was higher in November sowing than December sowing. Landa *et al.* (2004) in Spain reported that an epidemic developing of wilt was earlier and faster as mean temperature increased. The degree of disease control depends primarily upon choice of sowing date.

Also one of the major factors affecting chickpea production is plant distribution patterns. Singh and Singh (1989) in India declared that when chickpea was grown in with 5, 10 or 15 cm between plants within rows, hill spacing of 5 and 10 cm gave higher yields than 15 cm. EL-Batal and Abdel Gawad (1991) reported that 100-seed weight didn't significantly affect by plant distributions. Rabeia and El-warraky(1998) in Egypt reported that number of full pods and seeds/plant, seed yield/plant and 100-seed weight was significantly increased when plants distributed at one side of ridge than at both sides. While number of empty pods/plant, seed and straw yields were significantly increased when plants distributed at both sides of ridge than at one side. Khamees (2000) revealed that the lowest stand loss% was achieved with planting faba bean on two sides of ridge, two plants per hill, 20 cm apart. Radiation interception and utilization assume great importance because its utilization efficiency can be improved through appropriate crop management practices such as canopy architecture, plant distribution patterns and variety. Among these factors, planting geometry is an important factor in which plant distribution patterns play an important role in plant development (Lama *et al.*, 2003).

Many workers in Egypt showed that chickpea cultivars Giza 1, Giza 195 and Giza 531 differ in yield characters (Rabeia and El-Warraky ,1996; Rabeia *et al.*,1999 ;Rabeia and El-Warraky, 1998) . Also Rahhal *et al.* (2000) found that seed yield/plot and seed yield/plant increased greatly in Giza 531 followed by Giza 195 and Giza 1. Nassif (2002) pointed out that chickpea lines were highly significant source of variation for yield components except for number of empty pods/plant.

The objective of this work was studying response of chickpea varieties to some environmental factors (sowing date and plant distribution patterns).

MATERIALS AND METHODS

Two field trials were carried out in the Agric. Exp. St., Fac. Agric., Cairo Univ., Giza, Egypt during 2003/2004 and 2004/2005 growing seasons, to study the effect of four sowing dates and three plant distribution patterns on yield of three chickpea varieties. A split-split plot design in randomize complete blocks design with four replications was used. Four sowing dates of 20 October, 10 November, 30 November and 20 December were assigned to the main plots. The sub-plots were allocated to the three chickpea varieties, Giza 1, Giza 195 and Giza 531.Three distribution patterns were assigned to the sub-sub plots. The examined distribution patterns were as follows:

1- Sowing two plants per hill, 10 cm apart on one side of ridge (D_1)
2- Sowing one plant per hill, 10 cm apart on both sides of ridge (D_2)
3- Sowing two plants per hill, 20 cm apart on both sides of ridge (D_3)

The experimental unit area was 10 m^2 .Thinning toke place after full germination. All cultural practices were carried out as recommended for chickpea production. The meteorological data of the experimental site through the whole period of growing are presented in Table (1).

Table (1):The mean values of air temperature at ten days interval during 2003/ 2004 and2004/2005 seasons.

Periods	Air temperature (°C)					
	2003/2004			2004/2005		
	Max.	Min.	Avg.	Max.	Min.	Avg.
October						
20-31	31.42	17.41	24.44	30.61	19.91	25.29
November						
1-10	28.52	16.22	22.39	31.47	17.32	24.42
11-20	23.01	12.62	17.85	28.57	15.31	22.46
21-30	24.22	12.28	18.28	21.13	7.73	14.45
December						
1-10	22.09	10.46	16.41	22.41	11.53	16.99
11-20	23.71	11.38	17.58	19.06	7.91	13.51
21-31	20.61	7.15	13.91	20.85	6.13	13.56
January						
1-10	19.27	3.94	11.64	18.76	8.41	13.63
11-20	19.4	7.95	13.71	18.85	6.93	12.92
21-31	18.41	7.14	12.8	23.04	7.1	15.02
February						
1-10	19.26	8.06	13.68	17.29	4.39	10.87
11-20	20.13	5. 53	12.84	22.06	6.84	14.48
21-28	26.69	10	18.37	23.36	10.94	17.16
March						
1-10	22.55	12.88	17.73	24.45	12.94	18.71
11-20	20.07	12.38	16.77	20.38	7.75	14.09
21-31	19.94	12.41	16.18	25.46	11.41	18.45
April						
1-10	25.95	14.35	20.17	24.95	10.54	17.78
11-20	30.33	14.83	22.61	30.35	15.21	22.77
21-30	28.45	13.78	21.16	28.75	15.55	22.18
May						
1-10	34.75	25.15	29.99	28.79	14.78	21.8
11-20	31.29	17.04	24.2	33.25	17.71	25.08

Data were obtained from Giza Agronometerological station, Egypt. (Lat 30.30, Lon 31.13 and altitudes 95 m.)

Experimental determinations:

At harvest date, six guarded plants were randomly selected from the central three ridges to estimate:

1- Number of full pods/plant.
2- Empty pods/plant percentage.
3- Number of seeds/plant.
4- Seed index (100-seed weight, g.).
5- Seed yield/plant (g.).

Seed and straw yields ton/fad., were estimated on plot basis. Stand loss percentage was calculated as follows:

[(Plants at thinning - harvested plants)/ Plants at thinning] X 100

The obtained data of each season were statistically analyzed according to (Snedecor and Cochran, 1988). Means were compared using Least Significant Difference (L.S.D) test at 0.05 % level of probability.

RESULTS AND DISCUSSION

1-Effect of sowing date:

As shown in Tables 2 and 3 the highest values of number of full pods, number of seeds/plant and seed yield/plant were obtained from sowing on Nov.10, while the lowest values obtained with late sowing (December, 20), in both seasons. Early planting date Oct.20 exceeded other planting dates in empty pods percentage, in both seasons. Data presented in Tables 2 and 3 indicated that seed index (100 seed weight) wasn't significantly affected by sowing time. It seems that this trait slightly affected by environmental conditions. The reduction in number of full pods/plant with delaying sowing date might be due to the decrease in means of temperature during flowering stage (Table, 1) which adversely affected on vitality of pollen grain and consequently causes a failing of ovules fertilization. Also under late planting, crop faces relatively high temperature during the grain development which resulted in relatively shortening of crop life and forced maturity. While the decreases in number of full pods/plant with Oct.20 sowing date might be due to un favourable weather conditions (hail-storm period during February) prevailed during the crop season was responsible for poor yield under 20 October sowing especially in second season.

These results are supported by the findings of Gill *et al.* (1993) , Dixit *et al.* (1993) , Saini and Faroda (1997),Bastawisy *et al.* (1999), Rabei *et al.*(1999) . Gan *et al.* (2002) and Anwar *et al.* (2003 b).Data presented in Tables 2 and 3 show that medium sowing date (November 10) realized the highest yield/faddan (0.994 and 0.806 ton), followed by November, 30 sowing date (0.616 and 0.651 ton) and October, 20 (0.530 and 0.406 ton) as compared with late sowing date (0.248 and 0.240 ton) for first and second seasons, respectively. This result may be attributed to the superiority of medium sowing (November, 10) in seed yield/plant and its components (as discussed earlier).

The highest straw yield/faddan was obtained from October, 20 sowing followed by November 10 and November 30 as compared with late sowing date in both seasons. Results in Tables 2 and 3 showed clearly that delaying sowing date significantly decreased stand loss percentage. In both seasons, the greatest stand loss percentage was obtained from October, 20 sowing date by (24.80 and 26.51 %), for first and second seasons, respectively. This might be due that high temperatures prevailing during vegetative growth of early-sown chickpea, is optimal for several diseases especially wilt. This adversely affected germination of seeds and stand percentage at harvest. These results are similar to those of Gill *et al.* (1993), Dixit *et al.* (1993), Saini and Faroda (1997), Anwar *et al.* (2003 b) and Landa *et al.* (2004).

2-Effect of plant distribution pattern:

Data in Tables 2 and 3 indicated that maximum number of full pods/plant (in both seasons), number of seeds/plant and seed yield/plant (in first season) resulted with D_1 and D_2 systems which were significantly par. The lowest value obtained from D_3 system. In second season D_2 system surpassed the rest distribution patterns in number of seeds/plant and seed yield/plant (Tables 2 and 3). On the other hand, planting with D_1 recorded the lowest value of empty pods /plant percentage, in both seasons. Seed index didn't significantly influence with distributions. The increase in number of pods/plant as a result for sowing on one side of the ridge may be due to more plant space leading to higher photo synthetic activity/plant, which may result in better pod and seed set. Also, distributing the plants with D_2 system surpassed D_3 one. This may be due to intraspecific competition for edaphic resources in planting two plants/hill as compared with planting one plant/hill.

These results are in harmony with those obtained by EL-Batal and Abdel Gawad (1991) for seed index and also with those of Rabeia (1998) for number of full pods and seeds/plant as well as empty pods percentage and seed yield/plant, but disagreement with Rabeia (1998) for seed index. Data presented in Tables (2 and 3) reveal that D_2 distribution recorded the highest seed yield/faddan (0.642 and 0.547 ton), followed by D_1 system (0.598 and 0.527 ton) as compared with D_3 system (0.578 and 0.504 ton) for first and second seasons, respectively. This result may be attributed to the superiority D_2 distribution with seed yield/plant and its components, especially in second season, (as discussed earlier).It seems that the distribution of chickpea in arrangements that approached uniformity of planting D_1 or D_2 increased seed yield through increasing yield components. Similar results found by Singh and Singh (1989) and Rabeia (1998)

Table (2): Yields and their attributes of chickpea as affected by sowing date, plant distribution pattern and variety in 2003/2004 season.

Factors		Full pods /plant no.	Empty Pods /plant (%)	Seeds /plant no.	100 Seed wt. g.	Seed yield /plant g.	Seed yield /fed. ton.	Straw yield /fed. ton.	Stand loss (%)
Sowing date	Oct.20	26.04 b	44.70 a	26.04 c	19.79 a	5.22 c	0.530 c	2.652 a	24.80 a
	Nov.10	43.85 a	6.60 d	49.87 a	19.89 a	9.73 a	0.994 a	2.187 b	12.13 b
	Nov.30	25.65 b	8.33 c	33.63 b	18.05 a	6.64 b	0.616 b	1.662 c	11.64 c
	Dec.20	14.16 c	11.59 b	16.39 d	19.83 a	3.25 d	0.248 d	1.011 d	8.85 d
Distrib-ution	D_1	28.44 a	16.06 b	32.51 a	19.59 a	6.40 a	0.598 b	1.919 a	14.12 b
	D_2	28.09 a	18.32 a	32.00 a	19.46 a	6.53 a	0.642 a	1.867 b	14.23 b
	D_3	25.55 b	19.03 a	29.94 b	19.12 a	5.71 b	0.578 c	1.847 c	15.11 a
Variety	G1	25.43 b	19.78 a	29.37 c	19.53 b	5.70 c	0.570 c	1.884 a	15.49 a
	G195	28.06 a	16.92 b	32.22 b	18.69 c	6.21 b	0.606 b	1.879 b	14.06 b
	G 531	28.58 a	16.72 b	32.85 a	19.95 a	6.72 a	0.641 a	1.870 c	13.52 c

Means designated with the same letter in the same column aren't significantly different at 0.05 level of probability.

D_1: One side of ridge, two plants per hill, 10 cm apart, D2: Two sides of ridge, one plant per hill, 10 cm apart. D_3: Two sides of ridge, two plants per hill, 20 cm apart.

Table (3): Yields and their attributes of chickpea as affected by sowing date, plant distribution pattern and variety in 2004/2005 season.

Factors		Full pods /plant no.	Empty Pods /plant (%)	Seeds /plant no.	100 Seed wt. g.	Seed yield /plant g.	Seed yield /fed. ton.	Straw yield /fed. ton.	Stand loss (%)
Sowing date	Oct.20	18.64 c	53.51 a	21.70 c	19.37 a	4.41 c	0.406 c	2.329 a	26.51 a
	Nov.10	39.69 a	9.40 c	44.21 a	19.28 a	8.31 a	0.806 a	1.825 b	14.65 b
	Nov.30	27.37 b	7.27 d	34.59 b	18.24 a	6.85 b	0.651 b	1.684 c	12.64 c
	Dec.20	11.33 d	15.32 b	12.67 d	19.22 a	2.69 d	0.240 d	0.902 d	10.99 d
Distrib-ution	D_1	25.45 a	19.33 b	28.78 b	19.34 a	5.64 b	0.527 b	1.726 a	15.97 b
	D_2	25.26 a	22.29 a	29.30 a	19.02 a	5.83 a	0.547 a	1.667 b	15.83 b
	D_3	22.05 b	22.51 a	26.80 c	18.73 a	5.22 c	0.504 c	1.661 b	16.78 a
Variety	G1	22.25 b	24.19 a	26.30 b	19.22 a	5.21 b	0.497 b	1.699 a	17.46 a
	G195	25.30 a	20.51 b	29.15 a	18.52 b	5.74 a	0.545 a	1.664 b	15.47 b
	G 531	25.22 a	19.34 c	29.42 a	19.35 a	5.78 a	0.535 a	1.691 a	15.66 b

Means designated with the same letter in the same column aren't significantly different at 0.05 level of probability

Results presented in Tables (2 and 3) show that the highest straw yield/faddan was obtained from D_1 distribution as compared with D_2 and D_3 systems, in both seasons. However, in second season D_2 and D_3 distributions were significantly par. This result is in disagreement with those of Rabeia (1998). Results in Tables 2 and 3 showed that in both seasons, the greatest stand loss percentage was obtained from D_3 distribution. This result isn't confirmed with those of Khamees (2000) who indicated that the lowest stand loss% obtained with sowing faba bean with two plants/hill, 20 cm apart, on both sides of ridge.

3- Effect of variety:

Data in Tables 2 and 3 indicated that Giza 531 variety significantly surpassed Giza 195 and Giza 1 varieties in seed index, number of seeds/plant and seed yield/plant in first season. The highest number of full pods/plant recorded with Giza 195 and Giza 531 cultivars which were significantly par as compared with Giza 1, in both seasons. Giza 1 and Giza 531 varieties recorded statically equal values for seed index in second season. Giza 195 and Giza 531 recorded statically equal values for number of seeds/plant and seed yield/plant in second season. These results are comparatively in accordance with those of Rabeia *et al.* (1999),Rahhal *et al.* (2000) and Nassif (2002) .

For seed yield/faddan, it is clear that Giza 531 surpassed other varieties in first season, while in second season, the highest seed yield/faddan recorded with Giza 195 and Giza 531 which were significantly par (Tables 2, 3). This may be due to superiority of Giza 531 and Giza 195 varieties in seed yield/plant and its attributes. Regarding straw yield, Giza 1 surpassed other varieties in first season. While in second season, the highest straw yield recorded with Giza 1 and Giza 531 which were significantly par. In both seasons, Giza 1 recorded the highest values of empty pods and stand loss percentage. These results are supported by Rabeia and El-Warraky

(1996), Rabeia *et al.* (1999), Rabeia and El-Warraky (1999), Rahhal *et al.* (2000) and Anwar *et al.* (2003 b) .

4. Effect of interactions:

Regarding effect of interactions, it is rather of interest to note that the insignificant interactions in all studied traits aren't discussed.

4.1. Sowing dates x varieties interaction:

Data in Tables 4 and 5 show the effect of sowing dates x varieties interaction on yields and their attributes. The highest values of number of full pods and seeds/plant as well as seed yield/plant and seed yield/faddan were obtained with sowing Giza 531 on November 10 in first season, while in second season planting either Giza 195 or Giza 531 on November 10 recorded maximum values of these traits. Maximum straw yield was recorded in first season with sowing Giza 195 variety on October 20. However, in second season, straw yield of all varieties were at par with early sowing on October. Maximum empty pods and stand loss percentage obtained from sowing Giza 1 variety on October 20, in both seasons.

Table (4): Yields and their attributes of chickpea as affected by sowing dates and varieties interaction in 2003/2004 season.

Sowing dates	Varieties	Full pods/ plant (no.)	Empty Pods /plant (%)	Seeds /plant (no.)	Seeds / plant (g.)	Seed yield (t/fad.)	Straw yield (t/fad.)	Stand loss (%)
Oct. 20	Giza 1	24.22 g	47.33 a	24.22 i	4.55h	0.500 f	2.674 b	27.23 a
	Giza 195	27.56 d	41.01 c	27.56 g	5.68f	0.561 e	2.693 a	23.11 c
	Giza 531	26.33 f	45.76 b	26.33 h	5.43g	0.530 ef	2.614 c	24.06 b
Nov. 10	Giza 1	41.83 c	7.38 gh	47.74 c	9.20c	0.919 c	2.171 e	12.64 d
	Giza 195	43.95 b	6.69 hi	50.19 b	9.37b	0.973 b	2.171 e	12.23 d
	Giza 531	44.96 a	5.72 i	51.67 a	10.62a	1.091 a	2.219 d	11.51ef
Nov. 30	Giza 1	22.90 h	9.84 f	30.74 f	6.14e	0.599 d	1.666 g	12.20 de
	Giza 195	27.37 de	7.09 gh	35.52 d	6.95d	0.625 d	1.633 h	11.46 f
	Giza 531	26.67 ef	8.08 g	34.64 e	6.84d	0.625 d	1.687 f	11.28 f
Dec. 20	Giza 1	12.75 j	14.58 d	14.79 l	2.91j	0.264 h	1.052 l	9.89 g
	Giza 195	13.38 j	12.89 e	15.60 k	2.86j	0.268 h	1.017 j	9.46 g
	Giza 531	16.35 i	7.31 gh	18.78 j	3.98i	0.320 g	0.962 k	7.22 h

Means designated with the same letter in the same column aren't significantly different at 0.05 level of probability.

4.2. Sowing dates x plant distribution patterns interaction:

As shown from results in Tables 6 and 7, the highest values of number of full pods and seeds/plant as well as seed yield/plant and seed yield/faddan were obtained from sowing chickpea plants on November, 10 with D_2 system in both seasons. The interaction between sowing dates and plant distributions significantly affected straw yield, only in first season. Maximum straw yield recorded with sowing chickpea plants with D_1 system on October, 20. In respect of empty pods percentage and stand loss percentage, sowing crop plants with D_2 system on October, 20 recorded the highest values of these traits, in both seasons (Tables 6, 7).

Varieties X distribution patterns interaction as well as sowing dates X varieties X distributions interaction didn't significantly affect all studied traits.

Table (5): Yields and their attributes of chickpea as affected by sowing dates and varieties interaction in 2004/2005 season.

Sowing dates	Varieties	Full pods/ plant (no.)	Empty pods/ plant (%)	Seeds /plant (no.)	Seeds/ plant (g.)	Seed yield (t/fad.)	Straw yield (t/fad.)	Stand loss (%)
Oct. 20	Giza 1	15.80 g	58.75 a	19.16 h	4.01 g	0.363 g	2.355 a	28.46 a
	Giza 195	21.69 e	47.81 c	24.14 f	4.88 e	0.453 e	2.340 a	24.47 c
	Giza 531	18.44 f	53.97 b	21.81 g	4.35 f	0.404 f	2.29 a	26.59 b
Nov. 10	Giza 1	38.10 b	10.34 e	42.44 b	7.85 b	0.768 b	1.790 bc	16.01 d
	Giza 195	40.53 a	8.93 f	45.08 a	8.55 a	0.826 a	1.804 bc	13.92 e
	Giza 531	40.42 a	8.94 f	45.11 a	8.53 a	0.825 a	1.881 b	14.00 e
Nov. 30	Giza 1	24.84 d	8.74 f	32.36 e	6.48 d	0.627 d	1.686 d	13.97 e
	Giza 195	28.68 c	6.54 g	36.18 c	7.04 c	0.670 c	1.652 d	12.05 f
	Giza 531	28.58 c	6.53 g	35.22 d	7.02 c	0.657 c	1.712 cd	11.89 f
Dec. 20	Giza 1	10.26 i	18.91 d	11.22 j	2.50 i	0.231 h	0.966 e	11.41 f
	Giza 195	10.30 i	18.77 d	11.22 j	2.49 i	0.231 h	0.858 f	11.42 f
	Giza 531	13.43 h	8.28 f	15.56 i	3.06 h	0.259 h	0.881 ef	10.15 g

Means designated with the same letter in the same column aren't significantly different at 0.05 level of probability.

Table (6): Yields and their attributes of chickpea as affected by sowing dates and plant distribution patterns interaction in 2003/2004 season.

Sowing dates	Plant distribution patterns	Full pods/ plant (no.)	Empty pods/ plant (%)	Seeds /plant (no.)	Seeds/ plant (g.)	Seed yield (t/fad.)	Straw yield (t/fad.)	Stand loss (%)
Oct. 20	D_1	28.11 d	41.71 b	28.11 g	5.53 f	0.541 f	2.703 a	24.30b
	D_2	21.44 f	50.40 a	21.44 h	4.56 g	0.506 g	2.655 b	25.80a
	D_3	28.56 d	41.99 b	28.56 g	5.56 f	0.543 f	2.597 c	24.90b
Nov. 10	D_1	43.37 b	6.44 fg	49.58 b	9.61 b	0.933 b	2.214 d	12.72c
	D_2	47.98 a	5.37 g	53.84 a	10.97 a	1.113 a	2.173 e	10.78e
	D_3	39.40 c	7.98 e	46.17 c	8.61 c	0.936 b	2.174 e	12.88c
Nov. 30	D_1	25.66 e	7.48 ef	33.46 e	6.70 e	0.599 d	1.696 f	11.74d
	D_2	29.31 d	6.29 fg	36.85 d	7.52 d	0.683 c	1.656 g	11.10e
	D_3	21.96 f	11.23 d	30.59 f	5.71 f	0.566 e	1.634 h	12.09d
Dec. 20	D_1	16.60 g	8.63 e	18.89 l	3.76 h	0.319 h	1.065 l	7.74g
	D_2	13.61 h	11.23 d	15.85 j	3.05 i	0.266 i	0.983 j	9.22f
	D_3	12.26 h	14.92 c	14.42 k	2.94 i	0.266 i	0.984 j	9.61f

Means designated with the same letter in the same column aren't significantly different at 0.05 level of probability.

Table (7): Yields and their attributes of chickpea as affected by sowing dates and plant distribution patterns interaction in 2004/2005 season.

Sowing dates	Plant distribution patterns	Full pods/ plant (no.)	Empty Pods /plant (%)	Seeds /plant (no.)	Seeds/ plant (g.)	Seed yield (t/fad.)	Stand loss (%)
Oct. 20	D_1	20.44 g	50.04 c	23.16 g	4.54 g	0.418 f	25.91 b
	D_2	15.89 i	58.82 a	18.99 h	4.15 h	0.386 g	27.50 a
	D_3	19.60 h	51.67 b	22.96 g	4.55 g	0.415 f	26.12 b
Nov. 10	D_1	40.81 b	8.89 fg	43.94 b	8.17 b	0.780 b	15.15 c
	D_2	43.72 a	7.83 gh	47.37 a	9.06 a	0.857 a	13.10d e
	D_3	34.53 c	11.49 e	41.34 c	7.69 c	0.782 b	15.69 c
Nov. 30	D_1	27.07 e	6.95 h	34.32 e	6.80 e	0.645 d	12.81 e
	D_2	31.12 d	5.36 i	37.77 d	7.62 d	0.716 c	11.40 f
	D_3	23.90 f	5.91 f	31.68 f	6.13 f	0.593 e	13.70 d
Dec. 20	D_1	13.50 g	11.44 e	15.78 i	3.05 i	0.265 h	10.03 g
	D_2	10.32 k	17.13 d	11.00 j	2.50 j	0.228 i	11.34 f
	D_3	10.17 k	17.39 d	11.22 j	2.51 j	0.227 i	11.60 f

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تأثير ميعاد الزراعة و نظم توزيع النباتات على المحصول في بعض أصناف الحمص

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أجريت تجربتان حقليتان بمحطة التجارب والبحوث الزراعية بكلية الزراعة-جامعة القاهرة-الجيزة-مصر خلال موسمي ٢٠٠٣/٢٠٠٤ و ٢٠٠٤/٢٠٠٥ وذلك بهدف دراسة تأثير أربعة مواعيد للزراعة (٢٠ أكتوبر، ١٠ نوفمبر، ٣٠ نوفمبر و ٢٠ ديسمبر) و ثلاثة توزيعات نباتية على المحصول في ثلاثة أصناف من الحمص (جيزة ١، جيزة ١٩٥ و جيزة ٥٣١). تم توزيع النباتات بثلاث أنظمة للتوزيع كمايلي:

١- نباتين في الجورة، والمسافة بين الجور ١٠ سم على ريشة واحدة من الخط.
٢- نبات واحد في الجورة ، والمسافة بين الجور ١٠ سم على ريشتي الخط.
٣- نباتين في الجورة، والمسافة بين الجور ٢٠ سم على ريشتي الخط. مع العلم بان المسافة ثابتة بين الخطوط (٥٠ سم).

أظهرت النتائج أن موعد الزراعة ١٠ نوفمبر أعطى أعلى قيم للمحصول من الفدان ومكوناته (عدد القرون والبذور/النبات، وزن البذور/النبات)، بينما أقل قيم لهذه الصفات تم الحصول عليها من الزراعة المتأخرة في ديسمبر في كلا الموسمين. كما أوضحت النتائج أن زراعة نبات واحد في الجورة، والمسافة بين الجور ١٠ سم على ريشتي الخط تفوقت على الأنظمة الأخرى في عدد البذور/النبات، وزن البذور/ النبات إضافة إلى محصول الفدان. تفوق الصنف جيزة ٥٣١ على الأصناف الأخرى في محصول البذور في الموسم الأول. في الموسم الثاني أعطى الصنفين جيزة ٥٣١ و جيزة ١٩٥ أعلى محصول بذور.

أظهر تفاعل مواعيد الزراعة والأصناف أو التفاعل المواعيد x التوزيعات النباتية تأثيرات معنوية في بعض الصفات في الموسمين، في حين أن التفاعل بين الأصناف x التوزيعات النباتية أو التفاعل الثلاثي مواعيد الزراعة x الأصناف x التوزيعات النباتية لم يظهر تأثير معنوي على أي من الصفات المدروسة في الموسمين.