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EFFECT OF PLANTING DATE AND PLANT DENSITIES ON COWPEA PRODUCTIVITY GROWING AT NEW VALLEY.

Abd El-Lateef, A.A.*; S.H. Hendawy and M.S. Barsoum***

*** Agronomy Unit, Plant Production Dept., Desert Res. C., Mataria Cairo.**

**** Plant Ecology and Rang Management Dept., Desert Research Center, Mataria Cairo.**

ABSTRACT

Two field experiments were carried out in the Desert Research Center (D.R.C.), Agricultural experimental station at El-Kharga, New Valley Governorate, during two growing seasons of 2005 and 2006, to study the effect of planting dates and plant densities on productivity of cowpea (*Vigna Sinensis* L., cv. Kareem 7). The soil texture was sandy clay loam containing 2.04 % organic matter, pH 8.3 and EC 4.4 dS/ m. Underground water was the source of irrigation its pH was 7.3 and EC 1.08 dS/ m. **Combined analysis of the two seasons data showed the follows:**

1- Planting on 15 March as well as the density of 224000 plants / fed. each gave the highest significant values in plant height, number of branches / plant, fresh and dry weight / plant, fresh and dry forage yield/fed, number of pods / plant, number of seeds / plant, seed weight / pod, 100-seed weight, biological yield, seed yield, straw yield and chemical composition such as, nitrogen, phosphorus, potassium, total carbohydrate, crude protein contents and TDN % in seeds and straw of cowpea plants.

2- The interaction between planting date and plant density had a significant effect on plant height, number of branches / plant, fresh and dry weight / plant, fresh and dry forage yield/fed, number of pods / plant, number of seeds / plant, seed weight / pod, 100-seed weight, biological yield, seed yield and straw yield. The highest values were obtained by planting on 15 March with the density of 224000 plants / fed. while the reverse were obtained by planting on 15 February with 84000 plants / fed. Planting on 15 March increased all chemical characters i.e., nitrogen, phosphorus, potassium, total carbohydrate and crude protein contents of cowpea plants under planting density of 224000 plants / fed., except TDN % of straw which gave the highest value by planting in 1st March with 224000 plant / fed.

INTRODUCTION

There are some promising newly reclaimed lands in Egypt. In this respect, one of the most suitable location is the Oasis of New Valley region (Located at the Western Desert of Egypt), which represents large land resources and a good hope for agriculture expansion. In this region, weather is hot and dry, and cultivation depends mainly on under ground water from wells, so agriculture expansion in this case needs of special managements for better use of land and water resources.

The demand for summer forage crops of good quality for livestock has increased vigorously in recent years. In this respect, cowpea is on of the promising summer annual legume forage crop. It is well adapted to a wide range of ecological conditions and can produce better forage yield under unfavourable conditions in the newly reclaimed soils. Such soils may adversely affected the availability of some mineral nutrients to the grown crops. In this respect Ali, *et al.,* (1997) and Badr, *et al.,*(1998) mentioned that to cultivate this crop in the reclaimed lands like New Valley must define planting dates that play an important role in the productivity of cowpea crop,

the suitable selection of sowing dates reflect on forage (fresh and dry) and yield characters as a results of increasing the utilization efficiency from the environmental factors. Thus, by using this plants, the same pervious views were detected by Enyl (1974), Kamara and Aggrey (1979), Ofori and Stern (1987), lion (1988) and Bonny and Williams (1992).

It is worth noticing that determining of the optimal plant density that achieves the minimal intra-specific competition is essential to maximize the usage of water and nutrients per land unit area resulting in increasing productivity under these conditions. Plant density at 224000 plants / fed. gave the highest growth and yield of cowpea plants as compared with the 84000 plants / fed. Some investigators found that growth and yields of cowpea plants were higher at lower densities [Cabrido and Verzosa (1980), Remison (1980), Rees (1986), Bucag (1987), Ohler *et al.* (1996) and Craufurd (2000).]

The objective of this investigation is to determine the suitable planting date and plant density to produce optimum cowpea production under New Valley conditions.

MATERIALS AND METHODS

Two field experiments were carried out in the Desert Research Center (DRC), Agricultural experimental station at El-Kharga Oasis (30.53 longitude, 25.45 latitude and elevation 78.8), New Valley Governorate, during the two summer growing seasons of 2005 and 2006. The soil texture of the site was sandy clay-loam containing 2.04 % organic matter, pH 8.3 and EC 4.4 dS/m. Mechanical and chemical analysis of the experimental soil is shown in Table (1)). The soil analysis were carried out according to Jackson (1970).

Each experiment included twenty four treatments, which were the combinations of four planting date (15 Feb, 1st March, 15 March and 1st April) as well as six plant densities, i.e. 84000 (20cm between hills and one plant in hill, 20 plants/m^2), 112000 (15cm between hills and one plant in hill, 26.7 plants/m^2), 168000 (10cm between hills and one plant in hill), 168000 (20cm between hills and two plants in hill), 336000 (10cm between hills and two plants in hill, 80 plants/m^2) and 224000 (15cm between hills and two plants in hill, 53.3 plants/m^2).

The experiment was laid out in a split plot design with six replicates. The main plots were assigned for planting date and the sub plots were devoted to plant density treatments. Each experimental unit area was 10.5 m^2 (3 x 3.5 m) having 5 rows of 3.5 length and 40 cm width. Cowpea cultivar was Kareem 7. Seeding was done by drilling on different plant date in 2005 and 2006 seasons .Cowpea seeds were inoculated with the specific strais of nodule bacteria just before planting. The plants were thinned, 20 days after planting.

The first cut was taken from three replicates after 60 days and the second cut after 105 days from planting in both seasons. The following characters were recorded from 10 plants (random samples) i.e. plant height (cm), number of branches / plant, number of leaves / plant, fresh and dry weight (g) of plants. Fresh and dry forage yields were calculated from the whole plot (ton / fed).

At 105 days from planting, the following data were recorded from ten plants (at random) i.e., pod length (cm), number of pods and seeds / plant and 100-seed weight (g). Seed, straw and biological yields (Kg/fed.) were calculated from the yield of the whole plot. The chemical composition was also determined in seeds and straw at 105 days from sowing. Nitrogen percentage (N %) was determined by the method described by Koch and McMeehen (1924). Phosphorus percentage (P %) was determined as reported by Frei *et al.* (1964), using colorimetric determination with ascorbic acid. Potassium percentage (K %) was determined as described by Brown and Lilliand (1964) using flame photometer. Total carbohydrate content was determined according to the method described by Dubois *et al.* (1951). Total digestible nutrients (TDN) was estimated by using the following equations:

TDN % =74.43 + 0.35 crude protein (CP) % - 0.73 crude fiber (CF) % according to Adams *et al.* (1964).

Statistical analysis was done according to McIntosh (1986) The treatment means were compared using the least significant difference (L.S.D.) at the level of 5 % significance.

Table (1): Physical and chemical analysis of El-Kharga soil.

Mechanical analysis			
Sandy	51 %	Soil texture: sandy clay loam	
Clay	30.4 %		
Silt	18.1 %		
Chemical analysis			
Ph	8.32		
EC dS/m.	4.4		
Cations (meq/l)		Anions (meq/l)	
Ca^{++}	4.08	Co_3^-	0.00
Mg^{++}	3.25	Hco_3^-	1.27
K^+	1.66	Cl^-	1.84
Na^+	15.79	$So_4^=$	5.53

RESULTS AND DISCUSSION

A- Growth characters:

1-Effect of planting date:

Results presented in Table (2) indicated clearly that planting in 15 March showed the highest significant increase in plant height, number of branches / plant, fresh and dry weight / plant and green and dry forage yields of cowpea plants in the first and second cuts by using combined analysis of 2005 and 2006 growing seasons as compared with the other three planting dates. This increment in growth characters could be due to that 15 March planting date was more favor to plant growth. Similar results were obtained by lion (1988), Bonny and Williams (1992), Sangakkara (1998), Muoneke *et al.* (2008) and Bensen and Temple (2008).

2- Effect of plant density:

Data illustrated in Table (2) show that increasing plant density from 84000 to 224000 plants / fed. caused gradually increasing in plant height, number of branches / plant, fresh and dry weight / plant and green and dry forage yield of

cowpea plants in the first and second cuts (combined analysis of 2005 and 2006 growing seasons). Therefore, 224000 plants / fed. gave the highest values of all growth characters. These results may be attributed to the intra-plant competition on nutrient and radiation. Many investigators found similar results Cabrido and Verzosa (1980), Rees (1986), Bucag (1987) and Njoku and Muoneke (2008) who found that increasing plant density increased growth and yield of cowpea .

Table (2): Effect of planting date and plant densities on growth characters of cowpea plants (Combined analysis of 2005 and 2006 growing seasons)

Characters	Plant height (cm)	No. of branches / plant	Fresh weight / plant (g)	Dry weight / plant (g)	Green forage yield (ton / fed.)	Dry forage yield (ton / fed.)
First cut after 60 days from planting						
Planting date						
15 Feb.	78.67	9.24	59.66	19.28	6.18	2.23
1 March	83.15	9.87	68.15	21.31	6.78	2.41
15 March	94.28	10.14	98.49	27.73	7.86	2.75
1 April	84.28	9.57	78.85	22.87	6.82	2.47
L.S.D.	5.08	0.41	12.67	3.02	0.42	0.09
Plant density						
B1	64.57	6.87	56.72	18.28	5.61	1.94
B2	70.09	7.93	70.18	20.93	5.82	2.08
B3	73.39	8.84	84.28	23.71	6.73	2.31
B4	82.14	9.32	85.28	24.22	6.94	2.43
B5	85.11	9.80	92.66	26.71	7.41	2.57
B6	93.10	10.08	94.28	27.83	7.98	2.78
L.S.D.	7.12	2.15	15.22	3.14	0.41	0.19
Second cut after 105 days from planting						
Planting date						
15 Feb.	82.19	9.08	60.56	21.16	6.11	2.35
1 March	86.83	9.28	84.64	25.21	6.63	2.54
15 March	96.17	10.31	97.08	27.33	7.58	2.88
1 April	87.58	9.71	87.27	24.85	6.78	2.60
L.S.D.	5.47	0.51	19.22	3.98	0.44	0.03
Plant density						
B1	65.54	6.82	60.12	19.60	5.32	2.03
B2	72.23	7.68	71.14	20.82	5.77	2.22
B3	76.44	8.73	77.99	22.80	6.49	2.46
B4	84.28	9.40	87.18	24.62	6.94	2.68
B5	86.37	9.95	93.28	26.04	7.14	2.76
B6	94.58	10.42	95.77	27.33	7.58	2.89
L.S.D.	8.34	2.94	22.24	2.28	0.42	0.19

B1= 84000 plant / fed. B2= 112000 plant / fed. B3= 168000plant / fed.
B4= 168000 plant / fed. B5= 336000 plant / fed. B6= 224000 plant / fed.

3- Effect of interaction between planting date and plant density:

Results in Table (3) indicated that growth parameters, i.e. plant height, number of branches / plant, fresh and dry weight / plant and green and dry forage yield of

cowpea plants/fed at El-Kharga Oasis were significantly affected by the interaction between planting date and plant density treatments at the first and second cuts (combined analysis of 2005 and 2006 growing seasons). Planting date at 15 March with planting densities at 224000 plant / fed. increased significant all growth characters of cowpea plants in both cuts.

Table (3): Effect of the interaction between planting date and plant densities on growth characters of cowpea plants (Combined analysis of 2005 and 2006 growing seasons)

		First cut after 60 days from planting						Second cut after 105 days from planting					
A	B	Plant height (cm)	No. of branches / plant	Fresh weight / plant (g)	Dry weight / plant (g)	Green forage yield (ton / fed.)	Dry forage yield (ton / fed.)	Plant height (cm)	No. of branches / plant	Fresh weight / plant (g)	Dry weight / plant (g)	Green forage yield (ton / fed.)	Dry forage yield (ton / fed.)
A1	B1	65.19	6.57	46.72	13.46	4.86	1.67	67.09	6.82	55.98	16.13	4.31	1.65
	B2	64.82	7.53	49.70	14.32	4.98	1.71	70.68	7.48	57.77	16.64	4.52	1.74
	B3	67.17	7.22	53.82	15.51	5.41	1.86	73.18	8.53	60.22	17.35	5.43	2.08
	B4	71.06	8.59	61.58	17.74	5.78	1.99	77.13	8.69	67.57	19.47	5.83	2.24
	B5	76.08	9.28	66.17	19.06	5.91	2.04	81.23	9.79	70.72	20.37	5.91	2.28
	B6	79.92	9.82	67.81	19.54	6.58	2.27	83.15	9 94	71.59	22.68	6.42	2.46
A2	B1	68.68	6.73	55.08	15.85	5.61	1.93	66.14	6.73	69.62	19.37	5.17	1.98
	B2	71.25	7.66	60.52	17.45	5.89	2.03	74.38	6.94	74.64	21.51	5.46	2.11
	B3	74.38	8.17	65.78	18.95	6.21	2.14	78.39	7.85	77.69	22.38	5.87	2.25
	B4	78.97	8.38	68.15	19.63	6.48	2.26	80.92	8.57	80.79	23.84	6.18	2.38
	B5	81.11	9.24	71.17	20.51	6.81	2.35	85.17	9.64	86.85	25.02	6.53	2.53
	B6	85.39	9.79	74.53	21.47	7.31	2.52	88.12	10.42	89.28	26.07	6.74	2.59
A3	B1	70.85	7.53	66.75	19.23	5.51	1.92	75.49	7.22	70.22	20.23	5.48	2.18
	B2	74.25	8.72	72.71	20.95	5.83	2.01	80.48	8.93	75.67	21.81	5.81	2.23
	B3	79.88	9.57	83.13	23.92	6.92	2.38	84.17	9.14	81.52	23.49	6.32	2.43
	B4	88.07	9.88	88.24	25.42	6.99	2.42	92.02	9.84	87.33	25.15	6.85	2.65
	B5	90.14	10.17	94.35	27.19	7.35	2.54	93.48	10.18	93.38	26.91	7.23	2.78
	B6	96.12	10.52	98.80	28.70	7.89	2.77	97.63	10.62	96.67	27.85	7.58	2.98
A4	B1	65.75	7.60	57.37	16.53	5.52	1.89	67.17	7.65	65.56	18.89	5.38	2.06
	B2	71.28	8.43	62.71	18.07	5.78	1.99	74.06	7.81	73.78	21.26	5.63	2.16
	B3	74.73	8.77	66.82	19.25	6.28	2.16	76.21	8.36	77.67	22.28	5.78	2.25
	B4	78.05	9.63	71.93	20.72	6.57	2.27	79.85	9.64	82.52	23.79	6.37	2.45
	B5	81.79	9.98	75.69	21.83	6.84	2.39	86.27	9.82	84.73	24.41	6.68	2.55
	B6	86.08	10.12	82.52	23.80	7.22	2.51	89.21	10.18	89.82	25.88	6.73	2.59
L.S.D.		4.28	1.08	5.12	2.90	0.86	0.18	4.07	1.12	5.20	2.85	0.90	0.27

A= Planting date B= Plant densities A1= 15 Feb. A2= 1 March
A3= 15 March A4= 1 April

B- Yield and its components:

1-Effect of planting date:

Data given in Table (4) showed that planting in 15 March had a remarkable increases in number of pods / plant, number of seeds / plant, seed weight / pod, 100-seed weight, biological yield, seed yield and straw yield of cowpea /fed as compared with planting on 1st April, 1st March and 15 February in the combined the two studied seasons. The obtained highest yield at 15 March planting might be attributed to the favorable climatic conditions prevailing during this planting date which was reflected on the stimulation of plant growth. Many investigators found similar results, Kamara (1981) on cowpea, found that pod number and seed yield of cowpea planted in early date were

significantly greater than from other planting dates. While, Ezueh (1982) mentioned that dry grain yield of cowpea plants was higher in the early planting season but quality of harvested crop was better in the late season. On the other hand, Bensen and Temple (2008) on cowpea, showed that early-planted plots yielded less seed in the first year and more seed in the second year than late-planted plots.

2- Effect of plant density:

The data presented in Table (4) showed that the highest values of number of pods / plant, number of seeds / plant, seed weight / pod, 100-seed weight, biological yield, seed yield and straw yield of cowpea / fed were obtained by plant density of 224000 plants / fed., while the lowest values of yield and its components were obtained by 84000 plant / fed. The difference between planting densities treatments were significant (combined analysis of 2005 and 2006 growing seasons). Moreover, density of 224000 plants / fed. gave the highest values of yield and its components of cowpea plants compared with the other plant densities. These results tended to the true that increasing plant density caused decreases the light efficient to photosynthesis, since the plant become tallest to opium the efficient light to photosynthesis produce. These results are in agreement with those obtained by Cabrido and Verzosa (1980), Rees (1986), Bucag (1987), Ohler *et al.* (1996), Ezumah and Lkeorgu (2008) and Njoku and Muoneke (2008).

Table (4): Effect of planting date and plant densities on yield and its components of cowpea plants (Combined analysis of 2005 and 2006 growing seasons)

Characters	No. of pods / plant	No. of seeds / plant	Seed weight / pod (g)	100-seed weight (g)	Biological yield (kg/fed.)	Seed yield (kg/fed.)	Straw yield (kg/fed.)
Planting date							
15 Feb.	13.94	128.58	1.95	16.12	2044.5	357.2	1587.3
1 March	14.22	134.71	2.07	16.45	2121.4	462.3	1659.2
15 March	15.68	154.18	2.14	18.52	2384.6	485.9	18.98.5
1 April	14.65	129.62	2.09	16.80	2221.9	468.1	1753.8
L.S.D.	1.08	6.59	0.08	0.95	78.5	27.1	49.0
plant density							
B1	12.11	118.57	1.21	10.13	1858.4	400.2	1458.2
B2	12.98	129.17	1.34	11.58	1966.9	423.7	1543.3
B3	13.75	139.45	1.73	13.91	2083.5	438.5	1645.0
B4	14.57	144.18	2.11	15.62	2201.6	462.1	1738.5
B5	15.07	152.92	2.17	17.52	2294.8	472.2	1822.2
B6	15.84	157.82	2.23	18.05	2372.3	484.6	1880.0
L.S.D.	1.14	8.94	0.27	2.26	94.1	16.3	101.0

3- Effect of the interaction between planting date and plant density:

Table (5) indicate that the interaction between planting date and plant density had a significant effected on number of pods / plant, number of seeds / plant, seed weight / pod, 100-seed weight, biological yield, seed yield and straw yield of cowpea / fed.. The highest and the lowest values of yield and its components were obtained by planting on 15 March with density of 224000 plants / fed and planting on 15 February under 84000 plants / fed., respectively. Similar results were obtained by Ofori and Stern (1987).

Table (5): Effect of the interaction between planting date and plant densities on yield and its components of cowpea plants (Combined analysis of 2005 and 2006 growing seasons).

Characters / Treatments		No. of pods / plant	No. of seeds / plant	Seed weight / pod (g)	100-seed weight (g)	Biological yield (kg/fed.)	Seed yield (kg/fed.)	Straw yield (kg/fed.)
A1	B1	11.24	94.68	0.921	9.12	1676.2	382.5	1293.7
	B2	11.64	103.31	1.084	10.47	1703.1	391.9	1311.2
	B3	12.47	113.11	1.285	11.59	1821.6	407.5	1414.1
	B4	12.56	119.83	1.375	12.93	1875.5	417.3	1458.3
	B5	13.78	127.02	1.858	14.78	1970.7	440.5	1530.0
	B6	14.02	138.11	2.014	16.42	2136.1	457.6	1678.4
A2	B1	11.75	115.35	1.143	10.11	1799.9	390.2	1409.7
	B2	11.98	127.45	1.394	11.21	1865.3	397.0	1468.2
	B3	12.73	130.73	1.602	13.24	1901.9	412.4	1488.6
	B4	13.24	132.85	1.914	15.08	1976.4	433.5	1542.9
	B5	13.74	140.52	2.085	16.17	2032.8	448.3	1584.1
	B6	14.41	144.73	2.178	16.66	2136.9	468.6	1668.3
A3	B1	12.57	118.97	1.483	10.31	1867.6	401.3	1467.0
	B2	12.83	131.28	1.572	11.91	1991.3	425.3	1566.9
	B3	13.95	140.07	1.782	14.53	2125.2	440.7	1684.5
	B4	14.76	145.18	2.089	16.85	2211.6	462.2	1748.8
	B5	15.48	154.28	2.204	17.62	2268.7	475.9	1794.4
	B6	15.88	159.02	2.413	18.61	2411.2	492.5	1918.5
A4	B1	12.12	111.02	1.184	9.81	1811.4	392.8	1418.6
	B2	12.94	119.28	1.388	11.34	1924.0	405.3	1528.2
	B3	13.71	124.73	1.583	13.42	2034.3	426.4	1607.9
	B4	14.09	140.83	1.822	14.75	2083.9	431.2	1652.4
	B5	14.56	144.75	2.102	15.75	2148.3	453.7	1694.7
	B6	14.89	147.16	2.188	16.51	2242.5	476.6	1766.3
L.S.D.		1.89	6.15	0.432	2.31	95.2	17.2	103.1

C- Chemical composition:

1-Effect of planting date:

Results in Tables (6&7) indicated that the highest nitrogen, phosphorus, potassium, total carbohydrate and crude protein contents in seeds and straw of cowpea plants were obtained when planting was carried out on 15 March. Moreover, the difference between the treatments of planting dates was significant. The lowest content of all chemical characters were observed by planting on 15 February. On the other hand, the highest value of TDN % was recorded with planted of cowpea as 15 March and 1st March, respectively. This result may be due to that the microclimate in 15 March was more suitable for plants to accumulate nitrogen, phosphorus, potassium, total carbohydrate , crude protein contents and TDN % in cowpea plants. Similar result was reported by Hafez (2005).

2- Effect of plant density:

It is obvious from the data presented in Tables (6&7) that increasing plant density up to 224000 plants / fed. significantly by increased nitrogen, phosphorus, potassium, total carbohydrate, crude protein contents and TDN % in seeds and straw of cowpea plants. The highest values were recorded by 224000 plants / fed. treatment, whereas the lowest one was obtained in case of 84000 plant / fed. (combined analysis of 2005 and 2006 growing seasons). These results are in agreement with those found by Ahlawat and Saraf (1981) who noticed

that total nitrogen increased with increasing plant density of pigeon pea (*Cajanus cajan L.* Mill. Sp). In the reverse, El-Hossini (1990) pointed out that crude protein and carbohydrate percentage of leaves and stem of pigeon pea were not influenced with widening distance between hills except in the first cut for crude protein percentage of leaves.

Table (6): Effect of planting date and plant densities on chemical composition in seeds of cowpea plants (Combined analysis of 2005 and 2006 growing seasons).

Characters	Nitrogen content (N %)	Phosphorus content (P %)	Potassium content (K %)	Total carbohydrate content (%)	Crude protein content (%)	TDN (%)
Planting date						
15 Fab.	3.86	0.779	2.33	31.81	23.87	84.40
1 March	3.96	0.792	2.49	31.85	24.62	85.26
15 March	4.18	0.849	2.78	32.14	26.12	86.07
1 April	3.89	0.781	2.64	31.98	24.31	84.80
L.S.D.	0.16	0.094	0.151	0.01	1.87	0.98
plant density						
B1	3.44	0.532	1.83	27.73	21.50	83.84
B2	3.70	0.589	1.97	28.17	23.12	84.48
B3	3.87	0.626	2.22	29.28	24.18	84.92
B4	4.02	0.693	2.42	30.47	25.03	85.38
B5	4.11	0.758	2.63	31.15	25.62	85.87
B6	4.26	0.842	2.81	31.87	26.37	86.31
L.S.D.	0.21	0.184	0.176	2.65	3.18	0.92

TDN = Total digestible nutrients

Table (7): Effect of planting date and plant densities on chemical composition in straw of cowpea plants (Combined analysis of 2005 and 2006 growing seasons).

Characters	Nitrogen content (N %)	Phosphorus content (P %)	Potassium content (K %)	Total carbohydrate content %	Crude protein content %	TDN %
Planting date						
15 Fab.	2.27	0.788	1.44	20.66	14.21	57.84
1 March	2.57	0.885	1.55	21.52	16.04	57.89
15 March	2.70	1.027	1.82	22.69	16.85	57.32
1 April	2.37	0.821	1.68	21.80	14.82	57.26
L.S.D.	0.01	0.007	0.02	0.02	0.04	0.11
Plant density						
B1	2.30	0.710	1.40	21.47	14.36	57.28
B2	2.37	0.764	1.48	21.47	14.79	57.49
B3	2.42	0.827	1.54	21.55	15.15	57.56
B4	2.51	0.907	1.69	21.69	15.68	57.64
B5	2.57	0.997	1.76	21.81	16.08	57.69
B6	2.69	1.077	1.86	22.00	16.82	57.81
L.S.D.	0.01	0.006	0.01	0.02	0.07	0.11

3- Effect of interaction between planting date and plant density:

The data presented in Tables (8&9) showed that chemical composition, i.e. nitrogen, phosphorus, potassium, total carbohydrate and crude protein contents in seeds

and straw of cowpea plants were significantly affected by the interaction between planting date and plant density treatments. Planting date at 15 March with planting densities at 224000 plants / fed. interaction treatment, increased all chemical characters of cowpea plants except TDN % of straw which gave the highest value by planting on1st March with density of 224000 plant / fed. However, the lowest values of nitrogen, phosphorus, potassium, total carbohydrate and crude protein contents in seeds and straw of cowpea were obtained by planted cowpea on 15 February with 84000 plants / fed. While TDN % in seeds and straw gave the lowest values by planting on 15 February and 1st April with 84000 plants / fed., respectively.

Table (8): Effect of the interaction between planting date and plant densities on chemical composition in seeds of cowpea plants (Combined analysis of 2005 and 2006 growing seasons).

Characters / Treatments		Nitrogen content (N %)	Phosphorus content (P %)	Potassium content (K %)	Total carbohydrate content (%)	Crude protein content (%)	TDN (%)
A1	B1	3.34	0.463	1.85	26.93	20.87	83.31
	B2	3.47	0.519	1.92	27.47	21.68	83.85
	B3	3.56	0.602	2.24	28.60	22.25	84.19
	B4	3.67	0.662	2.35	29.65	22.53	84.52
	B5	3.74	0.738	2.54	30.64	23.37	85.11
	B6	3.79	0.785	2.63	31.85	23.62	85.43
A2	B1	3.45	0.482	1.92	27.47	21.56	84.05
	B2	3.56	0.554	1.96	28.34	22.25	84.59
	B3	3.66	0.609	2.05	29.42	22.81	85.00
	B4	3.79	0.646	2.31	30.28	23.59	85.58
	B5	3.85	0.726	2.46	31.22	24.01	85.98
	B6	3.96	0.786	2.63	31.89	24.57	86.36
A3	B1	3.43	0.534	1.88	27.68	21.43	84.30
	B2	3.79	0.584	1.97	29.37	23.68	85.36
	B3	3.91	0.627	2.27	30.30	24.43	85.91
	B4	4.03	0.695	2.43	31.10	25.18	86.47
	B5	4.17	0.755	2.65	31.75	25.75	86.88
	B6	4.28	0.853	2.89	32.08	26.62	87.50
A4	B1	3.43	0.486	1.86	27.33	21.44	83.71
	B2	3.58	0.551	2.09	28.22	22.19	84.13
	B3	3.67	0.624	2.27	29.70	22.53	84.58
	B4	3.78	0.668	2.48	30.53	22.89	84.94
	B5	3.85	0.734	2.57	31.19	23.57	85.50
	B6	3.94	0.783	2.73	31.93	24.18	85.95
L.S.D.		0.25	0.192	0.19	3.28	4.56	N.S

Table (9): Effect of the interaction between planting date and plant densities on chemical composition in straw of cowpea plants (Combined analysis of 2005 and 2006 growing seasons).

Characters / Treatments		Nitrogen content (N %)	Phosphorus content (P %)	Potassium content (K %)	Total carbohydrate content (%)	Crude protein content (%)	TDN (%)
A1	B1	2.10	0.615	1.22	20.34	13.15	57.50
	B2	2.16	0.658	1.31	20.47	13.48	57.76
	B3	2.24	0.767	1.35	20.53	14.02	57.91
	B4	2.33	0.804	1.50	20.71	14.56	57.96
	B5	2.35	0.902	1.58	20.86	14.69	57.90
	B6	2.46	0.983	1.66	21.02	15.38	58.03
A2	B1	2.42	0.700	1.33	21.26	15.13	57.76
	B2	2.49	0.742	1.38	21.37	15.54	57.83
	B3	2.51	0.804	1.51	21.43	15.71	57.84
	B4	2.57	0.962	1.62	21.54	16.06	57.88
	B5	2.66	0.995	1.67	21.66	16.61	57.99
	B6	2.75	1.110	1.78	21.84	17.19	58.06
A3	B1	2.47	0.879	1.60	22.52	15.46	56.96
	B2	2.56	0.955	1.67	22.55	16.02	57.12
	B3	2.60	0.973	1.71	22.63	16.23	57.14
	B4	2.73	1.002	1.91	22.70	17.06	57.39
	B5	2.82	1.127	1.99	22.75	17.65	57.56
	B6	2.98	1.224	2.06	22.98	18.65	57.74
A4	B1	2.19	0.646	1.46	21.75	13.69	56.90
	B2	2.26	0.701	1.54	21.48	14.13	57.25
	B3	2.34	0.765	1.60	21.59	14.65	57.35
	B4	2.40	0.860	1.74	21.82	15.02	57.32
	B5	2.46	0.965	1.81	21.98	15.36	57.31
	B6	2.57	0.990	1.95	22.18	16.06	57.42
L.S.D.		0.02	0.012	0.03	0.04	0.13	0.22

REFERENCES

Adams, R.S.; Moore, J.H., Kesler E.M. and Stevens, G.Z. (1964). New relationships for estimating TDN content of forage from chemical composition. J. Dairy Sci, 47: 1461.

Ahlawat, I.P.S. and Saraf, C.S. (1981): Response of pigeon pea (*Cajanus cajan L. Mill.* Sp.) to plant density and phosphorus fertilizer under dry land conditions. J. of Agric. Sci., Uk. 97 (1): 119-124.

Ali, E.A.; El-Douby, K.A. and Youssef, M.S. (1997). Effect of phosphorus levels on forage yield of berseem and barley mixture. Ann. Agric. Sci., Moshtohor, 35 (1): 159-170.

Badr, A.M.; El-Sheikh, F.T.; Barsoum, M.S. and Abd El-Lateef, A.A. (1998). Response of cowpea (Vigna *sinensis*, L.) grown on a calcarous soil to N,P,K fertilization. Proc. 8 th Conf. Agron., Suez Canal, Univ. Ismailia, Egypt, 28-29 Nov. 1998.

Bensen, T.A. and Temple, S.R. (2008). Trap cropping, planting date, and cowpea variety as potential elements of an integrated pest management strategy for *Lygus hesperus* in blackeyed cowpea. Crop Protection, 27 (10): 1343-1353.

Bonny, R.N. and Williams, J.H. (1992). Response of cowpea cultivars to planting pattern and date of sowing in intercrops with pearl millet in Niger. Experiments Agric., 28: 41-48.

Brown, J.D. and Lilliland, O. (1964). Rapid determination of potassium and sodium in plant material and soil extracts by flame photometry. Proc. Amer. Soc. Hort. Sci., 48: 341-346.

Bucag, M.T. (1987). Growth and yield response of cowpea to different planting distances and farm manure. Agris Repository Search Results. 4 (1 &2): 60-65.

Cabrido, D.V. and Verzosa, J.C. (1980). The growth and yield response of cowpea to varying distances of planting under Dasol (Parnassian, Philippines) conditions. Plant Physiology and Biochemistry. 2 (3): 215-220.

Craufurd, P.Q. (2000). Effect of plant density on the yield of sorghum, cowpea and pearl millet-cowpea intercrops in Northern Nigeria. Experimental Agric., 36: 379-395.

Dubois, M.; Gilles, K.; Hamelton, J.K.; Rebers, P.A. and Smith, F. (1951). A colorimetric method for the determination of sugars. Nature, 168-176.

El-Hossini, A.A.M. (1990): Studies of *Cajanus cajan* as a forage crop under the north western coast of Egypt conditions. M. Sci Thesis, Fac. Agric., Ain Shams Univ., Cairo, Egypt.

Enyl, B.A.C. (1974). Effect of time sowing and phosphamidon (dihedron) on cowpea (*Vigna unguiculata*). Experiments Agric., 10: 87-95.

Ezueh, M.I. (1982). Effect of planting dates on pest infestation, yield and harvest quality of cowpea (*Vigna unguiculata*). Experiments Agric., 18: 311-318.

Ezumah. H.C. and Lkeorgu, J.E.G. (2008). Population and planting pattern effects on intercropped maize and cowpea. J. of agron. and crop Sci., 170 (3): 187-194.

Frie, E.; Payer, K. and Schutz, E. (1964). Determination of phosphorus by ascorbic acid method, Schw. Landwirisch-forshung. Helt., 3: 318-328.

Hafez, M.R. (2005). Studies on productivity, quality and storability of jerusalem artichoke (*Helianthus tuberosus* L.) under North Sinai conditions. Ph.D. Thesis. Fac. Agric., Ain Shams Univ.

Jackson, M.L. (1970). "Soil Chemical Analysis" The Eng. Long Book Soc. New Delhi, India.

Kamara, C.S. (1981). Effect of planting date and mulching on cowpea in Sierra leone. . Experiments Agric., 17: 25-31.

Kamara, C.S. and Aggrey, W.G. (1979). Time of planting, rainfall and moisture effect on cowpea in Sierra leone. Experiments Agric., 15: 315-320.

Koch, F.C. and Mc-Meeken, T.L. (1924). The chemical analysis of food products. J. amr. Chem. Sco., 46: 2066.

Lion, I. (1988). Growth and yield performance of cowpea as influenced by the time of pruning and rate of planting. Agris Repository Search Results. 10 (2): p.23.

McIntosh, M.S.C. (1986). Analysis of combined experiments. Agron. J. 75: 153-155.

Muoneke, C.O.; Asiegbu, J.E.A. and Udeogalanya, C.C. (2008). Effect of Relative Sowing Time on the Growth and Yield of the Component Crops in Okra/Maize and Okra/Cowpea Intercropping Systems. J. of agron. and crop Sci., 179 (3): 179-185.

Njoku, D.N. and Muoneke, C.O. (2008). Effect of cowpea planting density on growth, yield and productivity of component crops in cowpea/cassava intercropping system. *Agro-Science*. 7 (2): 106-113.

Ofori, F. and Stern, W.R. (1987). Relative sowing time and density of component crops in a maize/cowpea intercrop system. Experiments Agric., 23: 41-52.

Ohler, T.A.; Nielsen, S.S. and Mitchell, C.A. (1996). Varying plant density and harvest time to optimize cowpea leaf yield and nutrient content. Agris Repository Search Results. 31 (2): 193-197.
Rees, D.J. (1986). The effect of density and intercropping with cowpea on the water use and growth of sorghum in semi-arid conditions in Botswana. Agris Repository Search Results. 37 (4): 293-308.
Remison, S.U. (1980). Varietal response of cowpea to a range of densities in a forest zone. Experiments Agric., 16: 201-205.
Sangakkara, U.R. (1998). Growth and yields of cowpea (*Vigna unguiculata* (L.) Walp) as influenced by seed characters, soil moisture and season of planting. J. of agron. and crop Sci., 180: 137-142.

تأثير ميعاد الزراعة والكثافة النباتية على إنتاجية لوبيا العلف النامية بالوادى الجديد

أحمد عبد المنعم عبد اللطيف* ، سيد حسين هنداوى و منير صبحي برسوم ***

* قسم الإنتاج النباتى – مركز بحوث الصحراء– المطرية – القاهرة

** قسم البيئة النباتية والمراعى – مركز بحوث الصحراء– المطرية – القاهرة**

أقيمت تجربتان حقليتان بمحطة التجارب الزراعية بالخارجة التابعة لمركز بحوث الصحراء، محافظة الوادى الجديد، خلال موسمى الزراعة الصيفية ٢٠٠٥ و ٢٠٠٦ حيث أجرى التحليل التجميعى للموسمين لدراسة تأثير أربعة مواعيد للزراعة (١٥ فبراير و أول مارس و ١٥ مارس و أول ابريل) والكثافة النباتية (٨٤٠٠٠ و ١١٢٠٠٠ و ١٦٨٠٠٠ و ٢٢٤٠٠٠ و ٣٣٦٠٠٠ ألف نبات / فدان) والتفاعل بينهما على صفات النمو والمحصول ومكوناتة وكذلك التركيب الكيماوى لنبات لوبيا العلف. وزعت المعاملات فى تصميم قطع منشقة مرة واحدة حيث وضعت مواعيد الزراعة فى القطع الرئيسية والكثافة النباتية فى القطع الشقية موزعة ستة مكررات خصصت ثلاثة مكررات لصفات والمحصول العلفى والثلاثة مكررات الأخرى خصصت لكل من المحصول ومكوناته. وتتلخص أهم النتائج فيما يلى:

أ- صفات النمو:

أظهر موعد الزراعة في ١٥ مارس وزراعة ٢٢٤٠٠٠ نبات للفدان تفوقاً معنوياً عن باقي مواعيد الزراعة والكثافات النباتية فى طول النبات و عدد الأفرع / نبات و الوزن الغض والجاف / نبات والمحصول العلفى الغض والجاف / فدان لنبات لوبيا العلف وذلك في كل من الحشة الأولى والثانية.

ب- المحصول ومكوناتة:

أمكن الحصول على أعلى محصول من عدد القرون والبذور / نبات و وزن البذور / قرن و وزن ال١٠٠ بذرة و المحصول البيولوجى و محصول البذور والقش لنبات لوبيا العلف بزراعتها فى ١٥ مارس وعند كثافة نباتية ٢٢٤٠٠٠ نبات / فدان.

ج-التركيب الكيماوى:

زادت النسبة المئوية لكل من النيتروجين والفوسفوروالبوتاسيوم والكربوهيدرات الكلية والبروتين الخام والمركبات الكلية المهضومة في البذور والقش بالزراعة في ١٥ مارس وعدد نباتات ٢٢٤٠٠٠ نبات للفدان

واظهر التفاعل بين مواعيد الزراعة والكثافة النباتية تأثيرا معنويا على صفات النمو والمحصول ومكوناتة وكذلك التحاليل الكيماوية لنبات لوبيا العلف، عدا المركبات الكلية المهضومة في البذور.

قام بتحكيم البحث

أ.د / أحمد نادر السيد عطية — كلية الزراعة – جامعة المنصورة

أ.د/ عبد المنعم محمد حجازى — مركز بحوث الصحراء