J. Plant Production, Mansoura Univ., Vol. 3 (2): 217 - 227, 2012

INFLUENCE OF SEEDING RATES AND ROW SPACINGS ON FORAGE YIELD AND QUALITY OF COWPEA (*Vigna sinenses* L.) GROWN IN THREE LOCATIONS

Salem, Azza Kh.; Zeinab M. Abd El-Naby and N. M. N. Nasr
Field Crop Res. Institute, ARC.

ABSTRACT

Field experiments were carried out during 2009 and 2010 seasons at three Field Crops Research Stations of (Ismaelia, Sids and New valley). Five different seeding rates were used i.e. 25, 30, 35, 40 and 45 kg/fed and two row spacing i.e. , 30 and 60 cm. Split plot design in three replications are used.

The results indicated that sowing at seeding rate of 35 kg/fed with 30 cm row spacing significantly increased all agronomic characters over all cuts and recorded 42.64 t/fed and 8.49 t/fed for total fresh and dry yield, and considered as the best recommended treatment to cowpea under New valley conditions. At Ismaelia conditions, the higher yield was obtained from sowing at seeding rate 45 kg /fed and row spacing of 30 and of 60 cm. Sowing at seeding rate 25 kg/fed with row spacing 30 cm was a perfect treatment for increasing yield. Over two cuts of Sids conditions sowing at seeding rate 30 kg /fed and row spacing 60 cm recorded the best result 15.63, 9.65 t/fed of fresh yield and 1.94, 1.04 $t.fed^{-1}$ of dry yield for the first and second cuts.

The results showed insignificant regression of total fresh yield related to the control was recorded R^2 = 0.2895, R^2 = 0.1888 and R^2 = 0.5822 for New Valley, Ismaelia and Sids, respectively. Chemical composition recorded means of 26.3% soluble carbohydrate, 17.4% crude protein, 21.8% crude fiber and 13.0% ash. Increasing in seeding rates amplified the competition among plants for environmental factors.

Keywords: Cowpea, *Vigna sinensis* L., Seeding rate, Row spacing, Fresh and dry yield, Regression, Crude protein.

INTRODUCTION

Cowpea is chiefly used as a grain crop, for animal fodder, or as a vegetable. It is quick growing, high yielding, with substantially rich biomass production, grows well with associated crops and is highly protein.

It grows well in a wide range of soil texture, from heavy clays, if well drained, to sand (Hector and Jody, 2002). Ndiaga (2000) concluded that cowpea cultivars with different plant morphology would require different optimum densities to express their full seed yield potential. It can also grow successfully as a relay inter-crop with cereal or cash crops in mid-August (Elawad, 2000).

Gill *et al*. (1977) reported that, growth parameters of cowpea such as plant height, lateral branches and trifoliate leaves increased with increased spacing from 20 cm through 30 cm to 45 cm. Yadav (2003) reported plant height significantly incresed with 30 cm row spacing than at 45 and 60 cm spacing. Biswas *et al.* (1997) and Tsigewoin *et al*. (2003) indicated that lower seeding rate produced higher number of branches, leaves per plant and yield per plot. Yadav (2003) observed significant interaction between row spacing's and seeding rates on grain yield. The row spacing of 30 cm with 20 kg /ha seed rate was significantly superior to 15 kg seeds/ ha but at wider spacing, the effect of seed rate was insignificant. The specific objectives of this were aimed to:

1-Study performance of cowpea under different seeding rates and row spacing, and

2-To compare the patterns of growth and development of plants grown under different locations in Egypt and their effects on forage and dry yield.

MATERIALS AND METHODS

Field experiments were carried out during 2009 and 2010 seasons at Field Crops Research Institute Stations of (Ismaelia, Sids and New valley). Five different seeding rates were investigated with 25, 30, 35, 40 and 45 kg fed^{-1} and two spacings rows, 30 and 60 cm, using the local variety (Buff) cowpea.

The experiment was arranged in a split design in three replications. The seeding rate treatments were distributed at random in the main plots, while the row spaces were treated as sub- plots. Each plot consisted of ten or five rows separated by 30 or 60 cm and 2 m long. Seeds were drilled sowing in each row according to seeding rates (25, 30, 35, 40 and 45 kg/fed). The plots were separated by border rows consisting of two ridges along each of the plot length and width.

Plant stand establishment recordings were made after two weeks from sowing date. The agronomical observation on plant height, number of tillers, stem leaves ratio (SLR%), forage and dry yield were recorded for two (Sids) or three cuts (New valley and Ismaelia), each cut was after 50-60 days from the previous one. Optimum cultural practices were followed as recommended through the growing season.

Growth characteristics were measured per plant and per plot for fresh and dry forage yield. Observations were recorded on 10 plants chosen at random from each plot. Samples of dry matter were analyzed chemically for crude protein%, carbohydrates%, fiber% and ash%.

Data for the two growing seasons were statistically analyzed according to Steel and Torrie (1984) procedure using SAS software due to absence of significant variance homogeneity. In addition differences between means were tested for significance using Duncan multiple ranges test (Duncan 1955). Table 1 presents data of soil texture, temperature and relative humidity of three locations

Table 1: Means of stations, soil texture, degrees of temperature ºC and relative humidity% (over the two growing seasons 2009 and 2010).

Forage Crops Station	Soil texture	pH	Organic mater	Means of temperature and relative humidity									
				April		May		June		July		August	
				T	RH%	T	RH%	T	RH%	T	RH%	T	RH%
Ismaelia	Sandy	7.97	0.75	21.6	58.5	23.1	57.0	28.3	58.0	28.7	61.0	28.1	63.3
Sids	Clay	7.60	1.98	24.2	55.0	25.5	51.0	30.0	49.3	30.4	58.7	29.3	60.8
New Valley	Sandy loam	8.0	0.86	36.0	26.3	35.8	26.3	40.7	21.8	41.3	26.0	39.8	28.0

T: temperature ºC. RH%: relative humidity%

New valley is located at the south western desert of Egypt with latitude 25-27º and longitude 30-32º. Sandy loam texture of soil is suitable for growing many of the forage field crops, especially alfalfa. Ismaelia is located at the North eastern of Egypt, west coast of Swis Canal with latitude 30-36º and longitude 32 -14º. Sandy texture of soil is suitable for growing of the forage field crops. Sids area is located at latitude 29-04º and longitude 31-06º. Its clay, old soil, suited all of the forage field crops. Sids station recorded the highest cowpea production over all agricultural research stations. Sids area is located at latitude 29-04º and longitude 31-06º. Its clay, old soil, suited all of the forage field crops. Sids station recorded the highest cowpea production over all agricultural research stations.

RESULTS AND DISCUSSION

New valley

Data of Table 2 reported that seeding rate of 45 kg/fed with row spacing 30 cm showed tallest plants which were (94.75cm, 89.00 cm and 82.75 cm) for the first, second and third cuts respectively, with insignificant differences with the sowing rate 30 kg/fed of 30 cm spacing. Spacing row of 30 cm increased plant height over row spacing of 60 cm at all seeding rates and all cuts.

Increasing row spacing reduced number of tillers per plant when sowing with the low seeding rates 25 kg/fed and 30cm row spacing (2.50, 2.75 and 1.75 tiller/plant for the first, second and third cuts respectively). Conversely sowing at seeding rate of 30 kg/fed produced the greatest number of tillers for 60 cm row spacing 3.75, 3.50

and 2.75 tiller per plant for the first, second and third cut, followed by sowing of 40 and 45 kg/fed rates.

The leaf stem ratio (LSR%) declined with the increasing seeding rates (Table 2) and insignificant differences for this character were found between the first and third cuts. High LSR% was produced (52.71 %) from sowing seeding rate at (45 kg/fed) with spacing row 30 cm in second cut followed by (45.18%) produced from for sowing at seeding rate of 35 kg/fed with using the same row spacing (Table 2).

The highest fresh t/fed was recorded from using row spacing of 30 cm and using seeding rate at 35kg/fed which were (18.89, 14.44, 9.30 and 42.64 t/fed for the first, second , third and total yield) . The best dry yield in first, second, third and total yield (3.58, 2.66, 2.25 and 8.49 t/fed, respectively) were recorded for the same seeding rate and spacing row (35 kg/fed and 30cm). (Table 3) The results indicated that higher fresh and dry yield from sowing using row spacing of 60 cm at seeding rate 35kg/fed (16.81, 11.94, 8.05 and 36.81 t/fed for fresh yield and 3.15, 2.34, 2.03and 7.52 t/fed for dry yield in the first, second, third and total yield, respectively). The results reported that fresh and dry yield significantly affected by interaction between row spacings and sowing seed rates over cuts except for the third cut. Table 3 showed significantly affected by row spacing for total fresh and dry yield by using 25, 35 and 40 kg/fed seeding rates. The sowing rate of 35 kg/fed at spacing row 30 cm indicated superior fresh and dry yield at the first, second and total yield over all seeding rates.

Table 2: Means of plant height, number of tillers and stem leaves ratio per plant of cuts three of cowpea under different seeding rates and row spacings combined of two seasons (2009 and 2010) at New valley.

Seeding rate	Row spacing	Plant height cm			No. tillers			Leaf stem ratio%		
		Cut 1	Cut 2	Cut 3	Cut 1	Cut 2	Cut 3	Cut 1	Cut 2	Cut 3
25 kg/fed	60 cm	73.00cd	71.75ef	59.00c	2.50b	2.75b	1.75b	37.47	46.02	41.68
	30 cm	79.50c	77.25c	50.75d	1.50cd	2.25b	1.50c	42.62	40.15	35.40
	Mean	76.25C	74.50C	54.88C	2.00BC	2.50AB	1.63B	40.04	43.09A	38.54
30 kg/fed	60 cm	87.50ab	80.25bc	69.50b	1.50cd	1.50cd	1.50c	38.40	37.94	38.67
	30 cm	87.75ab	83.25b	70.25b	1.25d	1.25d	1.25c	35.42	36.00	30.34
	Mean	87.63A	81.75AB	69.88AB	1.38C	1.38C	1.38C	36.91	36.97C	34.50
35 kg/fed	60 cm	76.75c	75.25d	71.75ab	3.75a	3.50a	2.75a	35.51	41.84	29.20
	30 cm	83.75b	79.50c	72.5ab	3.50a	3.50a	2.50a	42.15	45.18	29.98
	Mean	80.25B	77.38B	72.13A	3.63A	3.50A	2.63A	38.83	43.51A	29.59
40 kg/fed	60 cm	86.75b	80.75bc	56.75cd	3.00b	2.50b	2.50a	35.56	41.43	34.12
	30 cm	91.75a	86.5a	61.25bc	2.50b	2.50b	2.50a	32.85	39.09	29.34
	Mean	89.25A	83.63A	59.00C	2.75B	2.50AB	2.50A	34.20	40.26B	31.73
45 kg/fed	60 cm	72.00d	69.00f	55.00cd	2.00c	1.75c	2.00b	38.10	39.30	30.64
	30 cm	94.75a	89.00a	82.75a	3.00b	2.75b	2.50a	39.94	52.71	32.03
	Mean	83.38AB	79.00B	68.88B	2.50B	2.25B	2.25A	39.02	46.01A	31.33
Over all rates	60 cm	83.75	79.40	67.95A	2.55	2.40	2.10	37.01	41.31	35.14A
	30 cm	82.95	79.10	61.95B	2.35	2.45	2.05	38.60	42.63	31.14B
	Mean	83.35	79.25	64.95	2.42	2.42	2.08	37.80	41.97	33.14
Interaction(F. test)		**	**	n.s.	*	n.s.	n.s.	n.s.	**	n.s.

Means in each column followed by similar letters are not significantly different at 5% level.
****,* , n.s.: high, significant and insignificant differences at 5% level, respectively.**

Generally, increasing seeding rates amplified the competition among plants for soil, temperature °C and relative humidity%. The lower relative humidity 26.3 % with the higher temperature 36°C at sowing may help seedlings for better growth and may have effect on the interaction between soil moisture and plant recovery after cutting (Table 1), thus, a facility to compete and vigour. Furthermore, the narrow row spacing i.e. 30 cm, effect on plant to grow as isolated units for most of their early life and interfered less with each other than at large spaces, 60 cm, this might explain the significant effects of seeding rats on most of the characters measured in this study. So, sowing using seeding rate of 35 kg/fed at narrow row spacing (30cm) may be increase the competition between plants with high temperature causing by increase plant density in low unite area. This may affected the interaction between plants and environmental factors.

Table 3: Means of fresh, dry and total yield of three cuts of cowpea under different seeding rates and two row spacing combined of two seasons (2009 and 2010) at New valley.

Seeding rate	Row spacing	Fresh yield t/fed			Dry yield t/fed			Total cuts t/fed	
		Cut 1	Cut 2	Cut 3	Cut 1	Cut 2	Cut 3	Forage	Dry
25 kg/fed	60 cm	7.65e	7.91c	4.16d	1.92c	1.31c	1.03	19.74e	4.25c
	30 cm	12.08d	9.86b	5.14c	2.39b	2.08b	1.48	27.08d	5.95bc
	Mean	9.87D	8.89C	4.65C	2.15C	1.69B	1.25	23.41C	5.10C
30 kg/fed	60 cm	13.34c	10.83b	6.39c	2.72a	2.32b	1.73	30.56c	6.76b
	30 cm	14.58b	11.67a	7.36b	3.03a	2.44a	1.86	33.61bc	7.34a
	Mean	13.96BC	11.25AB	6.88B	2.88A	2.38A	1.80	32.08B	7.05B
35 kg/fed	60 cm	16.81ab	11.94a	8.05ab	3.15a	2.34b	2.03	36.81b	7.52a
	30 cm	18.89a	14.44a	9.30a	3.58a	2.66a	2.25	42.64a	8.49a
	Mean	17.84A	13.19A	8.68A	3.36A	2.50A	2.14	39.72A	8.00A
40 kg/fed	60 cm	12.64c	10.00b	7.22b	2.30b	2.60a	1.74	29.86	6.64b
	30 cm	14.16c	11.25a	7.64b	2.70a	2.23b	2.05	33.06bc	6.97b
	Mean	13.40C	10.63B	7.43A	2.50B	2.41A	1.89	31.46B	6.81
45 kg/fed	60 cm	13.72c	11.28a	7.14bc	2.73a	2.43a	1.84	32.14c	7.41a
	30 cm	16.71ab	7.09c	7.50b	3.03a	2.47a	1.64	31.29c	7.30a
	Mean	15.22B	9.18BC	7.32AB	2.68B	2.69A	1.85	31.52B	7.22A
Over all rates	**60 cm**	**11.35B**	**3.97**	**1.56**	**2.38B**	**1.32**	**0.87**	**16.88B**	**4.57B**
	30 cm	**16.30A**	**2.43**	**1.99**	**3.06A**	**1.70**	**1.10**	**20.72A**	**5.86A**
	Mean	**13.09**	**2.81**	**1.91**	**2.60**	**1.44**	**1.06**	**17.81**	**5.10**
Interaction (F. test)		**	**	*	**	**	n.s.	*	*

****,* , n.s.: high, significant and. insignificant differences at 5% level, respectively.**
Means in each column followed by similar letters are not significantly different at 5% level

Ismaelia

Plant height showed decreases in all cuts and sowing with seeding rates of 30 cm row spacings compared with those sown at 60 cm row spacing, except for sowing rates at 25, 40 kg/fed and in the second cut with sowing at seeding rate of 35kg/fed. The tallest plants were produced for sowing at seeding rate of 25 kg/fed and row spacing 30cm, which were (85.75, 79.25 and 62.00 cm for the first, second and thirst cuts, respectively).

The results indicated that sowing at seeding rate at 45 kg /fed recorded tallest plants when sown plant at 60 cm spaced row, over all cuts, with 85.00, 83.00 and 65.75 cm for the first, second and thirst cuts, respectively as combined data of two seasons. Superior number of tillers was obtained from sowing rate of 40 kg/fed and row spacing of 30 cm and 60 cm which were, 3.75, 3.50, 2.50 and 3.5, 3.5, 2.5 of first, second and third cuts, respectively. High percentage of stem leaves ratio was produced in the second cut of 25kg/fed seeding rate and sowing at row spacing of 60 cm which were 50.71 % and 45.96 at 30 cm. The second cut produced the highest percentage of SLR% over all cuts and treatments, whereas the third cut was decreased and was similar to first one.

Concerning to fresh and dry yield/fed, the results in Table (5) clearly showed that fresh and dry yield/fed and their totals over cuts at Ismaelia location showed depressed compared with New valley conditions. This may be related to soil type, deficit of irrigation high percentage of RH (47.3 to 60.8%) and weed competition. Sowing at seeding rate 25 kg/fed at row spacing 30 cm produced the highest fresh yield of first, second and third cuts (6.60 t/fed, 5.93 t/fed and 4.25t/fed, respectively) with high total fresh yield (16.78t/fed). The higher fresh yield produced from seeding rate 45kg/fed with the two row spacings (6.32 t/fed in first cut, 5.86 t/fed in second cut and 4.63 t/fed in third cut) for 60 cm row spacing and (6.14 t/fed in first cut, 5.72 t/fed in second cut and 4.35 t/fed in third cut) for row spacing of 30 cm.

In spite of higher yield by using seeding rate 45 kg/fed with the two row spacing, we recommend using 25kg/fed seeding rate with 30 cm row spacing in Ismaelia location.

Table 4: Means of plant height, number of tillers and stem leaves ratio per plant of three cuts of cowpea under different seeding rates and two row spacings combined of two growing seasons (2009 and 2010) at Ismaelia.

Seeding rate	Row spacing	Plant height cm			No. tillers			Stem leaves ratio%		
		Cut 1	Cut 2	Cut 3	Cut 1	Cut 2	Cut 3	Cut 1	Cut 2	Cut 3
25 kg/fed	60 cm	72.25	52.25	63.25a	2.50b	2.00c	1.25b	39.25	50.71a	36.81a
	30 cm	85.75	79.25	62.00b	3.00a	3.25a	2.50a	38.84	45.96a	38.38a
	Mean	79.00	65.75	62.63B	2.75C	2.63B	1.88B	39.05	48.34A	37.60A
30 kg/fed	60 cm	75.25	73.75	64.75a	3.00a	2.50b	1.75b	42.62	40.15b	35.40a
	30 cm	68.75	64.50	60.50b	1.75bc	2.25b	1.50b	38.4	37.94c	38.67a
	Mean	72.00	69.13	62.63B	2.38C	2.38B	1.63	40.51	39.05C	37.03A
35 kg/fed	60 cm	67.75	58.75	51.50c	1.75c	1.75c	1.00c	35.42	36.00c	30.34b
	30 cm	54.50	68.00	50.25c	2.50b	2.00c	1.25b	35.51	41.84b	29.20c
	Mean	61.13	63.38	50.88D	2.13C	1.88C	1.13C	35.46	38.92C	29.77C
40 kg/fed	60 cm	72.75	66.75	53.50c	3.75a	3.50a	2.50a	42.15	45.18a	29.98c
	30 cm	76.25	72.00	60.00b	3.50a	3.50a	2.50a	35.56	41.43b	34.12b
	Mean	74.50	69.38	56.75C	3.63A	3.50 A	2.50A	38.85	43.31B	32.05B
45 kg/fed	60 cm	85.00	83.00	65.75a	3.25a	2.50b	2.50a	32.85	39.09b	29.34c
	30 cm	78.50	76.25	71.00a	2.75b	2.50b	2.50a	38.10	39.30b	32.03b
	Mean	81.75	79.63	68.38A	3.00B	2.50B	2.50A	35.48	39.20C	30.68B
Over all rates	60 cm	**72.30**	**67.33**	**61.27**	**2.30**	**2.10**	**1.77**	**38.49**	**40.98**	**34.30**
	30 cm	**72.52**	**75.13**	**60.00**	**2.94**	**2.48**	**2.23**	**35.86**	**42.65**	**30.64**
	Mean	**72.41**	**71.29**	**60.62**	**2.62**	**2.29**	**2.00**	**37.15**	**41.83**	**32.44**
Interaction (F. test)		n.s.	n.s.	*	n.s.	*	*	n.s.	n.s.	n.s.

Means in each column followed by similar letters are not significantly different at 5% level
***, n.s.: significant and. insignificant differences at 5% level, respectively.**

Table 5: Means of fresh, dry and total yield of three cuts of cowpea under different seeding rates and two row spacings combined of two growing seasons (2009 and 2010) at Ismaelia.

Seeding rate	Row spacing	Fresh yield t/fed			Dry yield t/fed			Total t/fed	
		Cut 1	Cut 2	Cut 3	Cut 1	Cut 2	Cut 3	Forage	Dry
25 kg/fed	60 cm	4.92b	3.80bc	2.64d	0.91	2.11d	1.47d	11.36d	4.49c
	30 cm	6.60a	5.93a	4.25a	1.24a	3.29a	2.36a	16.78a	6.89a
	Mean	5.76A	4.87A	3.45B	1.07B	2.70B	1.92C	14.07BC	5.69B
30 kg/fed	60 cm	5.99a	5.10a	3.71ab	1.11a	2.83ab	2.06b	14.79b	6.01b
	30 cm	4.55b	4.21b	3.07b	0.99b	2.34c	1.71c	11.83d	5.03c
	Mean	5.27B	4.65B	3.39B	1.05B	2.58C	1.88C	13.31C	5.52B
35 kg/fed	60 cm	3.81c	3.00c	1.83d	0.71d	1.67e	1.02e	8.64e	3.39d
	30 cm	4.53b	4.28b	2.97c	0.85c	2.38c	1.66c	11.78d	4.88bc
	Mean	4.17C	3.64C	2.40C	0.78C	2.02D	1.34D	10.21D	4.14C
40 kg/fed	60 cm	5.54a	4.88b	3.71ab	1.03a	2.71b	2.06b	14.13c	5.80b
	30 cm	5.86a	5.55a	4.07a	1.14a	3.09a	2.26b	15.49b	6.49ab
	Mean	5.70A	5.22A	3.89AB	1.08AB	2.90B	2.16B	14.81B	6.14A
45 kg/fed	60 cm	6.32a	5.86a	4.63a	1.18a	3.26a	2.57a	16.81a	7.01a
	30 cm	6.14a	5.72a	4.35a	1.14a	3.18a	2.41a	16.21a	6.73a
	Mean	6.23A	5.79A	4.49A	1.16A	3.22A	2.49A	16.51A	6.87A
Over all rates	60 cm	**5.21**	**4.45**	**3.02**	**0.88**	**2.47**	**1.68B**	**12.68B**	**5.03**
	30 cm	**5.41**	**5.00**	**3.61**	**0.91**	**2.78**	**2.00A**	**14.02A**	**5.69**
	Mean	**5.31**	**4.73**	**3.32**	**0.89**	**2.63**	**1.84**	**13.36**	**5.37**
Interaction (F. test)		**	**	**	*	**	**	**	**

Means in each column followed by similar letters are not significantly different at 5% level
**** , *: high and significant differences at 5% level, respectively .**

Sids

Regarding to Sids location, the results in Table (6) two cuts only were recorded. From sowing rates of 45 and 35 kg/fed recorded tallest plants (72.75cm and73.00cm) at 30cm row spacing in the first and second cuts.

With respect to number of tillers/plant, the results clearly showed high depression under all treatments of the second cut. Great number of tillers (30.25 and 6.25) produced from sowing at 35 kg fed^{-1} and using row spacing 30 cm in the first and second cuts, respectively. Differences among seeding rates in plant height were reported by Miller (1988) and Mohammed (1984). Increasing plant density decreased number of leaves per plant. These results are in agreement with the previous findings reported by many workers (Alege and Mustapha, 2007; Weber *et al* 1966; Mohammed, 1984). They showed that increased row spacing reduced the number of branches per plant. These results are in conformity with the findings of Yadav (2003) for plant height, lateral branches and number of trifoliate leaves in cowpea.

The results indicated that high fresh yield/fed produced from using 40 kg/fed not only in the first cut (14.51 and 15.35 t/fed) for row spacing 30 and 60cm, but also in the second cut (9.58 and12.15 t/fed) for both spacing comparing with seeding rate 25kg /fed at 60 cm row spacing, 14.10 and 7.85 t/fed, for the same cuts. Increasing of fresh yield (t.fed^{-1}) began with 35, 40 and 45 kg/fed seeding rate. The treatment of 30 kg/fed seeding rate with 60 cm spacing rows recorded the best result 15.63, 9.65 t/fed of fresh yield and 1.94, 1.04 t/fed of dry yield for the first and second cuts, respectively.

Table 6: Means of plant height, number of tillers and leaf stem ratio per plant of three cuts of cowpea under different seeding rates and two row spacings combined of two growing seasons (2009 and 2010) at Sids.

Seeding rate	ow pacing	Plant height cm		No. tillers		Stem leaves ratio%		Fresh yield t/fed		Dry yield t/fed		Total cuts t/fed	
		Cut 1	Cut 2	Cut 1	Cut2	Cut 1	Cut 2	Cut 1	Cut 2	Cut 1	Cut 2	Fresh	Dry
25 kg/fed	60 cm	63.75	65.75b	24.25b	4.25b	35.75	41.25	14.10c	7.85c	1.67	0.99b	21.94c	2.66b
	30 cm	64.75	66.00b	24.50b	3.25c	31.25	33.25	13.47c	5.14c	1.68	0.62c	18.61c	2.29c
	Mean	64.25	65.88A	24.38AB	3.75B	33.50	37.25	13.78B	6.49D	1.67	0.81C	20.28C	2.48C
30 kg/fed	60 cm	67.75	62.00b	19.75c	3.00c	39.75	34.50	15.63a	9.65b	1.94	1.04b	25.28b	2.99a
	30 cm	66.00	60.00c	24.25b	3.00c	40.50	37.50	14.52b	5.47c	1.71	0.62c	19.99c	2.33c
	Mean	66.88	61.00B	22.00C	3.00C	40.13	36.00	15.07A	7.56C	1.82	0.83C	22.63B	2.65B
35 kg/fed	60 cm	65.50	66.00b	22.75b	3.25c	36.50	33.25	13.61c	8.33c	1.67	0.87c	21.94c	2.54b
	30 cm	69.25	73.00a	30.25a	6.25a	40.00	36.25	13.34c	9.31b	1.58	1.14b	22.64c	2.72a
	Mean	67.38	69.50A	26.50A	4.75A	38.25	34.75	13.47C	8.82B	1.63	1.01B	22.29B	2.63B
40 kg/fed	60 cm	64.75	62.50b	24.50b	6.25a	36.50	36.50	14.51b	9.58b	1.78	1.07b	24.10b	2.85b
	30 cm	62.25	71.75a	22.75b	3.25c	33.00	32.25	15.35a	12.15a	1.89	1.40a	27.50a	3.29a
	Mean	63.50	67.13A	23.63B	4.75A	34.75	34.38	14.93A	10.87A	1.84	1.24A	25.80A	3.07A
45 kg/fed	60 cm	64.50	66.00b	25.50b	3.50b	41.00	35.25	14.93b	7.29c	1.54	0.89c	22.23c	2.42b
	30 cm	72.75	59.00c	25.25b	3.75b	35.75	32.50	15.97a	8.89c	1.92	1.04b	24.86b	2.96a
	Mean	68.63	62.50B	25.38A	3.63B	38.38	33.88	15.45A	8.09B	1.73	0.96B	23.54A	2.69B
Over all rates	60 cm	**62.93**	**62.73**	**23.40**	**3.47**	**36.70**	**36.70**	**12.32**	**6.62**	**1.49**	**0.60**	**18.94**	**2.09**
	30 cm	**64.40**	**61.30**	**24.93**	**4.67**	**35.63**	**35.63**	**12.78**	**8.32**	**1.51**	**0.79**	**21.10**	**2.30**
	Mean	**63.67**	**62.02**	**24.17**	**4.07**	**36.17**	**36.17**	**12.55**	**7.47**	**1.50**	**0.70**	**20.02**	**2.20**
Interaction(F. test)		n.s.	*	*	*	*	n.s	n.s	n.s	n.s	n.s	n.s	n.s

Means in each column followed by similar letters are not significantly different at 5% level
*** , ,n.s.: high, significant and. insignificant differences at 5% level, respectively.**

Figure 1: Total fresh yield regression among the different seeding rate at three locations.

Insignificant regression of total fresh yield related to the control (seeding rate at 25 kg/fed with 60 cm row spacing) were recorded R^2 = 0.2895, R^2 = 0.1888 and R^2 = 0.5822 for New Valley, Ismaelia and Sids , respectively. Despite the difference in the number of cuts in Ismaelia (three cuts) and Sids (two cuts) the behavior of the yield was similar in the two locations. We can grow cowpea in the new reclaimed lands with the advantage of economic field crops in Sids location.

Regarding to chemical analysis of cowpea dry yield for all locations, the range of soluble carbohydrate varied from 25.5% to 26.8% with average mean 26.3%. Sids location indicated higher percentage of crude protein (18.8%). New Valley indicated high percentage of crude fiber and ash (22.5 and 13.5%, respectively). Tarawali *et al*. ,1997, found that crude protein content in analyzed grain and leaves ranges from 22 to 30% on a dry weight. Tsigewoin and Agarwal (2000) reported that the medium seed rate of 40 kg/ha for cowpea fodder was significantly superior to others in dry matter yield and crude protein yield. In Cuba, Santiesteban *et al*. (2002) observed that the chemical composition was not affected by sowing rate in cowpea.

Table 7: Chemical analysis of cowpea.

Location		**%**		
	Carbohydrates	**Crude protein**	**Crude fiber**	**Ash**
New Valley	26.8	16.6	22.5	13.5
Ismaelia	25.5	16.9	21.6	12.9
Sids	26.6	18.8	21.3	12.6
Mean	26.3	17.4	21.8	13.0

It may be assumed that, increasing the plant population due to increased seeding rates will increase competition among plants for soil, moisture, nutrient and light. While, the low plant population density by decreasing seeding rate grew as isolated units for most of their early life and interfered less with each other than at higher densities. This might explain significant effects of seeding rates and increasing the number of plants in unit area, which will increase competition and affect the most of the parameters measured in each location. The fact that the semi prostrate growth habit of cowpea has a compensate ability at spacing row, seeding rate, within the row will allow for thus increased yield per unit area.

An advantage of narrow row spacing (30 cm) is more equidistant plant spacing that leads to increased LSR, growth rate, dry matter accumulation, yield and quality.

Conclusion

It could be concluded that soil texture and environmental factors interactions with seeding rate and row spacing affected plant morphology, yield and quality. Increasing seeding rate increased fresh and dry yield (t/fed). In New valley location, the highest yield per unit area produced from seeding rate 35 kg /fed with 30 cm row spacing.

The seeding rate of 25 kg /fed at 30 cm row spacing was recommended for Ismaelia location. At Sids location, seeding rate of 30 kg/fed with 60 cm row spacing recorded highest fresh and dry yield/fed.

REFERENCES

Alege, G.O. and O.T. Mustapha. (2007). Characterization studies and yield attributes of some varieties of cowpea (Vigna unguiculata L.). Ilorin, Nigeria.

Burton, G. W. (1952). Quantitative inheritance in grasses. Proc. 6th Int. Grassland Congr. 1: 277-283.

Biswas, P.K., M. Akhteruzzaman, G.N.C. Sutradhar and K. K. Biswas. (1997). Effect of seed rate on grain yield and yield attributes of cowpea. Bangladesh Journal of Scientific and Industrial Research, 32 (3): 333-335.

Duncan, D. B. (1955). Multiple range and multiple F test. Biometrics 11:1-42.

Elawad, H.O. (2000). The performance of selected cowpea (*Vigna unguiculata* L. Walp).Varieties in the sandy rainfed areas of Kordofan. Agricultural Research Corporation, Elobied, Sudan.

Gill, P.S. Kanwar Singh and H.P. Tripathi (1977). Effect of seed rates and row spacings on the forage yield of cowpea (*Vigna unguiculata* L.) varieties. Haryana Agricultural University Journal of Research*,* 2:1-6.

Hector, V. and S. Jody (2002). Cowpea, sustainable agriculture green manure crops. SA-GM-6.

Mohammed, A.S.E. (1984). Growth and yield of cowpea as influenced by sowing date intra-row spacing inoculation and nitrogen fertilization. M.Sc. Thesis. University of Khartoum, Sudan.

Miller, R. (1988). Legume cover crops for Northern California, small farm news. Small Farm Center, UC coop. Ext., UC Davis.

Ndiaga, C. (2000). Genotype x Row Spacing and Environment interaction of cowpea in Semi-arid Zones.African Crop Science Journal, 9(2): 359-367.

Santiesteban, S.R., R. A. Zomora, P. E. Gomez, P.P. Verdecia, G.L. Hernandez [*Vigna unguiculata* (L.) Walp] in two seasons of the year. *Alimentaria*, 39: 45-48

SAS Institute. (2000). SAS language and procedure: Usage. Version 8, 1*st* ed. SAS Inst., Cary, NC

Steel, R.G.D. and J.H. Torrie. (1984). Principles and Procedures of Statistics.Mc Graw Hill Book Co. Inc., Singapore. pp: 172-178.

Tarawali, S. A., B. B. Singh, M. Peters and S. F. Blade (1997). Cowpea haulms as fodder. In: B. B. Singh, D. R. Mohan Raj, K. Dashiell and L. E. N. Jackai (Eds.). pp. 313–325. Advances in Cowpea Research. Co-publication of International Institute of Tropical Agriculture (IITA) and Japan International Centre for Agricultural Sciences (JIRCAS), IITA, Ibadan, Nigeria.

Tsigewoin, T. and I.S. Agarwal (2000). Effect of variety and seed rate on yield, nutrient composition and dry matter digestibility of cowpea fodder. *Indian* Journal of Animal Nutrition*,* 17(4): 279-283.

Tsigewoin, T. , Agarwal, I.S. and Virendra Singh, (2003). Study on the effect of variety and seeding rate on growth characteristics and yield of fodder cowpea. Legume Research*,* 26(1): 42-44.

Weber, C.R., R.M. Shibles and D.E. Byth, (1966). Effect of plant population and row spacing on Soybean development and production. American Society of Agronomy Journal, 58: 99-102.

Yadav, G.L.(2003). Effect of sowing time, row spacing and seed rate on yield of cowpea under rainfed condition. Indian Journal of Pulses Research, 16 (2): 157-158.

تأثير معدلات التقاوي والمسافات بين السطور على محصول العلف والجودة للوبيا العلف (*Vigna sinenses* L.) منزرعة في ثلاثة مواقع

عزة خليل سالم، زينب محمد عبد النبي و ناصر محمد ناصر نصر
قسم بحوث العلف، معهد المحاصيل الحقلية، مركز البحوث الزراعية

أجريت التجارب الحقلية لهذه الدراسة علي محصول لوبيا العلف خلال الموسمين الزراعيين ٢٠٠٩ و٢٠١٠ في محطات بحوث الإسماعيلية (تربة رملية صفراء)، والوادي الجديد (تربة رملية طميية) و سدس (تربة طينية خفيفة). وقد استخدمت خمسة معدلات تقاوي مختلفة هي ٢٥، ٣٠، ٣٥، ٤٠ و ٤٥ كجم بذور/فدان، كما تمت الزراعة علي مسافتين بين السطور هما ٣٠ و ٦٠ سم. و تم تنفيذ التجارب في تصميم القطاعات المنشقة (مرة واحدة) في ثلاث مكررات

و كانت النتائج المتحصل عليها هي:

١- أشارت النتائج إلي أن الزراعة بمعدل تقاوي ٣٥ كجم بذور/ فدان مع الزراعة علي مسافة ٣٠ سم سجل أعلي نتائج لجميع الصفات الخضرية ، وسجلت (٤٢,٦٤ طن/ فدان) من المحصول الأخضر الكلي و (٨,٤٩ طن/فدان) من المحصول الكلي الجاف ويمكن اعتبارها أفضل توصية عند زراعة محصول لوبيا العلف في الظروف البيئية لمنطقة الوادي الجديد.

٢- أظهرت النتائج تحت ظروف الاسماعيلية أن الزراعة بمعدل التقاوي ٤٥ كجم بذور/ فدان و الزراعة علي المسافتين ٣٠ و٦٠ سم بين السطور قد سجلت أعلي إنتاجية لمحصول العلف الأخضر الكلي. ويمكن أن تؤدي هذه التوصية إلي زيادة تكاليف الإنتاج نظرا لارتفاع أسعار التقاوي ، لذا ينصح باستخدام معدل تقاوي ٢٥ كجم بذور/فدان مع مسافة ٣٠ سم بين السطور.

٣- أشارت النتائج المتحصل عليها تحت ظروف منطقة الصعيد (سدس) أن الزراعة علي سطور ٣٠ كجم بذور/فدان مع مسافة ٦٠ سم بين السطور سجلت أفضل محصول أخضر و جاف (٦٣. ١٥ و٩٤. ١ طن /فدان) في الحشة الأولي و (٩,٦٥ و٠٤. ١ طن/فدان) في الحشة الثانية.

٤- لم يظهر معامل الانحدار أي فروق معنوية بين معدلات التقاوي و المحصول الأخضر الكلي بالطن للفدان في كل منطقة (علي حدة) حيث كانت النتائج كالتالي:
في منطقة الوادي الجديد كانت (R^2 =٠,٥٨٢٢) وفي منطقة الإسماعيلية (١٨٨٨. ٠ = R^2) و في منطقة سدس (R^2=٠,٢٨٩٥) .

٥- أوضحت نتائج التحليل الكيماوي لعينة متجانسة من لوبيا العلف عدم وجود فروق معنوية بين نتائج المواقع الثلاثة حيث كان المتوسط العام لنسبة الكربوهيدرات و البروتين الخام و الألياف الخام و الرماد هي٦٢,٣% و ٤,١٧% و ٢١,٨% و ٠. ١٣%.

توصي هذه الدراسة للحصول علي أعلي إنتاجية من محصول العلف الأخضر من لوبيا العلف عند الزراعة بمعدل ٣٥ كجم /فدان علي سطور ٣٠ سم و ذلك تحت الظروف البيئية للوادي الجديد.

قام بتحكيم البحث

أ.د / علي السعيد شريف	**كلية الزراعة – جامعة المنصورة**
أ.د / مظهر فوزي عبد الله	**كلية الزراعة – جامعة القاهرة**