Growth and Yield Response of Selected Cowpea (*Vigna unguiculata* (L.) Walp) Varieties to Irrigation Interval and Sowing Date.

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ABSTRACT

Two field experimental trials were conducted at the research farms of the Faculty of Agriculture, Bayero University Kano (11^{o} 58'N, 8^{o} 25'E) and Irrigation Research Station Kadawa, Institute for Agricultural Research, Samaru Zaria (11^{0} 39'N, 08^{0} 27' E), respectively, during 2009/2010 dry season. The two study locations are in the Sudan Savanna ecological zone of Nigeria. The aim was to evaluate growth and yield response of selected cowpea varieties to sowing dates and irrigation intervals.

The treatment consisted of three cowpea varieties (IT93K-452-1, Achishru and IT97K-205-8), three sowing dates, (mid-February, late-February, and early-March) and three irrigation intervals (5, 10, and 15 days). The treatments were arranged in a split-plot design with sowing date and irrigation intervals assigned to main plot, while variety was placed in the sub-plot. The treatment combinations were replicated three times.

Results indicated that the yield of the IT97K-205-8 variety was found to be statistically significantly higher than the other varieties evaluated. Planting cowpea in mid-March significantly increased the number of days to 50% flowering, but sowing in mid- February resulted in significant increase in grain yield per hectare. Irrigation scheduling at 10 days interval significantly increased growth characters such as plant height, number of branches, and number of leaves, but reduced number of days to 50% flowering.

(Keywords: cowpea, irrigation interval, planting date, growth character)

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp) is one of the ancient human food sources and has probably been used as a crop since Neolithic times (Suliman, 2000). Major diversity in cowpea is found in Asia and Africa but the precise origin of cowpea has been a matter of speculation and discussion for many years (FAO, 2008). Food and Agriculture Organization estimated that 5.4 million metric tonnes of cowpea grain were produced worldwide in the year 2008 and 91 % of that production were from Africa (FAOSTAT, 2010). West Africa is the key cowpea producing zone with countries like Nigeria, Niger, Senegal, Ghana, Mali, and Burkina Faso taking the lead (FAOSTAT 2008). Among these countries, Nigeria and Niger are ahead with a production of about 2.92 million and 1.57 million metric tonnes respectively, in 2008 (Singh *et al.,* 2002; FAOSTAT, 2010).

Cowpea can be grown under rain-fed conditions and irrigation or residual moisture along river banks or lake flood plains during the dry season provided the temperature range are between 28^{o} and 30°C during the growing season (Dugje et al., 2009). With the development of extra-early and early maturing cowpea varieties, the crop can thrive in the Sahel zone, where the rainfall is less than 500 mm per annum (Dugje et al., 2009). It is drought tolerant and well adapted to sandy and poor soils. Being deep-rooted, cowpea performs well in sandy soils and is more tolerant to drought than soybean (Dadson *et al*., 2003). However, it does not tolerate excessive wet conditions or water-logging; thus best cowpea yields are obtained in well-drained sandy loam to clay loam soils with pH range between 6 and 7 (Dugje *et al*., 2009).

In Nigeria, much of cowpea cultivation is carried out under rain-fed condition. Planting period recommended by Dugje *et al*. (2009) ranged from last week of July to third week of August, depending on cowpea type and rainfall duration, which varies across the ecological zones.

In the Sudan and Sahel savannah ecological zones where the peak of rainfall is in August, cowpea under rain-fed is done best in second and third week of August. While so much is known about sowing period for cowpea under rain-fed condition, knowledge gaps still exist on sowing dates for the crop under irrigation in the Sudan and Sahel ecological zones of Nigeria. Moreover, the irrigation interval vis-à-vis sowing dates is still a knowledge gap in the ecological zone, and that need to be filled.

According to Gallagher and Biscoe (1978), sowing at optimum time enables the crop to best use the available growth factors such as temperature and solar radiation at different stages of growth for high productivity. Hussaini et al. (2004) studied the response of a cowpea variety (IT93K-452-1) to irrigation methods (furrow and check basins), irrigation intervals (7-, 14- and 21-day) and N-P-K fertilizer levels at Institute for Agricultural Research (IAR) Research Station, Kadawa. They reported that applying irrigation water at intervals of 14- and 21-day showed no significant difference in yield of the cowpea variety. It is necessary to verify such intervals of irrigation for other varieties of cowpea commonly cultivated under dry season and for other locations.

The objectives of this study therefore were to study the effect of sowing dates on some cowpea varieties in the dry season; and to determine the response of the selected cowpea varieties to different irrigation intervals.

MATERIALS AND METHODS

Location of Study

A field trail was conducted during the 2009/2010 dry season at two locations in the Sudan Savanna ecological zone of Nigeria. The first was set up at the Research Farms of Faculty of Agriculture, Bayero University Kano (11^{o} $58^{/}$ N, 8^{o} $25^{/}$ E) and the second was set up at the Irrigation Research Station Kadawa, (11^{0} 39'N, 08^{0} 027' E) belonging to the Institute for Agricultural Research, Samaru Zaria. The two study locations were about 50 km apart. The climate of the study area can be broadly monsoon, with a mono-modal rainfall which occurs between May and October. The other months of the year are usually dry Table 1 shows some weather data of the study locations for the cropping season.

The mean temperatures during the months of March and May make the study location favorable to cultivation of photo-sensitive crops like maize, groundnut and cowpea. The soils of the study locations can be classified as alluvial deposits with texture ranging from sandy loam to sandy clay loam.

Table 2 shows the physio-chemical properties of the soils of the two sites where the experiments were carried out.

Experimental Treatments and Layout

The treatments consisted of three sowing dates (mid- February, late- February and Early- March), three irrigation intervals (5, 10 and 15 days) and three cowpea varieties (IT93K-452-1, Achishuru and IT97K-205-8). The IT93K-452-1 variety was obtained from Seed Processing Unit of Institute for Agriculture Research, Samaru, Zaria. It has a semi-erect growth habit, early maturing (60-65 days), and medium white seeds with yield potential of 1200 $kgha^{-1}$. It has some level of resistance to insects and diseases. The Achishuru variety was source locally. It has indeterminate growth habit (spreading growth habit), early maturing (60-65 days), with small dark- brown seeds, and potential yield 1000 kg ha^{-1}. It has some level of resistance to insects and diseases.

The IT97K-205-8 variety was source from International Institute of Tropical Agriculture (IITA), Kano. It is an extra-early (about 60 days), heat tolerant and photo-insensitive variety with erect growth habit. It has white medium size seeds with a rough seed coat. The variety also has combined resistance to major diseases and insects and high yield potential of 1.4 t ha^{-1}.

Table 1: Weather Data for the Study Area During the Crop Growing Season.

Month	KANO					KADAWA				
	Rainfall (mm/ month)	Max. Temp (^{0}C)	Min. Temp. (^{0}C)	% Rel. Humidity	Sunshine (hrs/ day)	Rainfall (mm/ month)	Max. Temp (^{0}C)	Min. Temp. (^{0}C)	% Rel. Humidity	Sunshine (hrs/day)
Feb.	0.0	37.1	19.2	27.5	10.0	0.0	39.1	23.1	20.6	NA*
Mar.	0.0	38.0	22.4	30.8	7.1	0.0	41.6	24.9	36.3	NA
Apr.	19.4	40.7	26.1	38.8	7.9	7.0	40.5	25.6	39.5	NA
May	58.1	40.0	26.6	57.9	8.0	94.5	36.1	26.6	56.5	NA
Jun	145.3	35.2	24.3	69.5	8.1	66.4	30.4	21.8	58.5	NA

* NA = data not available

Table 2: Some Physio-Chemical Properties of Soil in the Two Experimental Sites.

Soil Compositions	0-15 cm depth		15-30 cm depth	
	BUK	Kadawa	BUK	Kadawa
Physical Properties				
Clay	11	18	13	27
Silt	14	22	12	21
Sand	75	60	75	52
Textural class	Sandy-loam	Sandy-loam	Sandy-loam	Sandy clay-loam
Chemical Compositions				
pH in H_2O (1:2.5)	7.10	7.00	7.30	7.10
pH in $CaCl_2$ 0.01m)	6.60	6.20	6.20	6.30
Organic Carbon (g/kg)	36.0	53.0	28.0	30.0
Total Nitrogen (g/kg)	5.30	5.30	7.00	3.50
Available Phosphorus(ppm)	10.50	14.00	8.74	8.75
Exchangeable bases (mol(+)kg)				
Ca	4.20	4.10	4.40	5.10
Mg	0.89	1.41	0.63	2.34
K	0.26	0.14	0.33	0.15
Na	0.31	0.45	0.64	0.63
CEC	5.80	7.30	6.30	9.70

The two experiments were laid out in a split-plot design and replicated three times. Sowing dates and irrigation intervals constituted the main treatments, and assigned to main plots, while cowpea varieties constituted the sub-treatments, assigned to sub plots. The field was marked into 9 main plots and 27 sub-plots per replication, with a total of 27 main plots and 81 sub-plots. The gross plot consisted of 3 x 3 m each, with a total area of 9 m^2, while the net plot consisted of 1.5 x 3 m long each given an area of 4.5m^2.

Agronomic Practices

Recommended agronomic and cultural practices were undertaken. The seeds were sown manually at three seeds per hole, with an inter-row and intra-row spacing of 75 and 20 cm respectively at the rate 25 kg ha^{-1} at 13th February, 27th February and 13th March. A total of three weeding was carried out thrice, at 2, 4, and 6 weeks after sowing. All the plots were irrigated weekly up to 3 weeks after sowing (WAS), after which the irrigation interval treatments were imposed. The method of irrigation was surface, and check basins were used. Water was applied sufficiently enough to raise the soil moisture content to field capacity in each irrigation event. However, the amount of water applied was not measured

Data Collection

Plant height, number of leaves, number of branches per plant were recorded at 4 and 8 WAS from five tagged plants per plot. Plant height was measured with a meter rule from ground level to the highest leaf, and the mean values per plot of the tagged plant were computed. The number of leaves and branches per plant were manually counted. Also noted was the number of days to 50% flowering, haulm dry weight, grain yield and harvest index. The

data collected were analyzed statistically and treatment effects were compared for significance using Duncan's multiple range tests.

RESULTS AND DISCUSSION

Plant Height

Treatment variation on plant height is presented in Table 3. The result shows significant variation at both locations. Achishuru produced significantly taller plant at 8WAS at both locations, while at 4WAS IT93K-452.1 produced statistically the tallest plants height at BUK and Kadawa respectively. Variety IT97K-205-8 produced stunted plants at both locations throughout the sampling period. The significant differences in varietal responses observed in plant height might be due to the varietal difference among the varieties evaluated. This result is similar to the findings of Kelechukwu *et al*. (2007) who observed that cowpea height is varietal dependent as certain varieties are taller than others.

Mid-February sowing produced significantly taller plants throughout the sampling period both at BUK and Kadawa, while lower plant height was recorded with mid- March sowing at both locations. At Kadawa, there was no significant difference between mid- February and late-February sown crops at 8WAS. Taller plants were produced in 13th February sowing due to longer time the plants took during the growth stage. These results confirm the observations of Ramzan *et al*. (1992) who reported that plant height was generally reduced in delayed sowing in case of mungbean.

Irrigation intervals significantly affected plant height at both sites. At 4WAS in BUK there was no significant difference between 5 and 10 day interval, but further increase to 15 days interval significantly reduced plant height but at 8, increasing the interval from 5 to 15 day intervals increased the plant height. At Kadawa, at 4WAS irrigating at 5 days interval gave significantly taller plants than the others that were statistically at par, while at 8WAS, 10 days interval gave taller plants than irrigating at 5 and 15. There was no significant interaction at both locations. The result is contradicted with the findings of Nnadi, (1975) who observed that increasing irrigation interval resulted to an increase in plant height but reduced water use efficiency.

Number of Branches per Plant

Varietal responses to sowing date and irrigation interval were significant on the number of branches per plant throughout the sampling period at both locations (Table 4). Variety IT93K-452-1 produced the highest number of branches per plant at 4WAS in BUK, while the lowest number of branches was produced by Achishuru. However, at 8 there was no significant difference between variety IT93K-452-1 and Achishuru at BUK but they produce higher number of branches than IT97K-205-8. While at Kadawa, Achishuru produced significantly more number of branches at 8 than IT93K-452-1 which produced more branches than IT97K-205-8. The result is similar to Ali *et al.* (2009) who observed that significant difference in number of branches per plant was as a result of varietal difference in cowpea.

Date of sowing was not significant on number of branches produced at 4 WAS in BUK. However at 8WAS statistically higher number of branches was obtained with late sown crop, compared to those of early and mid-sown crops which were statistically at par. Irrigation interval did not affect the number of branches at 4 WAS in BUK and Kadawa through all the sampling period. However at 8 WAS in BUK, increasing the interval from 5 to 10 day interval had no effect on number of branches, further increase from 10 to 15 days interval had no effect on this parameter. There were no significant interactions between the treatment combinations at both sites.

Number of Leaves per Plant

Varietal response to sowing dates and irrigation intervals on the number of leaves per plant is presented in Table 5. At 4 WAS there was no significant difference between varieties IT93K-452-1 and IT97K-205-8 with respect to number of leaves per plant at BUK, but they produced more leaves than Achishuru. At 8 WAS Achishuru recorded the higher number of leaves per plant, while variety IT97K-205-8 gave the least number of leave per plant. At 4WAS, in Kadawa, there was no significant difference between the varieties. At 8 WAS, there were no significant difference between variety IT93K-452-1 and Achishuru but they are statistically higher with respect to the number of leaves than IT97K-205-8.

Table 3: Plant Height at the Two Experiment Sites in 2009/2010 Dry Season.

Treatment	4WAS		8WAS	
	BUK	Kadawa	BUK	Kadawa
Variety (V)				
IT93K-452-1	15.65a	14.74a	57.10b	54.00b
'Achishuru'	15.41b	14.11b	109.20a	109.70a
IT97K-205-8	14.67c	14.00b	43.20c	40.20c
SE±	0.234	0.368	4.040	2.110
Sowing Date (S)				
Mid-February (13th Feb)	17.30a	16.88a	76.40a	74.70a
Late- February (27th Feb).	16.00b	14.84b	71.40b	65.70b
Mid-March (13th March)	12.42c	11.13c	61.80c	64.50b
SE±	0.330	0.431	4.080	2.070
Irrigation(I)				
5	15.33a	14.78a	58.80c	59.30b
10	15.45a	14.11b	71.50b	72.2a
15	14.50b	13.96b	79.40a	69.6b
SE±	0.330	0.431	4.080	2.070
Interaction				
V x S	NS	NS	NS	NS
V x I	NS	NS	NS	NS
S x I	NS	NS	NS	NS
V x S x I	NS	NS	NS	NS

*Means within a treatment column followed by same letter(s) is statistically similar (p>0.05) using DMRT.

Table 4: Number of Branches per Cowpea Plant at BUK and Kadawa in 2009/2010 Dry Season.

Treatment	4WAS		8WAS	
	BUK	Kadawa	BUK	Kadawa
Variety (V)				
IT93K-452-1	3.89a*	3.57	4.74a	5.43b
Achishuru	3.70c	3.70	4.67a	5.66a
IT97K-205-8	3.76b	3.66	4.60b	5.19c
SE±	0.123	0.114	0.118	0.087
Sowing Date (S)				
Mid-February (13th Feb)	3.90	3.54b	4.59b	5.31b
Late- February (27th Feb).	4.24	3.91a	4.62b	5.52a
Mid-March (13th March)	3.20	3.48b	4.82a	5.44a
SE±	0.158	0.157	0.121	0.139
Irrigation (I)				
5	3.81	3.69	4.83a	5.54a
10	3.97	3.70	4.75a	5.40ab
15	3.57	3.55	4.44b	5.33b
SE±	0.158	0.157	0.121	0.139
Interaction				
V x S	NS	NS	NS	NS
V x I	NS	NS	NS	NS
S x I	NS	NS	NS	NS
V x S x I	NS	NS	NS	NS

*Means within a treatment column followed by same letter(s) is statistically similar (p>0.05) using DMRT.

Table 5: Number of Leaves per Cowpea Plant at BUK and Kadawa in 2009/2010 Dry Season.

Treatment	4WAS		8WAS	
	BUK	Kadawa	BUK	Kadawa
Variety (V)				
IT93K-452-1	18.34a	13.49	86.20b	94.10a
Achishuru	17.47b	14.44	92.30a	93.50a
IT97K-205-8	18.47a	14.57	63.90c	82.70b
SE+	0.314	0.374	2.920	2.430
Sowing Date (S)				
Early Sowing (13th Feb)	18.83a	13.09b	81.89	93.40a
Mid-Sowing (27th Feb).	17.63b	14.76a	80.50	88.50b
Late-Sowing (13th March)	17.81b	14.64a	80.10	88.40b
SE+	0.398	0.434	3.310	1.750
Irrigation (I)				
5	18.04	13.48b	89.90a	93.42
10	18.10	14.44a	77.90b	88.55
15	18.14	14.57a	74.60b	88.40
SE+	0.398	0.434	3.310	2.722
Interaction				
V x S	NS	NS	NS	NS
V x I	NS	NS	NS	NS
S x I	NS	NS	NS	NS
V x S x I	NS	NS	NS	NS

*Means within a treatment column followed by same letter(s) is statistically similar (p>0.05) using DMRT.

Date of sowing significantly affected number of leaves per plants at both locations (Table 5). At 4WAS in BUK, early sown crop produced significantly higher number of leaves per plant, compared to the mid and late sown crops which produced similar number of leaves. There was no significant effect at 8 WAS irrespective of sowing date in BUK. At 4WAS in Kadawa, delay sowing to 27th February increased the number of leaves per plant; further delay to13th March did not affect the parameter.

Irrigation intervals had no significant effect on number of leaves at 4WAS in BUK. At 8 WAS increasing the interval from 5 to 10 day intervals reduced the number of leaves per plant. Further increase to 15 days interval did not affect the parameter, while at 4WAS in Kadawa, increasing interval from 5 to 10 days increased the number of leaves, further increase to 15 days interval were similar on the number of leaves per plant. There was no significant interaction amongst the treatment combinations at both locations.

Number of Days to 50% Flowering

The effects of sowing date and irrigation interval on the number of days to 50% flowering on cowpea varieties were significant at both locations, (Table 6). Variety IT97K-205-8 significantly increased number of days to 50% flowering at BUK and Kadawa. There were no significant difference between IT93K-452-1 and Achishuru which were statistically at par at both locations. The result was in agreement with the findings of Obadoni *et al*. (2000) reported that cowpea varieties varied in number of days to 50% flowering. Sowing date had significant effect on number of days to 50% flowering at both BUK and Kadawa. At BUK, there was no significant difference between 27th February and 13th March sowing dates with respect to number of days to 50% flowering, while at Kadawa, 13th March sowing significantly increased number of days to 50% flowering. Irrigation interval had no significant effect on number of days to 50% flowering at BUK. At Kadawa, irrigating at 15 day intervals significantly increased number of leaves per plant at BUK, but they produced more leaves than Achishuru. At 8 WAS Achishuru recorded the higher number of leaves per plant, while variety IT97K-205-8 gave the least number of leave per plant. At 4WAS, in Kadawa, there was no significant difference between the varieties. At 8 WAS, there were no significant difference between variety IT93K-452-1 and Achishuru but they are statistically higher with respect to the number of leaves than IT97K-205-8.

Table 6: Number of Days to 50% Flowering and Haulm Dry Weight of Cowpea in 2009/2010 Dry Season.

Treatment	Days to 50% flowering		Haulm dry weight (g)	
	BUK	Kadawa	BUK	Kadawa
Variety (V)				
IT93K-452-1	47.37b*	47.59b	25.70	34.70b
'Achishuru'	47.07b	47.30b	26.80	20.00c
IT97K-205-8	48.74a	48.56a	27.10	45.00a
SE+	0.291	0.287	1.960	2.350
Sowing Date (S)				
Mid-February (13th Feb)	47.07b	47.22c	27.47	35.00a
Late- February (27th Feb).	47.96a	37.85b	28.52	29.10b
Mid-March (13th March)	48.15a	48.37a	23.60	35.60a
SE+	0.205	0.148	2.135	2.150
Irrigation (I)				
5	47.07	47.59b	27.30	33.200
10	47.96	47.30c	25.70	33.900
15	48.15	48.56a	26.60	32.600
SE+	0.291	0.148	2.110	2.150
Interaction				
V x S	NS	NS	NS	NS
V x I	NS	NS	NS	NS
S x I	NS	NS	NS	NS
V x S x I	NS	NS	NS	NS

*Means within a treatment column followed by same letter(s) is statistically similar (p>0.05) using DMRT

Table 7: Seed Yield ha-^{1} and Harvest Index at BUK and Kadawa in 2009/2010 Dry Season.

Treatment	Seed Yield (kg/ha)		Harvest Index	
	BUK	Kadawa	BUK	Kadawa
Variety (V)				
IT93K-452-1	291.00b*	317.00b	0.48	0.54
'Achishuru'	300.00b	297.00b	0.45	0.50
IT97K-205-8	442.00a	499.00a	0.42	0.43
SE+	29.8	23.6	0.06	0.05
Sowing Date (S)				
Mid-February (13th Feb)	403.00a	521.00a	0.46	0.42
Late- February (27th Feb).	411.00a	350.00b	0.37	0.55
Mid-March (13th March)	219.00b	242.00c	0.53	0.49
SE+	46.0	20.9	0.06	0.05
Irrigation (I)				
5	336.00	358.00b	0.47b	0.56a
10	350.00	354.00b	0.55a	0.53a
15	346.00	401.00a	0.33b	0.36b
SE+	46.0	20.9	0.06	0.5
Interaction				
V x S	NS	NS	NS	NS
V x I	NS	NS	NS	NS
S x I	NS	NS	NS	NS
V x S x I	NS	NS	NS	NS

*Means within a treatment column followed by same letter(s) is statistically similar (p>0.05) using DMRT

Date of sowing significantly affected number of leaves per plants at both locations (Table 5). At 4WAS in BUK, early sown crop produced significantly higher number of leaves per plant, compared to the mid and late sown crops which produced similar number of leaves. There was no significant effect at 8 WAS irrespective of sowing date in BUK. At 4WAS in Kadawa, delay sowing to 27th February increased the number of leaves per plant; further delay to13th March did not affect the parameter.

Irrigation intervals had no significant effect on number of leaves at 4WAS in BUK. At 8 WAS increasing the interval from 5 to 10 day intervals reduced the number of leaves per plant. Further increase to 15 days interval did not affect the parameter, while at 4WAS in Kadawa, increasing interval from 5 to 10 days increased the number of leaves, further increase to 15 days interval were similar on the number of leaves per plant. There was no significant interaction amongst the treatment combinations at both locations.

Number of Days to 50% Flowering

The effects of sowing date and irrigation interval on the number of days to 50% flowering on cowpea varieties were significant at both locations, (Table 6). Variety IT97K-205-8 significantly increased number of days to 50% flowering at BUK and Kadawa. There were no significant difference between IT93K-452-1 and Achishuru which were statistically at par at both locations. The result was in agreement with the findings of Obadoni *et al*. (2000) reported that cowpea varieties varied in number of days to 50% flowering. Sowing date had significant effect on number of days to 50% flowering at both BUK and Kadawa. At BUK, there was no significant difference between 27th February and 13th March sowing dates with respect to number of days to 50% flowering, while at Kadawa, 13th March sowing significantly increased number of days to 50% flowering. Irrigation interval had no significant effect on number of days to 50% flowering at BUK. At Kadawa, irrigating at 15 day intervals significantly increased number of days to 50% flowering.There were no significant interactions between variety and irrigation on the number of days to 50% flowering at both locations.

Haulm Dry Weight

Table 6 shows the effects of the sowing date and irrigation interval on haulm dry weight at harvest at both sites. Varieties responded similarly at BUK. While at Kadawa, IT97K-205-8 produced heavier haulm dry weight than IT93K-452-1, while Achishuru gave the least haulm dry weight. The result is similar to the result of Haizel (1972) and Turk *et al*. (1980) who found out that cowpea varieties have different capacities for dry matter accumulation. Sowing dates significantly affected haulm dry weight only at Kadawa. The result shows that 27th February sowing date gave statistically lower haulm yield than the other two dates which difference were similar. This is similar to the report of Akinola and Davies (1979) who observed that early sowing gave higher dry matter yield in cowpea than late sowing. Irrigation intervals had no significant effect in haulm dry weight at BUK and Kadawa. Interactions between the treatment levels were not significant at both locations.

Seed Yield

The effects of sowing date and irrigation interval on seed yield per hectare were significant at both locations (Table 7). The varietal responses on the seed yield per hectare were significant at both locations. Variety IT97K-205-8 significantly recorded the higher seed yield per hectare at both locations, while varieties IT93K-452-1 and Achishuru produced statistically similar yield at both sites. This is similar to the report of Ayaz *et al*. (2004) who reported that the variation in cowpea yield components was species dependent.

Effect of sowing dates on seed yield per hectare was significant at both locations. At BUK, 13th March sowing gave significantly lower seed yield than the other sowing dates which were statistically at par. While at Kadawa every delay in sowing was accompanied by reduction in seed yield. The result is in agreement with the findings of Ali (1999) who reported that early sown crops produce higher yields because they intercept more solar radiation over an extended period of growth.

Intervals of irrigation were not significantly affected seed yield per hectare at BUK; however, there were significant differences at Kadawa. Irrigating at 15 day interval gave significantly higher seed yield per hectare than other intervals which were statistically similar. There were no significant interactions among the treatments on seed yield per hectare at BUK and Kadawa. The 15 day irrigation intervals which gave the higher yield at Kadawa, possibly due to resistance nature of cowpea crop and the high water table status of Kadawa irrigated land. Chuadhary (1981) reported similar findings and concluded that increasing irrigation interval from 7 to 14 day for cowpea will enhance cowpea yield.

Harvest Index

Response of cowpea varieties to sowing date and irrigation interval on the harvest index is presented on Table 7. The result indicated no significant variation on harvest index among the varieties evaluated at both locations. Sowing dates had no significant differences on harvest index at both BUK and Kadawa.

Irrigation interval had significant effect on harvest index at both locations. At BUK, increasing the interval from 5 to 10 day gave higher harvest index compared to other intervals which were statistically at par. At Kadawa, irrigating at 5 and 10 days interval gave similar harvest index that were higher than those obtained at 15 day intervals. Harvest index varied significantly due to differences in the irrigation treatment. The highest harvest index was observed by irrigating at 10 day interval. There were no significant interaction between the treatment combination at both BUK and Kadawa.

CONCLUSION

Cowpea variety IT97K-205-8 out-yielded the other varieties when planted in mid-February and irrigated at 10 day interval at both locations. Sowing in early February and irrigating at 10 day interval for higher yield seemed to be optimum for higher yield of cowpea. Planting cowpea in mid-March significantly increased the number of days to 50% flowering, but sowing in mid- February resulted in significant increase in grain yield per hectare. Irrigation scheduling at 10 days interval significantly increased growth characters such as plant height, number of branches, and number of leaves, but reduced number of days to 50% flowering.

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