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Influence of Maize Varieties and Date of Planting Cowpea into Maize/Cowpea Intercropping System in Makurdi, Southern Guinea Savannah, Nigeria

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Abstract

Field experiments were conducted at the late season of 2016 and 2017 cropping seasons from August to November at the Teaching and Research Farm of the University of Agriculture Makurdi to investigate the influence of maize varieties and date of planting cowpea into maize-cowpea intercropping system. The experiment was a 2 x 2 x 3 split-split plot laid in a Randomized Complete Block Design with four replicates. Cropping system (sole and intercrop) constitute the main plot, maize varieties (ACR 89 DMESR-W and AK 94 DMESR-Y) constitute the sub-plot while date of planting cowpea (planting at the same time, two weeks after planting maize and four weeks after planting maize) constitute the sub-sub-plot. The result obtained showed significant reduction in all growth and yield characters tested as cowpea was intercropped.Allgrowth and yield characters of cowpea (except 50% pod maturity) were significantly affected by maize varieties. All cowpea growth and yield characters (except 50 % pod maturity)were also significantly influenced by date of planting. These characters decrease with delay time of planting except days to 50 % flowering and days to 50 % pod maturity which increases with delay time of planting. Result on maize showed that all growth and yield characters (except shelling percentage and 100 seeds weight) were significantly affected by intercrop. Variety AK 94 DMESR-Y was significantly different from variety ACR 89 DMESR-W.

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All growth and yield characters (except shelling percentage) were significantly influenced by date of planting, these characters increased with delayed planting of cowpea. The highest LER (1.48 and 1.46); LEC (0.52 and 0.49) and % of land saved were obtained when cowpea was planted at the same time with maize using maize variety ACR 89 DMESR-W which showed highest compatibility among the system.

Key words: Date of planting; intercropping; Yield advantage ;Variety; Cowpea.

1. Introduction

Intercropping is a multiple cropping system that two or more crops are planted in a field during a growing season [40]. The use of intercropping by small holder farmers is a common practice and date back to ancient times [15]. Intercropping is a wide spread agronomic practice in the tropics because it reduces losses cause by pests, diseases and weeds as well as guarantee better yield [16]. With the increasing pressure on agricultural land due to population growth, it becomes imperative to encourage farmers to implore new ways of intensifying production per unit area of land. Intercropping legume with cereal is an intensively applied planting pattern in crop cultivation. Cereal – legume intercropping plays an important role in subsistence food production in both developed and developing countries especially in situation of limited water resources [46]. Intercropping of cereal with legume can help maintain and improve soil fertility [53] and play an important role in subsistence food production in developing countries [16].

Maize is one of the oldest food sources; it is a productive food plant and has the highest potentials for carbohydrate accumulation per unit area per day [52]. It is the third ranking cereal in grain yield per hectare and second to wheat in total production [21]. Maize crop started as a subsistence crop in Nigeria and has gradually risen to a commercial crop on which many agro base industries depends on raw materials [32]. It is the most widely grown cereal crop in Guinea Savannah region of Nigeria and is the most widely distributed of any other cereals [43]. In Africa, Nigeria produces about 5.1 metric tonnes out of the 26 metrictonnes produce annually [20]. About 70% of maize produce in Nigeria comes from Guinea Savannah [5]. Nigeria is the tenth largest producer of maize in world and the largest in Africa [21].

Cowpea is an important grain legume throughout the tropics and subtropics covering Africa, Asia, central and south America, its value lies in its high protein content, its ability to tolerate drought and the fact that it fixes atmospheric nitrogen with high efficiency which allows it to grow on and improve poor soils [24]. It is shade tolerant and therefore compactible as an intercrop with many crops [46]. Cowpea is the most economically important grain legume adapted to savannah ecologies where it matures its grain in residue moisture; it is a crop that contribute to food security, income generation and soil amelioration for small scale farming conditions [10]. In West Africa where more than 70% of the total world production is grown, cowpea has become an integral part of the farming system [4] and is grown in mixture with other crops in various combinations.

The quality and quantity of crop seed is affected by the amount of rainfall and date of planting [8]. Date of sowing/planting any crop is dictated by many factors including weather and soil condition, management and crop production system, therefore, accurate timing of sowing a crop in a mixture in any particular location is an

important requirement [46]. Reference [29] recommended proper adjustment of time of sowing and plant types so as to minimize competition for light and other resources to enhance productivity, that the growth habit and plant architecture must be considered when deciding to defer planting of any component crop. A possible avenue for further reduction in competition for growth resources is through usage of early maturing taller component cultivars with less shading effect [39].

In Guinea Savannah of Nigeria, intercropping maize with cowpea is always carried out with the onset of rain by May/June which always results in poor yield and poor quality seeds of cowpea. Previous works on Maize – cowpea intercrop have address issues such as spatial arrangement [7], planting pattern [34], population density ([11,36]), Varietal trial ([1,2]). However, the relative date of planting cowpea in association with different maize varieties during late season planting in Southern guinea Savannah has not been extensively studied and not documented. Therefore, this work seeks to find out the relative date of planting cowpea and maize varieties on the growth and yield of late maize- cowpea intercrop.

2. Materials and methods

Field experiments were conducted during the 2016 and 2017 cropping seasons to investigate the influence of dates of planting cowpea and maize varieties in a cowpea/maize intercropping system at the Teaching and Research Farm of the University of Agriculture, Makurdi (7.41^{o}N;8.28^{o}E) which falls within the Southern Guinea Savannah agro-ecological zone of Nigeria. Ten core sample soil were collected from different part of the experimental field from a depth of 0 – 30 cm and bulk into composite sample. The samples were air-dried at room temperature for one week, grind (using muster and pistle) to pass through air 0.3mm screened for chemical and mechanical analysis (See Table Below)

The experimental design was a 2x2x3 split - split plot laid in a randomized complete block replicatedfour times. Two cropping systems (sole and intercrop), two maize varieties (AK94 DMESR-Y and ACR89 DMESR-W) and three dates of planting (Simultaneous planting of cowpea with maize, planting cowpea two weeks after planting maize and planting cowpea four weeks after planting maize). Each experimental unit (plot size) measured 5mx3m with four ridges of 5m long spaced 0.75m, site clearing and ridge making was done manually, spacing for maize sole and intercrop was recommended spacing of 0.75m x 0.5m at 2 plants per stand giving a population of approximately 53,333 plants per hectare using the additive mixture as stated by [22] . Spacing for sole and intercrop cowpea was 0.75m x 0.30m at two plants per stand giving a population of approximately 88,889 plants per hectare. Maizeseeds were sown (4 seeds/hill) on the side of the ridges and thinned to two plants per stand, cowpea was sown (4 seeds/ hill) on top of the ridges, which were thinned to two plants per stand both for sole and intercrop. Fertilizer was applied based on recommended fertilizer rates for Benue State as follows-Maize sole- 90kgN/ha, 45kgP2O5 and 45kgK2O/ha (300kg of NPK: 15:15:15/ha as first split application and 100kg urea/ha as second split application.)Cowpea -- 10kgN/ha, 36kgP2O5/ha and 20kgK2O/ha (22kg of urea/ha, 200kg of SSP/ha and33kg/ha of MOP).

Intercrop – 200kg/ha of NPK-15:15:15 as first split application and 200kg/ha of SSP on cowpea and 100kg/ha of urea on maize as second split application [33].Data collected on maize were plant height, leaf area index,ear

height at harvest,dry Stover weight per plant, number of ears per plant, number of seeds per ear,shelling percent, weight of 100 seeds and net yield. Data collected on cowpeawere – leaf area index, number of leaves per plant, total dry matter per plant, number of days to 50% flowering, number of primary branches, number of pods per plant, number of seeds per pod, days to 50% pod maturity, days to 100% physiological maturity, weight of 100 seeds and net yield.Maize crop was harvested when they were fully matured and dried while cowpea pods were harvest as they turn brown. All the data collected were subjected to analysis of variance using Genstat (version 5) statistical package. Land Equivalent Ratio was computed as stated by [37]. Competitive Ratio as stated by [55], Land Equivalent Coefficient as stated by [6] and percent Landsaved as stated by [54].

3. Result and discussion

3.1 Effect of intercropping on growth characters of cowpea and maize

Results of analysis of variance of main effects of various dates of planting cowpea, varieties of maize and cropping systems on cowpea growth characters is as presented in Table I. Cropping systems significantly affected all growth characters of cowpea. Sole cropped cowpea was taller than intercropped cowpea. This could be as a result of shading effect of maize which most have reduces the amount of solar radiation reaching the cowpea crop. This result is in consonance with [34] who reported that because of the availability of light sole cropped cowpea has the potential to grow taller than that of intercrop. Number of leaves and number of branches per plant of cowpea (Table I) were significantly increased in sole cropping system than intercropping system. This result is consistent with the earlier report of [34] that sole crop cowpea has the potential to harvest more light, produce more leaves, branches, pods and grains.

There was significant reduction in cowpea leaf area index as cowpea was intercropped. [49]reported decreased in leaf area index of intercropped bean in maize – bean intercrop also [31] on effect of crop combination revealed that intercropping reduces vegetative growth. There was significant increase in sole crop cowpea than intercrop cowpea on total dry matter which could be due to competition for above and below ground resources that limits growth in intercrop. This result is in accordance with [27]who observed reduction in cowpea dry matter as a result of intercrop.Result of the effect of intercropping on maize growth characters is as presented in Table III. Maize plant height was significantly affected by intercropping. Sole crop maize was taller than intercrop maize which could be as a result of inter-specific competition for natural resources in the mixture.

This result collaborates [9] who opined that there was significant difference between mixed and sole crops of maize in terms of height, also [49] found that mono cropped maize was taller than intercropped as against. Intercropping maize with cowpea had no significant effect on maize leaf area index. This could be because the maize is taller than its component crop, there was no interference of solar energy interception, and this could result to direct sun light diffusion, high elevation and high incidence of light intensity.

Reference [25] had reported that when a crop is taller than the other component crop in intercropping, the taller crop can grow well due to high photosynthetic activity with adequate solar radiation.

Table 1: Physico-Chemical Properties of the Surface Soil (0-30cm) at the Experimental Site in Makurdi Before Planting

	Values		
Soil Parameters	**2016**	**2017**	**Method of Analysis**
Sand (%)	79.02	78.84	Hydrometer Method
Silt (%)	11.46	10.76	Hydrometer Method
Clay (%)	9.52	10.4	Hydrometer Method
Textural class	Sandy loam	Sandy loam	
pH (H_2O)	6.2	6.25	PH meter
Organic Carbon (%)	0.66	0.68	Walky-Black
Organic Matter (%)	0.51	0.48	Improved Chromic Acid Digestive and
Total Nitrogen (%)	0.86	0.92	spectrophotometric method
Available Phosphorus (ppm)	5.02	5.06	Kjeldah1 procedure
Cal^{2+} Cmol kg^{-1} soil)	2.62	2.66	Bray-1 method
Mg^{2+} (Cmol kg^{-1} soil)	2.44	2.5	AAS
K^{+}Cmol kg^{-1} soil)	0.38	0.42	AAS
Na^{+}Cmol kg^{-1} soil)	0.23	0.26	Flame phhotometer
CEC Cmol kg^{-1} soil)	7.35	7.38	Flame phhotometer
Base Saturation (%)	94.4	95	Summation method

Table2: Main Effect of Date of Planting Cowpea, Maize Variety and Intercropping on Cowpea Growth Characters

Treatment/Factor	Plant height (cm) 45 DAP	Number of leaves/plant 55 DAP	Number of branches/plant 55 DAP	Total dry matter/plant (g) 35 DAP	Total dry matter/plant (g) 45 DAP	Leaf area index 40 DAP
Cropping system						
Sole	48.88	53.22	5.01	33.78	42.47	3,5
Intercrop	46.22	40.66	3.45	28.85	36.38	2.52
LSD 0.05	0.68	0.67	0.24	1.19	2.49	0.22
Maize Variety						
ACR 89	47.11	41.78	3.89	27.59	33.67	2.61
AK 94	51.93	36.30	3.20	22.01	29.24	2.03
LSD 0.05	0.84	1.40	0.46	0.84	2.18	0.33
date of planting						
D_i (Simultaneous)	49.53	48.08	4.89	35.25	43.73	3.43
D_2 (two weeks)	47.50	44.74	4.66	31.63	38.46	2.99
D_3 (four weeks)	45.61	36.66	3.46	27.06	36.08	2.29
LSD 0.05	0.85	0.82	0.30	1.46	3.05	0.27
Year						
1st (2016)	45.46	52.20	4.51	33.31	42.47	3.05
2nd (2017)	49.63	41.45	3.95	29.32	36.38	2.75
LSD 0.05	0.90	1.72	NS	NS	3.73	NS

Ear height of maize in intercrop was significantly reduced when compared to sole crop. Competition for light, water and nutrient in intercrop most have reduce maize plant height which translate into reduced ear height. This result agreed with the findings of [49] who observed reduction in ear height as a result of reduction in plant height. Furthermore, intercropping significantly reduced maize Stover weight per plant. Competition in intercrop (light, space, water and nutrient) could have caused suppression in growth of maize in intercrop. Reference [1] observed reduction in maize Stover weight and attributed the reduction to growth factors such as moisture and soil nutrient. Reference [35,42] also reported reduction in maize stover weight per plant in intercrop.

3.2 Effect of intercropping on yield characters of cowpea and maize

Result on cowpea yield characters (Table II) showed that all yield characters (except 50% pod maturity) were significantly affected by cropping system. 50% flowering and 100% physiological maturity were significantly delayed in intercropping system; it could be as a result of the shading effect of the taller maize plant which must have delayed flowering and maturity in cowpea. Reference [36] Opined that cowpea in intercrop flower later than those planted sole and he also observed late physiological maturity in intercrop cowpea than sole cowpea.There was significant decrease in number of pods and number of seeds per plant as a result of intercropping. Pod and seed yield attained in this experiment was consistent with previous findings of [4] and [18] who reported generally that intercropping reduces number of pods and number of seeds per plant of legume crops. Grain yield of sole crop cowpea was significantly higher than intercropped cowpea. Increased in sole cropped in this study could be due to increase in number of pods in sole crop as number of pods is said to significantly influence yield [4]. Reference [9,43] also reported yield increase in sole crop cowpea over intercrop, however, this work is at variance with the findings of Singh and [51] who reported yield increase in intercrop as a result of intercropping sorghum with cowpea . Result of this investigation on maize yield characters (Table IV) revealed significant effect of intercropping (except shelling percentage). Higher numbers of ears were produced by mono crop maize than intercrop maize. Reference [3] in his trial observed increase in number of ears in sole crop than intercrop. There was significant difference between intercrop and sole maize in number of seeds per ear. This could be attributed to the low competition (intra – specific competition) in sole cropped maize. In agreement to this findings, Reference [1] reported highest number of seeds in sole cropped maize than intercrop. 100 seeds weight of maize was not significantly affected by cropping system. Reference [14]also observed no significant difference in weight of 100 seeds of maize when cowpea was intercrop with maize. There was significant reduction in maize grain yield in intercropping system compare to mono cropping system. It could be attributed to inter-specific competition and variation in weather condition; similar results were reported by [9;3,7].

3.3 Effect of maize varieties on growth and yield characters of cowpea and maize

Maize varieties significantly affected all cowpea growth characters (Table I). All cowpea growth characters were significantly reduce when intercropwith maize variety AK 94. The higher leaf area index and foliage distribution of AK94 would have caused increased foliage overlap and foliage shading, thus, reducing light transmission into the lower canopy which invariably affects cowpea growth. This result is in line with [41] who

reported that canopy architecture determines the interception of solar radiation by a crop and the distribution of irradiance among component crops, that leaves with lower LAI are erectophites that allow penetration of light into lower canopy than planophites whose leaves are much spread and reduces the amount of solar radiation to other component crops.

Table 3: Main Effect of Date of Planting Cowpea, Maize Variety and Intercropping on CowpeaYield Characters

Treatment	50% Flowering	50% pod maturity	100% physiological maturity	Number of pods/plant	Number of seeds/pod	Net grain yield t/ha
			Cropping system			
Sole	48.37	66	61.75	61.75	11.3	0.83
Intercrop	49.17	66.25	66.32	46.32	10.66	0.61
LSD 0.05	0.91	NS	2.24	3.11	0.4	0.17
			Maize variety			
ACR 89	49.75	66.75	54.7	12.8	10.72	0.84
AK 94	49.5	68.25	53.34	10.12	10.48	0.72
LSD 0.05	NS	2.46	0.73	0.92	0.43	0.11
			Date of planting			
D1 (simultaneous)	49	66.5	54.65	17.11	11.6	0.87
D2(two weeks)	49.5	67.25	53.87	14.46	11.01	0.73
D3 (four weeks)	50.25	68	53.58	11.39	10.34	0.55
LSD 0.05	0.43	NS	0.56	0.74	0.49	0.19
			Year			
1st (2016)	49.25	66.5	54.6	14.74	11.25	0.79
2nd (2017)	50.75	67.25	53.47	13.17	10.73	0.63
LSD 0.05	0.61	NS	0.7	1.16	0.42	0.17

Varieties of maize significantly affected all cowpea yield characters (Table II). All yield characters of cowpea were reduce when intercrop with variety AK 94. Crop yield is said to be a function of the amount of solar radiation receive by the crop, the shading effect of AK 94 as a result of its high LAI foliage distribution could have resulted in significant reduction in cowpea yield characters.

Reference [12]observed that environmental factors such as solar radiation had profound influence on crop yield characters.There was significant difference between the varieties (ACR 89 and AK 94) on all the growth characters of maize(Table III). The tall sturdy and leafy variety AK 94 out grown variety ACR 89. This difference could be attributed to genetic characteristics of the varieties. [36]reported differences in crop varieties as a result of their genetic traits.

Table 4: Main Effect of Date of Planting Cowpea, Maize Variety and Intercropping on MaizeGrowth Characters

Treatment	Plant height (cm) 35 DAP	Plant height (cm) 60 DAP	Leaf area index	Ear height at harvest	Stover weight per plant
		Cropping system			
Sole	94,43	227.36	3.65	120.90	121.80
Intercrop	90.46	211.86	3.75	118.41	117.10
LSD (0.05)	0.74	1.78	0.03	0.74	2.11
		Maize variety			
ACR 89	67.77	214.52	2.52	114.76	118.01
AK 94	95.12	222.56	2.73	124.35	127.10
LSD (0.05)	2.64	4.82	0.53	0.57	4.11
		Date of planting			
D_1(simultaneous)	90.95	218.88	2.52	101.10	118.04
D_2(two weeks)	92.34	220.05	2.71	101.14	119.50
D_3(four weeks)	92.58	221.65	2.79	101.15	120.43
LSD (0.05)	1.24	1.46	0.09	0.04	0.90
		Year			
1st (2016)	94.95	208.47	2.75	109.96	111.32
2nd (2017)	94.20	229.91	3.07	129.35	127.80
LSD (0.05)	NS	5.50	NS	3.15	4.05

Table5: Main Effect of Date of Planting Cowpea, Maize Variety and Intercropping on Maize Yield Characters

Treatment	Number of ear per plant	Number of seeds/Ear	Shelling percentage	100 seeds weight (g)	Grain yield (t/ha)
			Cropping system		
Sole	1.11	667.67	65.4	23.55	2.27
Intercrop	1.23	547.43	64.69	23.15	2.09
LSD (0.05)	0.02	14.09	NS	NS	0.12
			Maize variety		
ACR 89	1.12	625.25	62.45	21.71	2.11
AK 94	1.13	676.02	69.63	23.92	2.25
LSD (0.05)	NS	6.26	2.27	1.23	0.14
			Date of planting		
D_1(simultaneous)	1.12	568.78	65.79	22.05	2.09
D_2(two weeks)	1.2	591.21	66.28	22.97	2.19
D_3(four weeks)	1.26	611.06	66.36	23.52	2.25
LSD (0.05)	0.05	12.24	NS	NS	0.09
			Year		
1st (2016)	1.2	427.23	62.59	22.74	
2nd (2017)	1.32	544.11	69.5	22.93	
LSD (0.05)	0.06	17.73	NS	NS	

Maize varieties significantly influence all yield characters of maize (Table IV) except numbers of ears per plant. The varietal difference in 100 seeds weight, number of seeds per ear, shelling percentage and grain yield could be attributed to differences in varietal yield contributing traits. Decline in grain yield was highly visible in maize variety ACR 89 than AK 94 (Table IV). The tall, sturdy and leafy nature of AK 94 confers on it the advantage to better withstand competition from cowpea. This confirm the finding of [41] who reported that genetic characteristics of a crop contributes to its yield differences.

3.4 Effect of date of planting cowpea on growth and yield characters of cowpea and maize

The result of cowpea growth characters as influence by date of planting cowpea are as presented in table 1. Date of planting significantly influenced all growth characters of cowpea, these characters decrease with delayed date of planting. the observed significant decreased in cowpea growth characters with delayed date of planting could be as a result of shading effect of maize, insufficient nutrient and low amount of water as date of planting progresses. [10] also observe significant decreased in cowpea growth characters as date of planting cowpea into maize was delayed and attributed the decrease to inter specific competition between well grown and established maize and the young cowpea planted lately into the intercrop. Date of planting also influence all yield characters of cowpea (except 50% pod maturity). 100% physiological maturity, number of pods per plant, seed per pod and grain yield decreased with delay planting of cowpea (Table II) whereas 50% flowering and 50% pod maturity increase with delay planting. This decrease in yield attribute could be due to competitive effect. [47]has recommended simultaneous planting of maize and bean as this will ensure little competition for light before the initiation of flowering while [48] concluded that cowpea should be planted simultaneously with millet for maximum yield of cowpea.

Date of planting cowpea significantly influence maize plant height, leaf area index, ear height and stover weight per plant (table 3).

Maize planted simultaneously with cowpea produce lowest plant height, leaf area index, ear height and stover weight per plant.

Simultaneous planting of cowpea with maize (D_1) significantly differed from delay maize planting (D_2 and D_3). These characters increase with delay cowpea planting, this could be due to reduce competitive effect on maize as planting of cowpea was delayed.

All maize yield characters (except shelling percentage and 100 seed weight) were significantly affected by date of planting cowpea (table 4).

Result also showed significant difference between simultaneous planting of cowpea (D_1) and other dates of planting (D_2 and D_3) for ear number and number of seeds per ear (which increase with delay planting) whereas for grain yield, D_3 (4WAP) was significantly different from the other date of planting(D_1 and D_2).

The significant increase in number of ears per plant, number of seeds per ear and grain yield could be attributed to decrease in inter specific competition especially in terms of water and nutrient which most have given the

maize enough ground to establish.

Reference [23]found maize yield to consistently increase with increasing delay in cowpea planting.

3.5 Yield advantages

Evaluation of yield advantages of date of planting cowpea and maize varieties into a maize/cowpea mixture as measure by LER, LEC, CR and % Land saved is as indicated in table 5, 6 and 7.Generally, LER values were greater than unity (1.00), however, simultaneous planting of cowpea with maize produced highest LER values (1.48 and 1.46) except with delay two weeks planting of cowpea with maize variety ACR 89 where LER was 1.47 (Table V).

Table 6: Land Equivalent Ratio of Maize/ Cowpea Mixture

Date of planting	Sole cowpea (t/ha)	Sole maize (t/ha)	Intercrop cowpea yield(t/ha)	Intercrop maize yield(t/ha)	Partial LER for maize	Partial LER for cowpea	Total LER
			ACR 89				
D_1	0.87	2.29	0.50	2.07	0.90	0.58	1.48
D_2	0.82	2.29	0.41	2.21	0.97	0.50	1.47
D_3	0.78	2.29	0.22	2.27	0.99	0.28	1.27
			AK 94				
D_1	0.85	2.42	0.45	2.25	0.93	0.53	1.46
D_2	0.82	2.42	0.25	2.36	0.97	0.31	1.28
D_3	0.78	2.42	0.15	2.41	0.99	0.19	1.18

CR values of simultaneous planting of cowpea with maize were lowest (0.77 and 0.89) for both varieties (ACR 89 and AK 94) at simultaneous planting and increase with delayed planting of cowpea (table VI).

Yield advantage was also observed by [3,7] when cowpea was intercrop with maize.

The LEC of all dates of planting were above 0.25 (25%) (Except simultaneous planting of cowpea with AK 94) signifying compatibility (table 7).

Reference [45] investigated the variability to intercrop adaptation and observed suitable genotypic traits that are necessary for compatibility in cowpea-bean intercrop.

This work indicated that it is advantageous to have the crops in mixture since the farmer will need as much as 1.48 and 1.46 hectare of land when crops are grown sole in order to achieve the same level from one hectare of land when crops are sown in mixture, thereby saving

32.43% and 31.51% of land (table VII). Reference [17,28] also reported increased in percentage of land saved in intercrop.

Table 7: Competitive Ratio of Maize/cowpea Mixture

Date of Planting	partial LER		
	LER Maize	LER Cowpea	C R
		ACR 89	
D_1(simultaneous)	0.91	0.59	0.77
D_2(two weeks)	0.97	0.50	0.97
D_3(four weeks)	0.99	0.28	1.77
		AK 94	
D_1(simultaneous)	0.91	0.53	0.89
D_2(two weeks)	0.97	0.30	1.60
D_3(four weeks)	0.99	0.25	1.98

Table 8: Land Equivalent Ratio (LER), Land Equivalent Coefficient (LEC) and Percentage Land Saved of Maize Varieties Intercropped with Cowpea

Variety	Land Equivalent Ratio	Land Equivalent Coefficient			Percentage Land Saved
		D1	D2	D3	
ACR 89	1.48	0.52	0.49	0.25	32.43
AK 94	1.46	0.49	0.30	0.19	31.51

4. Conclusion

From the result obtained, it can be concluded that, in Makurdi, Nigeria which falls within Southern Guinea Savannah Agro- ecological zone, the highest yield of maize/cowpea intercrop was obtain when cowpea was planted at the same time with maize. The highest LER, CR and LEC values were obtained when cowpea was planted at the same time with maize using maize variety ACR 89 which showed highest compatibility among the system. Also, greater percentages of land area saved were obtained when cowpea was planted at the same time with maize.

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