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SUSCEPTIBILITY OF SOME COWPEA (*VIGNA UNGUICULATA* (L) WALP) VARIETIES TO PERIOD OF WEED INTERFERENCE IN THE SOUTHERN GUINEA SAVANNA OF NIGERIA

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ABSTRACT

Field trials were conducted at the Research Farm of Niger State College of Agriculture, Mokwa, in the Southern Guinea Savanna of Nigeria during the 2019 and 2020 wet seasons to investigate the Reaction of cowpea varieties to periods of weed interference. The treatments were made of four cowpea varieties and ten periods of weed-interference in two sets. One set of the weed interference treatment plots were kept weed-free for 3, 6, 9, 12 weeks after sowing (WAS) till harvest while the other sets of treatment plots were left weed infested for the corresponding periods. There were two control treatments in which one plot was kept weed free till harvest while the other plot was left infested until harvest. The treatments were laid out in a split- plot design with three replications in a randomized complete block design where the main plot was assigned to cowpea varieties and the sub-plot to periods of weed interference. The results obtained from the study indicate that cowpea variety IT90k-277-2 and IT98k-305 produced significantly ($P<0.05$) highest grain yield compared to the other varieties in both years. Weed dry matter production was highest in IT98k-305 but was least with Dan Sokoto variety. Weeding cowpea for 3 WAS only was quite inadequate for effective weed control and promotion of acceptable grain yield. Cowpea varieties IT90k-277-2 and IT98k-305 are recommended for cultivation while a weed-free period for the first 4 – 6 WAS of growth is required for optimum grain yield in the study area.

Keywords: Competition; Cowpea; Critical period; Variety, Weeds infestation

INTRODUCTION

Vigna unguiculata L. Walp commonly known as cowpea is one of the most ancient crops known to man and one of the most important pulse crop globally (Abate *et al*., 2012; IITA 2015). It originated and was domesticated in Southern Africa. It was then cultivated in East and West Africa as well as Asia till today, it is grown mostly in semi-arid tropical zones across Africa, Asia, Europe and the Americas (FAOStat, 2021). However, most researches revealed that Africa predominates in its production (Dugje *et al*., 2009). Rural families that make up the larger part of the population of these regions derive from its production food, animal feed, alongside cash income (IAR, 2016).

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 is between 28°Cand 30°C during the growing season. The crop can thrive in the Sahel zone, where the rainfall is less than 500 mm per annum (Dugje *et al*., 2009; IITA, 2015). It is drought tolerant and well adapted to sandy and poor soils. 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 (Abate *et al*., 2012). In Nigeria, much of cowpea cultivation is carried out under rain-fed condition. The major cowpea producing States in Nigeria are Niger, Borno, Zamfara, Sokoto, Kano, Gombe and Yobe States in the northern part of the country (IAR, 2016), since this region naturally possesses the recommended growing conditions for the crop (IITA, 2015).

Cowpea seeds are important source of plant protein for man and feed for animals globally (Munoz-Amatriain *et al.*, 2021). The highest nutrient in cowpea seeds on analysis is protein accounting for 23 % amongst other nutrients like water, fat carbohydrate and fibre (Joshua et al., 2020). The seeds are mostly harvested and dried for storage and consumption at a later time, either after cooking whole or after being milled like a flour product and used in various recipes. Its young leaves and immature pods are not left out as they are also eaten as vegetables (Chikwendu *et al.*, 2014). Cowpea being a leguminous plant, its leaves and root systems replenish nitrogen-depleted soils; increases soil organic matter content and improves soil structure after soil incorporation thus increasing soil fertility (Egesa *et al*., 2016). Most farmers often grow creeper varieties of cowpea because of their groundcover properties which prevents erosion (Iqbal *et al*., 2019). Also, cowpea provides soil nitrogen to cereal crops such as maize, millet, and sorghum when grown in rotation, in areas of poor soil fertility (Egesa *et al*., 2016).

Poor yield values for Nigeria could be traced to the use of low plant population (Adigun *et al*., 2020), the practice of mixed cropping (Daramola *et al*., 2019), pests attack at different stages of growth and development (Gupta *et al.*, 2016). Weed related yield losses ranging from 65 – 92% had been recorded in Sub-Saharan Africa (Nikoa *et al*., 2015). Apart from direct competition with crop plants for space and light, weeds are reported to absorb soil nutrients faster than cowpea and in some cases serve as host plant to the insect pests of the crop (Akobundu, 1987; Suryanto *et al*., 2017; Ndeve *et al*., 2019)

The major constraints has been the dearth of information on the appropriate crop varieties, weed control methods and effective weed management periods for maximum yield of the crop. The broad aim of this trial is to determine the effect of four cowpea varieties to different periods of weed interference on their yield and yield components at Mokwa in the Southern Guinea Savanna zone of Nigeria.

MATERIALS AND METHODS

Field trial was conducted during the 2019 and 2020 wet session on the Teaching and Research farm of the International Institute of Tropical Agriculture (IITA) Mokwa Station (09^0 18'N and 05^0 50'E) in the Southern Guinea Savannah agro-ecology of Nigeria. The area is characterized by a bimodal rainfall pattern with a peak in June and September and a dry spell between mid- July and August. The site used in 2019 was under continues cropping between 2016 till the commencement of the study while the site for the 2020 trial was under natural fallow between 2018 and 2020.

Treatment and Experimental design

The treatment was laid out in a factorial Randomized Complete Block design; these were made into cowpea varieties and ten periods of weed interference. One set of the interference treatment plot was kept initially weed free for 3, 6, 9 and 12 weeks after sowing (WAS) and then subsequently left un-weeded. In the other set of treatment, plots were left un-weeded for 3, 6, 9 and 12 WAS which was then left weed free until harvest. Two control treatments were then maintained in which one plot was kept weed free while the other plot remained weed infested until harvest.

Cultural Practices

The experimental fields were cleared, ploughed, harrowed and then ridged at 75 cm apart and marked out into plots and replications. Basal application of nitrogen at the rate of 30 kg/ha using urea as source was done at two weeks after sowing to ensure good crop growth (Dugje *et al*., 2009). Three cowpea seeds of each variety were sown after dressing with Apron-star (methylthiuram + metalaxyl + carboxin) at the of rate 3.0 kg seed per 10 g sachet of the chemical to protect seed against soil borne pathogens. The sowing was carried out at an intra and inter–row spacing of 0.30 × 0.75 m along the ridges and later thinned to two per stand at 2 weeks after sowing (WAS). Manual weeding using hoe were carried out at 3, 6, 9 and 12 WAS on treatment specifications. Also insecticide (Cypermethrin plus Dimethoate) at 2.0 kg ai/ha of their product rate was used to control pest population and resurgence at flowering and pod initiation.

Observation and Data Collected

Weed parameters

The proportion of grasses, broadleaf weeds and sedges in each plot were identified from the both fields. Weed covers score was taken from each plot visually and the cumulative weed dry mater production was also determined.

Crop parameters

Cowpea vigor and establishment scores were determined at 6 Weeks after sowing (WAS). Pod numbers per stand, seed numbers per pod and the net grain yield were also considered after harvesting and processing.

Data collected were subjected to analysis of variance (ANOVA) using the statistical analysis system (SAS) package to estimate the significance in effects of treatments as described by Snedecor and Cochran (1967). Significant treatment differences were compared using the Duncan Multiple Range Test (Duncan, 1955).

RESULTS

Analysis of soils of the experimental sites in both years shows that it was sandy-loam with low organic matter content and slightly acidic (Table 1) and the area is characterized by a bimodal rainfall pattern with a peak in June and September and a dry spell between mid- July and August (Table 2).

Table 1: Physical and chemical properties of soils at the experimental sites at the depth of 0-15 cm at Mokwa during the 2019 and 2020 wet seasons

Physical properties (%)	2019	2020
Clay	14.6	17.2
Sand	64.8	67.9
Silt	17.3	18.4
Textural class	Sandy-loam	Sandy-loam
Chemical properties		
pH (H2O)	5.84	6.45
pH in 0.01 mol. Cacl2	5.13	5.32
Organic carbon (%)	0.43	0.34
Total Nitrogen (%)	0.82	0.56
Available phosphorus (mg/kg)	7.32	6.49
Exchangeable bases (Meq/100g/soil)		
Ca2+	1.04	0.14
K+	0.09	0.26
Na+	0.10	2.4
AL+H	0.27	0.22
C.E.C	3.23	3.94

Table 2: Meteorological data showing monthly rainfall at Mokwa during the 2019 and 2020 wet season

	Year	
Month	2019	2020
January	0	0
February	0.9	0
March	0	22.8
April	16.1	51.5
May	118.6	170.2
June	31.3	190
July	14.3	208.5
August	420.3	86.2
September	273.2	253.3
October	218.2	125.4
November	0	0
December	0	0

Source: Niger State College of Agriculture, Mokwa Meteorological Unit (2020)

Weed types and level of infestation on experimental sites

Weeds like *Hyptis sauveolens, Ageratum conyzoides, Hyptis spicigera* were majorly present in 2019 while *Tridax procumbens, Daniillia oliveri* dominates the 2020 seasons. *Apilia Africana* and *Cleome visiosa* were the broadleaves. Grasses such as *Eleusine indica, Axonopus compresus, Rottboellia* *cochinhiesnsis* and *Cynadon dactylon* were observed to be common in both study years. Among the sedges, *Cyperus rotundus* and *Cyperus esculantus* were moderately present at both years (Table 2). In general, 64.8% of the weeds identified in the experimental plots from the study years were broadleaved, while grasses and sedges were 23.5 and 11.7% respectively.

Table 3: List of major weeds found on the experimental field at Mokwa during the 2019 and 2020 wet season

Weed samples		Level of infestation	
Broadleaved	Life cycle	2019	2020
Strga gesnoriodes	A	**	***
Tridax procumbens (L)	A	**	*
Amaranthus spinosus (L)	A	**	**
Aspilia african (L) Pers	P	***	**
Leucas martinicensis (Jacq)	P	***	***
Hyptis spicigera (Lam)	A	**	***
Grasses			
Eleusine indica (L)	A	***	**
Axonopus compresus (Beaur)	A	***	**
Cynodon dactylon (L) Roob	P	**	***
Rottboellia cochinchiensis (L)	A	***	**
Sedges			
Cyperus rodundus (L)	P	***	**
Cyperus esculantus (L)	P	**	**

- Not present * Low infestation (<30%) ** Moderate infestation (39 – 60%)
- *** High infestation (> 60%)

Effect of variety on weed dry matter production

There were significant differences in weed dry mater production among the cowpea varieties. SAMPEA-4 consistently produced higher weed dry matter in the two years of study, though similar to IT90k-277-2 in 2019 and IT98k -305 in 2020. Also, period of weed interference had significant influence on weed dry matter production at 9 WAS in all the study periods. It was observed that the plots kept weed free until harvest produced the lowest weed dry matter. Although, weed dry matter production with infestation for 3 WAS only was comparable to the least with plots kept weed free initially for 6 and 9 WAS in 2019 and with initially weed free for 3 and 6 WAS in 2020 whereas the least was recorded by weed free till harvest (Table 4).

Similarly, plots of Dan Sokoto variety had significantly lower weed cover score in 2020, although, no significant effect was observed amongst the four cowpea varieties tested in 2019, but in 2020, IT90k-277-2, IT90k-277-2 and IT98k -305 varieties significantly gave the highest weed covers in both years. More so, cowpea plots kept weed free until harvest produced the lowest weed cover score. Cowpea plots kept weed infested throughout had the highest weeds cover than the weed free control plots throughout the studies. Keeping the plot initially weed infested for 3 WAS did not differ in weed cover, but at 9 WAS they were at par with the corresponding initial weed free periods.

Performance of cowpea varieties

In respect to cowpea vigor, a significant difference was observed amongst the tested cowpea varieties in 2020. Dan Sokoto variety exhibited consistently higher crop vigour throughout the trial periods. Also variety IT98k-227-2 resulted in higher crop vigour at 6 WAS in 2020 compared to other varieties.

Period of weed interference also significantly influenced crop vigour score in the two years of study at 6 WAS and at 9 WAS. Cowpea vigour scores in 2020 decreased with increase in period of weed infestation from 6 WAS to harvest. Cowpea crops kept weed free for initially 6 WAS and more in the combined study periods had higher vigour scores than those kept weed infested for initially 6 WAS to harvest

Table 3: Effect of cowpea varieties and period of weed interference on cumulative weed dry matter production at 9 WAS in Mokwa during the 2019 and 2020 wet season

Treatment	Weed dry matter (t/ha)		Weed cover score	
Variety (V)	2019	2020	2019	2020
IT98K-277-2	0.47a	0.41b	3.30	3.3ab
IT98K-305	0.37b	0.48ab	3.30	3.49a
IT98K-246-4	0.49a	0.51a	3.33	3.24b
Dan Sokoto	0.23c	0.19c	2.97	2.28c
SE±	0.12	0.15	0.42	0.37
Period of weed interference (W)				
Weed infested for 3 WAS[1]	0.31e[2]	0.64cd	3.27c	3.00bc
Weed infested for 6 WAS	0.56d	1.52d	3.60b	3.42bc
Weed infested for 9 WAS	1.96c	2.86c	4.52ab	4.12b
Weed infested for 12 WAS	2.05ab	4.37ab	4.67a	4.51a
Weed infested till harvest	2.42a	5.19a	5.00a	4.68a
Weed free for 3 WAS	1.12cd	2.83c	3.53bc	2.86bc
Weed free for 6 WAS	0.55d	1.41d	3.48bc	2.14d
Weed free for 9 WAS	0.24e	0.57e	2.84d	1.87de
Weed free for 12 WAS	0.18e	0.45e	1.36e	1.21e
Weed free till harvest	0.12f	0.34f	1.30e	1.19e
SE±	0.11	0.19	0.48	1.34
Interaction (V × W)	NS	NS	NS	NS

[1]Weeks after sowing [2]Means followed by the same letter(s) are not significantly different at 5% level of probability (DMRT). NS: Not significant; *Significant 5 % level of probability

The effect of varieties and periods of weed interference on crop establishment of cowpea at harvest during the 2019 and 2020 wet season is shown in Table 4. In 2019, cowpea varieties IT90k-277-2 and IT98K-305 gave a significantly higher crop establishment percentage while IT98K-246-4 and Dan Sokoto variety were similar; however, there was no significant difference among the four varieties in 2020.

It was observed that weed infestation for 3 WAS only in 2020 and up to 12 WAS 2019 did not significantly differ from plots initially kept weed free from various periods (Table 4). There were no significant differences on the plots initially kept weed free for various periods and until harvest. Keeping the plots weed infested for up to 6 WAS is as good as keeping the plots initially weed free for various periods and till harvest in 2020 but at harvest only 2019. Initial infestation up to 6 WAS only was significantly compared with initially weed free plots from 9 WAS till harvest throughout the study periods.

Effect of period of weed interference on cowpea production

The effects of cowpea variety and periods of weed interference on pod numbers at Mokwa in the 2019 and 2020 wet season is shown in Table 5. Pod numbers were observed to be significant among cowpea varieties only in 2019 season of the trial. Variety IT90k-277-2 produced higher pod numbers of 15 as compared to others that gave similar pod numbers per stand

In the same trend, cowpea plants kept initially weed free for various weeks and those weed infested for only 3 WAS in 2020, as well as those kept weed free initially for various weeks and till harvest in 2019 produced significantly more number of pods than those kept weed infested from 6 WAS till harvest in 2020.

Table 4: Effect of cowpea varieties and period of weed interference on cowpea Vigor and plant establishment rate in Mokwa during the 2019 and 2020 wet season

	Crop vigor score		Establishment rates	
Variety (V)	2019	2020	2019	2020
IT98K-277-2	4.5a	4.6a	58.8a	62.4
IT98K-305	4.0ab	3.5b	57.6a	60.2
IT98K-246-4	4.4a	3.9c	53.6b	62.1
Dan Sokoto	4.5a	4.6a	50.6b	60.2
SE±	0.21	0.18	1.24	1.2
Period of weed interference (W)				
Weed infested for 3 WAS	3.7b[2]	3.5c	55.5a	60.8ab
Weed infested for 6 WAS	3.8b	3.2bc	54.3a	61.2b
Weed infested for 9 WAS	2.3c	2.2d	53.5ab	54.1bc
Weed infested for 12 WAS	2.0ab	4.3ab	52.8ab	51.2c
Weed infested till harvest	2.2a	5.1a	50.7bc	50.1c
Weed free for 3 WAS	4.7a	4.6a	55.5a	62.9ab
Weed free for 6 WAS	4.5a	4.5a	56.0a	63.2a
Weed free for 9 WAS	4.6a	4.7a	55.6a	63.5a
Weed free for 12 WAS	0.18e	0.45e	55.4a	63.2a
Weed free till harvest	0.12f	0.34f	56.5a	63.7a
SE±	0.47	0.27	1.97	1.99
Interaction (V × W)	NS	NS	NS	NS

[1]Weeks after sowing [2]Means followed by the same letter(s) are not significantly different at 5% level of probability (DMRT). NS: Not significant; *Significant 5 % level of probability

Cowpea varieties differ significantly on seed numbers in the two study periods. In 2019, IT90k-277-2 produced higher number of seeds which were comparable with variety IT98K-305 and IT98K-246-4 in 2020. The Dan Sokoto variety consistently produced fewer seeds in the two trials

Also, significant difference was observed between the periods of weed interference. Cowpea plant kept initially weed free for 6 WAS and more, and those kept weed infested for 3 WAS only in 2019, as well as those initially kept weed free for 9 WAS in 2020 produced number of seeds per pod comparable to the maximum obtained with those kept weed free until harvest. Cowpea plants weed infested for 6 WAS and more in both years produced smaller number of seeds per pod which were significantly lower than those of weed infestation for 3 WAS in both trial years.

The effect of cowpea varieties and periods of weed interference on grain yield at Mokwa in the 2019 and 2020 wet season is shown in Table 6. Grain yields were significantly higher among the improved varieties. IT90k 277- 2 resulted in a significantly higher yield than other varieties in 2019 while IT98K-305 gave in a significant higher yield than Dan Sokoto and IT90k-277-2 in 2020. However, Dan Sokoto variety exhibited a significantly lower yield in both trial years.

The data also indicated that cowpea grain yield significantly differed between the periods of weed interference. Weed infestation for 3 WAS only in 2020 produced grain yield comparable to those obtained from various weed free plots. Weed infestation for 3 WAS only in 2019 produced in similar grain yield to those obtained from plots kept weed free for 6 and 9 WAS. In both study periods, maximum grain yield were obtained from plots initially kept weed free till harvest, although these were comparable in initial weed infestation for 3 WAS only.

Table 6 shows the interaction of cowpea varieties and periods of weed interference was significant on grain yield in the year 2019 only. Maximum grain yield was produced by cowpea IT90k-277-2 variety kept weed-free for 12 WAS and till harvest. Irrespective of the varieties tested, grain yield of cowpea decreases as the period of weed infestation increases from 3 WAS till harvest. IT90k-277-2 and IT98K-305 produced similar grain yield than Dan Sokoto with weed infestation for 3 WAS only. It appears and IT98K-246-4 and Dan Sokoto suffered yield reduction in the period of initial weed infestation were prolonged than IT90k-277-2 and IT98K-305 varieties.

Table 5: Effect of cowpea varieties and period of weed interference on cowpea pod, seed numbers and net grain yield in Mokwa during the 2019 and 2020 wet season

Treatment	Pod numbers		Seed numbers		Net yield (t/ha)	
Variety (V)	2019	2020	2019	2020	2019	2020
IT98K-277-2	15.4a	10.9ab	10.5a	10.6a	1.46a	1.21b
IT98K-305	14.0ab	10.8ab	10.0ab	10.4ab	1.24b	1.35a
IT98K-246-4	14.1ab	11.3a	9.4b	10.5a	1.23b	1.02ab
Dan Sokoto	12.0b	9.4b	8.0c	10.0b	0.58c	0.63c
SE±	0.41	0.23	0.28	0.2	0.09	0.14
Period of weed interference (W)						
Weed infested for 3 WAS[1]	15.0b[2]	11.6a	9.9ab	10.1cde	1.26b	1.08ab
Weed infested for 6 WAS	14.9c	10.3b	8.4bc	9.5de	0.98cd	0.85c
Weed infested for 9 WAS	10.5de	9.9b	8.0bc	9.0ef	0.46de	0.53cd
Weed infested for 12 WAS	7.7de	8.3c	7.6c	8.9ef	0.33e	0.27d
Weed infested till harvest	6.7f	6.3d	6.4d	8.1f	0.09ef	0.07e
Weed free for 3 WAS	16.7a	11.8a	9.6b	10.3cde	1.15cd	1.08ab
Weed free for 6 WAS	16.9a	11.8a	10.0a	10.7bcd	1.25b	1.29b
Weed free for 9 WAS	17.0a	12.2a	10.0a	11.8ab	1.33ab	1.24b
Weed free for 12 WAS	17.1a	12.1a	10.3a	11.9ab	1.42a	1.24b
Weed free till harvest	17.0a	11.6a	10.3a	12.4a	1.43a	1.32a
SE±	0.64	0.37	0.45	0.31	0.25	0.13
Interaction (V × W)	NS	NS	NS	NS	*	NS

[1]Weeks after sowing [2]Means followed by the same letter(s) are not significantly different at 5% level of probability (DMRT). NS: Not significant; *Significant 5 % level of probability

Table 6: Interaction of cowpea varieties and periods of weed interference on cowpea grain yield at Mokwa during the 2019 wet season

Period of weed interference (W)	IT90k-277-2	IT98K-305	IT98K-246-4	Dan Sokoto
Weed infested for 3WAS	1.25bc	1.08b-d	1.27b-d	1.11d
Weed infested for 6 WAS	0.80e	0.45e	1.05de	0.44e
Weed infested for 9 WAS	0.59e	0.36fg	0.43f	0.23g
Weed infested for 12 WAS	0.38fg	0.27fg	0.41f	0.20g
Weed infested till harvest	0.23g	0.22g	0.31fg	0.19h
Weed free for 3 WAS	1.20bc	1.12c-e	1.17cd	0.44e
Weed free for 6 WAS	1.26bc	1.14c-e	1.28b-d	1.06de
Weed free for 9 WAS	1.33a-c	1.28b-d	1.29b-d	1.08de
Weed free for 12 WAS	1.44a	1.29b-d	1.28b-d	1.05de
Weed free till harvest	1.43a	1.28b-d	1.37ab	1.15cd
SE±	Interaction = 0.45			
WAS – Week after sowing				

DISCUSSION

The better performance of cowpea as observed in the study in both years could be attributed to the favorable total rainfall received. The even distribution of the rainfall was adequate for both vegetative and reproductive phases of the crops. Also the good crop performance could be attributed to the relatively available phosphorus in the soils of the experimental sites, the ability of cowpea to fix nitrogen and good farm management. This conform to the findings of Mekonnen *et al*. (2015); Vitorino *et al*. (2017) and Adewale *et al*. (2021) that maximum grain yield between 1.6 – 2.0 t/ha could be obtained in the tropic if good farm management is practiced. The four varieties studied differed significantly in their performances in respect to crop establishment and plant vigor score at 6 weeks after sowing. IT98k-277-2 and IT98k-305 are erect varieties; fast growing and extra early maturing were consistently found to be more vigorous and gave a significantly highest mean percent of established crops in both years. The significantly highest pod numbers per plant and seed numbers per pod of these varieties were responsible for the significantly highest grain yield obtained compared with the local Dan Sokoto variety. Generally, the maximum yield of 1467 kg/ha obtained with IT98k -277-2 in 2019 and 1356 kg/ha from IT98k-305 in 2020 from weed free plots were average obtainable yield in similar trials (Takim and Fadayomi, 2010). This also is in conformity to the views of Olumide *et al*. (2020) that maximum yield of cowpea is achieved with improved varieties, appropriate timing and with effective weed management.

Striga gesneriodes (Willd.) Varke, *Cynodon dactylon* (L) Pers. *Euphobia heterophylla (*Linn*), Cyperus esculentus (*L*)*, e.t.c, were the prevalent weed species at the experimental sites, Takim and Fadayomi (2010); Osipitan (2017) and Osipitan *et al*. (2019) earlier reports these weed types to cause 74.9 to 91.4% reduction of legume grain yield as a result of their aggressive growth in the crop if not properly managed. The presence of these weeds might have also contributed to the poor yield obtained from weed initially infested plots. Also, the increase observed with the improved cowpea variety plots on weed dry matter production in both years is due to their erect growth habit which clearly indicates that weeds at the trial years exhibited differential response to cowpea varieties, although the Dan Sokoto variety grows prostrate that had the ability to spread and smother weed growth compare with the improve varieties which grow semi- upright. This agrees with the report by Soti and Racelis (2020). that cover crops (live mulch) such as prostrate cowpea cultivars and ‘egusi’ melon can be used to control unnecessary weed growth in the field, this serves as biological weed control agent in the plot.

In this study, as the weed free period increased, the cowpea grain yield also appeared to increase, although not significantly in all cases at both years of study. Also, up to 12 WAS, cowpea grain yield decreased as the initial period of weed infestation increased. These results agree with that of Nikoa *et al*. (2015) and Daramola *et al*. (2020) who earlier reported that cowpea (var. kananado) grain yields decrease with weeds intensity. Keeping the cowpea plant weed free for 3 weeks and leaving them un-weeded till maturity of the crop resulted in an average cowpea grain loss of 28 and 25% in 2019 and 2020 respectively compared to with the yield from weed free control plots. In contrast, weed association with cowpea plant for 12 WAS resulted in 72.34 and 67.03 kg/ha reduction in 2019 and 2020 respectively in the total grain yield compared with the best obtained with the crop kept weed free until harvest.

CONCLUSION AND RECOMMENDATIONS

Based on the result obtained from this research, it is concluded that among the cowpea varieties cultivated in both years, IT98k-277-2 and IT98k-305 produced maximum grain yield with clean weeding not later than 3 WAS with at least up to 6 WAS weed free periods. Weed infestation for 3 WAS only did not have adverse effects on the growth and yield of cowpea. It was also observed that the period between 3 and 6 WAS were periods of maximum weed growth and critical period of weed competition. It is recommended that a weed free period for the first 4 - 6 WAS of growth is required for optimum grain yield of the IT98k-277-2 and IT98k-305 cowpea variety. Similarly for a maximum cowpea grain yield to be obtained, there should be an effective weed management up to 6 WAS of crop growth, however supplementary weed management up till 9 WAS will go a long way to ameliorate yield loss in the improve varieties used in this trial.

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