CRITICAL PERIOD OF WEED CONTROL AT DIFFERENT GROWTH STAGE IN COWPEA (*Vigna unguiculata* L.) PRODUCTION IN MINNA, NORTH CENTRAL NIGERIA

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ABSTRACT

Field trial was conducted to study the critical period of weed control at different growth stage in cowpea at the Teaching and Research Farm of the Federal University of Technology, Minna (latitude 90 371 N and longitude 60 331 E) located in the Southern Guinea Savanna ecological zone of Nigeria during 2019 wet season. The experiments consisted of eight treatments which are weeding at second, fourth and sixth trifoliate, weeding at first flowering, podding, seeding, weed-free and weedy plot laid out in a Randomized Complete Block Design (RCBD) and replicated three times Results showed that weed dry weight was significantly ($p<0.05$) lower on weed-free plot and weeding at second trifoliate, cowpea 4plant height was higher on weed-free plot, weeding at second and fourth trifoliate, higher number of cowpea pod on weed-free plot and weeding at sixth trifoliate and higher grain yield on weed-free plot and weeding at sixth trifoliate. The practical implication of this study is that weed-free plot throughout growth stages gave better growth and yield performance of cowpea.

Keywords: Cowpea, Growth Stage, Weed Control.

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp.) is one of the widely cultivated crops in tropical and subtropical regions, being a staple food. It is a source of employment and income for the people of these regions (Lima *et al*., 2013). Nigeria is the largest cowpea producer in the world and accounts for over 2.5 million tons grain production from an estimated 4.9 million ha (FAO, 2014). The competition of weeds with crops has been considered one of the main biotic factors that cause productivity losses (Délye *et al*., 2013). Weed interference results in low productivity since it harms crops directly due to the competition for essential factors, and indirectly, as weeds can host pests, diseases, and release allelopathic substances that interfere with seed germination and growth of cultivated plants, in addition to increasing production costs (Freitas *et al*., 2009; Mirshekari *et al*., 2010). Weed interference in cowpea can reduce yield by 64% to 90% (Freitas *et al*., 2009; Adigun *et al*., 2014; Osipitan, 2017; Yadav *et al*., 2018), depending on management, weed species and environmental conditions. Cowpea covers the largest area of any grain legume in Africa and is especially important in West Africa, with Nigeria and Niger alone accounting for over 75% of the total cowpea production (Walker *et al*., 2014). It is an important food legume and essential component of cropping systems in sub-Saharan Africa where it is grown as a sole crop, relay, or inter cropped in various combinations with millet, sorghum and maize (Singh et al., 2002; Alene and Manyong, 2006; Kamara et al., 2010; Boukar *et al*., 2011). Nigeria is the largest cowpea producer in the world and, with about 25% of the population of Sub-Saharan Africa. It is also the largest consumer and importer of cowpea in the region (Langyintuo *et al*., 2003; Mishili *et al*., 2009). The gap between potential and actual yields obtained is attributed to weed infestation among other factors. The competition does not occur when the growth factor is abundant. However, it starts immediately when growth factors fall short in supply. In similar way, the critical period of weed competition might have originated from the belief that weeds are not equally damaging throughout the crop period. There may be ~~at~~ certain stage in crop growth period when weeds are more harmful to crop growth and yield. Because of its initial slow growth weeds takes advantage to utilise more growth resources and dominate over crops. Weeds compete with crop whole life cycle but its effect does not remain same during all stages of crop growth. The short time span in the life cycle of crop when weed causes maximum reduction in ~~its~~ crop yield is known as critical period of crop weed competition. In other words, it is period when weed control measure if adopted may fetch near maximal or maximum acceptable crop yield It is therefore, simply the specific duration of weed free situation of a crop resulting into near maximal yield. This study was conducted to determine the critical period among cowpea growth stages in the study area.

MATERIALS AND METHOD

Field experiment was conducted during 2019 wet season at the Teaching and Research Farm of Federal University of Technology, Minna (latitude 90^0 371 N and longitude 60^0 331 E) located in the Southern Guinea Savanna ecological zone of Nigeria. Treatments consisted of eight weed control strategies laid out in a Randomized Complete Block Design (RCBD) and replicated three times. These T1= cowpea + weeding at second trifoliate and left weedy to the end (CWST), T2=cowpea + weeding at fourth trifoliate and left weedy to the end (CWFT), T3=cowpea + weeding at sixth trifoliate to the end (CWST), T4=cowpea + weeding at first flowering to the end (CWFF), T5=cowpea + weeding at podding to the end (CWPD),T6=cowpea + weeding at seeding to the end (CWSD), T7=cowpea + weedy to the harvest (CW), T8=cowpea + weeding from the beginning to the end (weed free). The seeds were sown on 15th of August at the depth of 2cm at the rate of 2 seeds per hole with plant intra-row spacing of 25cm and inter-row spacing of 75 cm, Cowpea variety Ife Brown was used. Fertilizer (NPK 15:15:15) was applied at 2weeks after planting at recommended dose using side placement method, Hexalonazole 5% pesticide with the aid of knapsack sprayer (15lit) was also applied at 2, 6, and 8WAS (weeks after sowing) at the rate of 10mls in 1000mls of water to control insects attack.. Manual weeding was carried out according to experimental treatment using hoe. The Pods were harvested at maturity at about 15% moisture content according to treatment, it was sun dried, deshusked and weighed in gram and converted to kilogram per hectare.

Data collected were on fresh weed weight, Weed dry weight, Cowpea Plant height, Number of pods per plant, Cowpea grain yield. Data collected were subjected to analysis of variance (ANOVA) using statistical analysis system (SAS) procedure, 2010 model to test significance of treatment effects and treatment means were separated using new Duncan multiple range tests (DMRT) method at 5% probability level (Duncan, 1955).

RESULTS AND DISCUSSION

The effect of critical period of weed control on fresh weight was significantly ($p<0.05$) different throughout sampling periods (Table 1). At 2, 4, and 6WAS, treatment with weedy (weed infested) plots produced the highest fresh weed weight (76.56g, 89.92g, and 122.80g respectively) compared to weed free plot which recorded lowest weed fresh weights (44.96g, 30.83g, and 31.30grespectively). The lower fresh weed weight observed in treatment with cowpea and weed-free plot, could be as a result of the controlling ability of the treatments to reduce the presence of weeds which in turn reduces detrimental effect of weed on growth of plant compared to other treatments. This is in agreement with Adigun *et al* (2014) who reported that delaying weed removal for up to 14 Days after emergence reduced cowpea yield by 4-15%. The effect of critical period of weed control on weed dry weight was significantly ($P<0.05$) different at all sampling periods (Table 1).

Table 1: Effects of weed control method on weed fresh and dry weights on cowpea growth stages in cowpea during 2019 wet season at Minna

Treatment	Fresh weed dry weight(g)			Weed dry weight(g)		
	2WAS	4WAS	6 WAS	2WAS	4WAS	6 WAS
T1	57.23ab	35.92c	71.10c	28.61ab	17.96c	35.53b
T2	60.91ab	62.80b	35.30d	30.45ab	31.40b	29.03b
T3	44.96b	80.07a	113.15ab	23.45b	40.00a	56.56a
T4	57.59ab	84.85a	111.11ab	28.79ab	42.42a	55.56a
T5	65.69ab	88.40a	105.12ab	33.84ab	44.19a	52.56a
T6	65.25ab	77.91ab	112.34ab	32.62ab	38.94ab	56.17a
T7	76.56a	89.92a	122.80a	38.28a	44.96a	61.39a
T8	52.27ab	30.83c	31.30d	26.13ab	15.41c	15.65c
SE	2.87	4.84	7.32	1.43	2.42	3.33

Means followed the same letters in the same column are not significantly different according to Duncan multiple range test (DMRT) at 50% level of probability.
WAS – Weeks after sowing.
T1=CWST – Weeding at second trifoliate and left weedy to the end
T2=CWFT – Weeding at fourth trifoliate and left weedy to the end
T3=CWST – Weeding at sixth trifoliate to the end
T4=CWFF – Weeding at first flowering to the end
T5=CWPD – Weeding at podding to the end
T6=CWSD – Weeding at seedling to the end
T7=CW – Weedy to the end

Plots left weedy recorded highest weed dry weights (38.28g, 44.96g and 61.39g respectively) followed by treatments with weeding at sixth trifoliate to the harvest compared to lowest dry weed weights observed in treatment with weed free plot which recorded (26.13g, 15.41g and 15.65g respectively). Treatment with cowpea weeding at second trifoliate, fourth trifoliate, first flowering, podding and weeding at seeding which recorded weed dry weights of 28.61g, 30.45g, 28.79g, 33.84g and 32.62g respectively were statistically similar to the treatment that had highest dry weight (Table 1). The lower weed dry weight observed in treatment with cowpea and weed-free plot could be attributed to the effectiveness of the treatment to lower the population of weeds thereby reducing their interference. This is in accordance with report of Parasuraman (2000) who stated that hand weeding at 30 Days after sowing resulted in significant reduction in weed population and weed dry matter and increase in crop yield in rain-fed cowpea.

Number of pods per plant were significantly ($P<0.05$) different on critical periods of weed control (Table 2). Highest pods were recorded on treatment with weed free plot and weeding at sixth trifoliate to the end (176.00 and 165.00 respectively) compared to lowest pods recorded on treatment with weedy plot (104.00) and other treatments. The higher number of pod observed in treatment with weed-free plot could be attributed the ability of the treatment in suppressing the population of weed infestation and creating a favorable growth condition for crop growth over weed in terms of sunlight, water, space and nutrient which translated into a higher number of pods. This is in agrees with Osipitan *et.al*. (2016) who stated that frequently weeding of plot within 4-6 WAS for most legumes gave crop yield comparable advantage over weed. Grain yield were significantly ($P<0.05$) affected by critical period of weed control (Table 2). Treatment with weed free plot recorded the highest grain yield (1101.00kg) followed by weeding at sixth trifoliate to the end (947.00kg) compared to lowest observed at treatment with weedy plot (271.00kg). The higher grain yield observed in weed-free plot could be as a result of taller plant heights and increased pod number which contributed to better yield. This is in accordance with Norsworthy and Oliveira, (2004) who stated that cowpea sown in summer season is infested by number of weed species that compete with crop right from germination to harvest, affecting the crop yield adversely.

Table 2: Effects of weed control method on cowpea plant height (cm), pod number and grain yield (kg ha^{-1}) on cowpea growth stages in cowpea during 2019 wet season at Minna

Treatment	plant height (cm)			Pod number	Grain yield kg ha^{-1})
	2WAS	4WAS	6 WAS		
T1	17.17a	28.17ab	53.17bc	117.00b	294.00b
T2	17.20a	26.10bc	57.27ab	130.00b	417.00b
T3	17.57a	24.40c	54.87bc	165.00	947.00ab
T4	18.27a	24.27c	52.30bc	123.00b	389.00b
T5	16.17a	24.53bc	52.40bc	120.00b	377.00b
T6	17.10a	25.53bc	54.87bc	120.00b	313.00b
T7	16.03a	23.73c	50.70c	104.00b	271.00b
T8	18.30a	30.00a	62.40a	176.00a	1101.00a
SE±	0.31	0.52	1.31	5.43	305.36

Means followed the same letters in the same column are not significantly different according to Duncan multiple range test (DMRT) at 50% level of probability.
WAS – Weeks after sowing.
T1=CWST – Weeding at second trifoliate and left weedy to the end
T2=CWFT – Weeding at fourth trifoliate and left weedy to the end
T3=CWST – Weeding at sixth trifoliate to the end
T4=CWFF – Weeding at first flowering to the end
T5=CWPD – Weeding at podding to the end
T6=CWSD – Weeding at seedling to the end
T7=CW – Weedy to the end

CONCLUSION

In conclusion, treatment with cowpea and weed-free plot and weeding at sixth trifoliate to the harvest could substantially prevent yield losses associated weed interference.

It could be recommended that farmers should continuously keep their farm weed free throughout the growth stage for better cowpea growth and yield.

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