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Influence of Weed Control Methods on the Yield and Yield Components of Cowpea (*Vigna unguiculata* (L.) Walp.) Varieties in Sokoto, Nigeria

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ABSTRACT: Field trial was carried out during the 2017 wet season (July to October) at the Dryland Teaching and Research Farm of the Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto to determine the effect of weed control methods on the yield and yield components of three (3) cowpea (*Vigna unguiculata* (L.) Walp) varieties sourced from Sokoto Agricultural Development Project (SADP). Treatments consisted of factorial combination of four (4) weed control methods [Control (no weeding), Chemical weeding (Pendimethalin), Chemical + Hoe and Hoe weeding] and three (3) cowpea varieties [Dan Gidan Yunfa (Local), IT-288 and IT-277-2)]. Treatments were laid out in Randomized Complete Block Design (RCBD) replicated three (3) times. Data were collected on pod yield, grain yield, and haulm yield, total dry weight shelling percentage, 100-grain weight and weed dry weight. Dan Gidan Yunfa recorded higher pod and grain yield than the other varieties. Weed control had significant effect on weed dry matter, the control plot where no weeding was done throughout recorded the highest (103.50 kg ha^{-1}, 114.32 kg ha^{-1}, 139.45 kg ha^{-1}) weed dry matter at 4, 8 and 12 WAS, respectively. Therefore, it could be concluded that Dan Gidan Yunfa performed better than other varieties in the study area. The pod and grain yield of the crop in the weeding treatments were not different from the control (no weeding).

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Cowpea *(Vigna unguiculata* (L.) Walp), commonly referred to as southern pea, black eye pea, crowder pea or Lubia is an important legume grown extensively under tropical and sub-tropical areas of the world (Rathore *et al*., 2015). The crop produces a protein rich grain (20-25%) which is twice the protein content of most cereals (Singh *et al*., 2011). It is also an excellent source of fodder for livestock and fixes atmospheric N which enriches the soil (Singh and Tarawali, 1997; Singh *et al*., 2003; Aikins and Afuakwa, 2008). Despite the importance of the crop in the region, the yield is very low (Singh *et al*., 2011). This could be because of adoption of inappropriate varieties and improper weed control methods by the farmers. Madukwe *et al*. (2012) reported that the presence of weeds caused 53-60% yield loss in legumes including cowpea. Therefore, knowing the effect of methods of weed control in cowpea production will enable the farmers to know the best control method to be adopted in other to increase the yield of the crop (Freitas *et al*., 2009). Thus, the research was conducted to study the influence of weed control methods on the yield and yield components of cowpea varieties in the study area.

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MATERIALS AND METHODS

Field experiment was conducted at the Dryland Teaching and Research Farm of the Faculty of Agriculture, Usmanu Danfodiyo University Sokoto. Sokoto is located in the north-western Nigeria on latitude $13^{0}01'$ North and Longitude $5^{0}15'$ East.

Sokoto falls under Sudan savannah Agro-ecological zone of Nigeria (Singh *et al*., 2011).

Treatments consisted of three (3) cowpea [one (1) local variety (Ex-GidanYunfa) and two (2) improved (IT-288 and IT-277-2)] varieties and four (4) weed control methods (control, chemical weed control, chemical + hoe and hoe). Making a total of 12 treatments combinations laid out in a Randomized Complete Block Design (RCBD) replicated three times. The experimental site was cleared, ploughed and ridged and two (2) seeds per hill were sown at 3-5 cm deep and a spacing of 75cm x 20cm. Starter nitrogen (N) fertilizer was applied at the rate of 20 $kgha^{-1}$ using urea 46 % N. Phosphorus (p) and Potassium (k) were applied at the rate of 60 $kgha^{-1}$ P_2O_5 and 60 $kgha^{-1}$ K_2O, respectively. Weeding was carried out according to the treatments. The crop was harvested at maturity using sickle.

Data were collected on pod yield, grain yield, haulm yield, stover weight, and total dry weight, harvest index, shelling percentage, 100-grain weight and weed dry weight.

After harvest, the pods were spread to dry to a constant weight and weighed using top loading weighing balance.
The pods were shelled manually following drying to carefully separate the grains from the hulls. The grains were weighed using top loading weighing balance. The haulm yield constitutes the weight of the above ground part after removing the pods. The haulm collected were sun-dried to a constant weight and then weighed and recorded. The Stover weight constitutes the weight of the entire crop residue after removing the grain and was obtained by adding the weight of the haulm and the shell.

Stover weight = Haulm weight + Shell weight.

The total dry weight constitutes the weight of the entire shoot of the crop. In this research, the total dry weight was determined by adding the weight of the pod and haulm yield of the crop.

$$Total\ dryweight = Pod\ weight + Haulm\ weight$$

Shelling percentage which is the proportion of grain to the pod yield in percentage was estimated by dividing the weight of the grain by the total pod weight (hulls + grains) multiplied by hunded.

After shelling,100grains were randomly selected fro m each treatment and the weight expressed as to a near 0.00g.

Weeds were collected from each plot before every weeding at 4, 8 and 12 weeks after sowing (WAS), weeds collected were sun-dried to a constant weight and then weighed using electronic balance.

The data collected were subjected to analysis of variance (ANOVA) for randomized complete block design (RCBD) in GenStat 18th edition. Mean separation was carried out using Duncan's Multiple Range Test (DMRT) at 5% level.

RESULTS AND DISCUSSION

Pod and Grain Yield: The pod and grain yield of the crop as influenced by variety, weed control methods and interaction is presented in Table 1. Significant ($P<0.05$) difference among the varieties in pod yield was observed. Dan Gidan Yunfa recorded the highest pod and grain yield of 344.44 and 103.32 kg ha^{-1}, respectively followed by IT–277–2 with 250.00 kg ha^{-1} and 59.93 kg ha^{-1}, respectively. IT – 288 recorded no pod and grain yield (0 kg ha^{-1}) and the was therefore the least. No significant ($P>0.05$) effect of weed control methods on pod and grain yield of the crop was observed during the trial. Significant ($P<0.05$) interaction between the varieties and weed control methods on the pod yield was observed during the trial (Table 2). Dan Gidan Yunfa variety recorded higher (811.11 kg ha^{-1}) pod yield in the plots where no weeding was carried out and was similar to applying hoe weed control method on IT-277-2 which recorded 348.15 kg ha^{-1}. Other treatments were lower, and no yield was recorded in all the plots where IT–288 was planted irrespective of the weed control method. Significant ($P<0.05$) interaction between the varieties and the weed control methods on the grain yield of the crop was observed in the trial (Table 2). Application of hoe weeding on Dan Gidan Yunfa variety recorded the highest grain yield of 141.00 kg ha^{-1} and was similar to the grain yield (136.19 kg ha^{-1}) recorded where weeding was not carried out on the same variety. IT – 288 recorded the least grain yield irrespective of the weed control treatments.

Table 1: Pod and grain yield as affected by variety, weed control methods and interaction in 2017 cropping season.

Treatment	Pod yield (kg ha^{-1})	Grain yield (kg ha^{-1})
Variety (V)		
Dan gidan yunfa	344.44^{a}	103.32^{a}
IT- 288	0.0^{c}	0.0^{c}
IT- 277-2	250.00^{ab}	59.93^{b}
SE±	126.43	13.16
Significance	*	*
Weed control methods (W)		
Hoe	192.59	64.44
Chemical + Hoe	129.63	48.35
Chemical	122.22	41.56
Control (no weeding)	348.15	63.32
SE±	103.23	18.61
Significance	NS	NS
Interaction V x W	*	*

*Mean followed by the same letter within the same column are not s ignificantly different at p<0.05. * = significant at 5% level. NS = not significant at 5% level.*

Table 2: Interaction of variety and weed control methods on pod yield of cowpea in 2017 cropping season.

Interaction	Pod yield (kg ha^{-1})	Grain yield (kg ha^{-1})
No weeding + Dan Gidan Yunfa	811.11^{a}	136.19^{a}
No weeding + IT-288	0.0^{b}	0.0^{c}
No weeding + IT-277-2	233.33^{b}	53.78^{bc}
Chemical + Dan Gidan Yunfa	122.22^{b}	69.74^{bc}
Chemical + IT-288	0.0^{b}	0.0^{c}
Chemical + IT-277-2	244.44^{b}	54.93^{bc}
Chemical + Hoe + Dan Gidan Yunfa	214.81^{b}	66.37^{bc}
Chemical + Hoe + IT-288	0.0^{b}	0.0^{c}
Chemical + Hoe + IT-277-2	174.07^{b}	78.67^{ab}
Hoe + Dan Gidan Yunfa	229.63^{b}	141.00^{a}
Hoe + IT-288	0.0^{b}	0.0^{c}
Hoe + IT-277-2	348.15^{ab}	52.33^{bc}
SE±	176.21	21.67
Significance	*	*

*Mean followed by the same letter within the same column are not significantly different at p<0.05. * = significant at 5% level. Ns = not significant at 5% level.*

Haulm yield and total dry weight: The haulm yield and total dry weight of cowpea as influenced by variety, weed control methods and interaction is presented in Table 3. Significant (P<0.05) difference among the varieties in total dry weight was observed in the experiment. Dan Gidan Yunfa was higher in total dry weight (2354.63 kg ha^{-1}) than IT – 288 (1333.33 kg ha^{-1}). IT–277–2 recorded statistically similar values with both varieties (1997.22 kg ha^{-1}).

However, no significant (P>0.05) difference among the varieties in haulm yield of the crop was observed. No significant (P>0.05) effect of weed control methods on the haulm yield and total dry weight of the crop was observed during the trial. The interaction between the varieties and weed control methods on the haulm and total dry weight of the crop was not significant (P>0.05).

Table 3: Haulm yield and total dry weight as affected by variety, weed control methods and interaction in 2017 cropping season.

Treatment	Haulm yield (kg ha^{-1})	Total dry weight (kg ha^{-1})
Variety (V)		
Dan gidan yunfa	2010.19	2354.63^{a}
IT- 288	1333.33	1333.33^{b}
IT- 277-2	1747.22	1997.22^{ab}
SE±	317.69	338.28
Significance	NS	*
Weed control method (W)		
Hoe	1962.96	2155.55
Chemical + Hoe	1595.06	1724.69
Chemical	1790.12	1912.35
Control (no weeding)	1439.51	1787.65
SE±	366.83	390.62
Significance	NS	NS
Interaction		
Variety x Weeding	NS	NS

*Mean followed by the same letter within the same column are not s ignificantly different at p<0.05. * = significant at 5% level. NS = not significant at 5% level.*

Table 4: Shelling percentage ana 100-grain weight as influenced by variety, weed control methods and interaction in 2017 cropping season.

Treatment	Shelling percentage (%)	100-grain weight (g)
Variety (V)		
Dan gidan yunfa	68.66^{a}	15.17^{b}
IT- 288	0.00^{c}	0.00^{c}
IT- 277-2	32.76^{b}	21.75^{a}
SE±	5.10	0.46
Significance	*	*
Weed control method (W)		
Hoe	27.55	12.22
Chemical + Hoe	38.99	12.00
Chemical	34.18	12.33
Control (no weeding)	34.51	12.67
SE±	5.90	0.37
Significance	NS	NS
Interaction		
Variety x Weeding	NS	NS

*Mean followed by the same letter within the same column are not s ignificantly different at p<0.05. * = significant at 5% level. NS = not significant at 5% level.*

Shelling Percentage and 100-grain weight: Shelling percentage and 100-grain weight of cowpea as influenced by variety, weed control method and interaction is presented in Table 4. Significant (P<0.05) difference among the varieties in shelling percentage and 100-grain weight was observed during the trial. Dan Gidan Yunfa recorded the highest

shelling percentage (68.66 %) compared to IT–277–2 (32.76 %) and IT – 288 which recorded 0 % shelling percentage. However, for 100-grain weight, IT – 277 – 2 recorded the highest 100-grain weight (21.75 g) followed by Dan Gidan Yunfa (15.17 g) and IT – 288 that recorded no 100-grain weight. No significant (P>0.05) effect of weed control methods was observed on shelling percentage and 100-grain weight of the crop was observed. The interaction effect of variety and weed control methods on shelling percentage and 100-grain weight of the crop was not observed.

Weed Dry Weight: Weed dry weight at 4, 8 and 12 WAS as influenced by variety, weed control methods and interaction is presented in Table 5. Significant (P<0.05) difference among the varieties in weed dry weight was observed at 8 WAS.

Table 5: Weed dry weight of cowpea as affected by variety and weed control methods in 2017 cropping season

	Weed Dry Weight (g/m^2)		
Treatment	4 WAS	8 WAS	12 WAS
Variety (V)			
Dan gidan yunfa	28.27	32.39^{b}	46.56
IT- 288	41.61	42.69^{ab}	55.26
IT- 277-2	39.38	50.69^{a}	66.16
SE±	7.02	6.10	11.99
Significance	NS	*	NS
Weed control method (W)			
Hoe	27.03^{b}	29.12^{b}	44.78^{b}
Chemical + Hoe	11.24^{bc}	19.68^{b}	31.16^{bc}
Chemical	3.98^{c}	4.11^{c}	8.58^{c}
Control (no weeding)	103.58^{a}	114.32^{a}	139.46^{a}
SE±	8.12	7.05	13.86
Significance	*	*	*
Interaction			
Variety x Weeding	NS	NS	NS

*Mean followed by the same letter within the same column are not significantly different at p<0.05. * = significant at 5% level. NS = not significant at 5% level*

The weed dry weight (50.69 g/m^2) recorded in the plots planted with IT–277–2 variety was higher than 32.39 g/m^2 recorded in the plots where Dan Gidan Yunfa variety was planted. IT – 288 recoded (42.69 g/m^2) which was comparable to both Dan Gidan Yunfa and IT-277-2. The weed dry weight recorded at 4 and 12 WAS in the plots where the cowpea varieties were planted was not significantly (P>0.05) different. Significant (P<0.05) effect of weed control method on the weed dry weight was observed at 4, 8 and 12 WAS. Control (no weeding) recorded the highest weed dry weight at 4, 8 and 12 WAS (103.58, 114.32 and 139.46 g/m^2, respectively) compared to other weed control methods. No significant (P>0.05) interaction between the varieties and weed control methods on weed dry weight of the crop was observed during the trial.

The higher pod yield, grain yield and shelling percentage recorded by Dan Gidan Yunfa variety compared to other varieties could be due to its adaptation to the environment under which the experiment was carried out. Adaptation to the growing environment has been reported to determine the yield potential of grain legumes through its effect on reproductive stages (Wein and Summerfield, 1984). The higher performance of Dan Gidan Yunfa variety in pod and grain yield where no weeding was applied which was comparable to applying hoe weeding on the variety in grain yield confirms its adaptation to the growing conditions and could be the reason why farmers in the study area hold on it for cowpea production over the years. The finding here contradicts the report of Sunday and Udensi (2013) that uncontrolled weed growth in the crop leads to reduction in grain yield. The higher total dry weight recorded by Dan Gidan Yunfa variety could be due to its high grain yield since the performance of the varieties in haulm weight was not different. High total biomass in legumes is associated with grain yield. López-Bellido *et al*. (2004) identified biomass as most closely related parameter to grain yield of chickpea (*Cicer arietinum* L.). The higher 100-grain weight recoded by IT-277-2 than other varieties could be due to its genetic make-up since the varieties were grown under same environment. Munier-Jolain and Ney, (1988); Ayaz, (2001) reported that variations in individual seed weight is associated with its genetic makeup and the growing conditions. The higher weed dry weight recorded where IT-277-2 was planted at 8 WAS compared to other varieties could be due to its growing habit (semi - spreading) which gives room for weed to thrive. This agrees with the findings of Petel and hall, (1990). Similarly, the higher weed dry weight recorded in the plots where no weeding was applied (control) can be directly associated with the presence of uncontrolled weeds in those plots. Tripathi and Singh (2001) who reported that cowpea is associated with weeds growth at all stages of growth. Also, the low weed dry matter recorded in the plots that received other weed control options compared to control could be attributed to the reduced competition with the crop because of frequent weeding. Brar and Walia (1989) reported that weeds management is aimed at not only

to achieve weed control but also to create favourable conditions for crop growth.

Conclusion: Therefore, it could be concluded that Dan Gidan Yunfa performed better than other varieties in the study area. Pod and grain yield of the crop in the weeding treatments were not different from the control (no weeding).

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