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EFFECT OF WEED CONTROL STRATEGIES ON PROXIMATE COMPOSITION OF MAIZE, COWPEA, AND THEIR INTERCROP

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ABSTRACT

Weed interference causes low land-use efficiency, expensive cost of production, related to control of plant and pests, low quality of crops and high cost and less efficient utilization of labour. The increase in herbicide resistance weeds which has led to increase use of herbicide has been a great concern to human health. This necessitated the need to investigate the effect of pendimethalin (P) with supplementary hand weeding (HW) on weed control efficiency and proximate composition of maize, cowpea and their intercrop. Field experiments were carried out in 2017 and 2018 rainy seasons. The field layout followed complete randomized block design with three replicates. There were eight treatments: Sole Maize/Cowpea + P, Sole Maize/Cowpea + P + 1HW at 3 weeks after sowing (WAS), Sole Maize/Cowpea + P+ 2HW at 3 and 6 weeks after sowing (WAS), Sole Maize/Cowpea weedy check, Intercrop + P, Intercrop + P + 1HW at 3WAS, Intercrop + P + 2HW at 3 and 6 WAS and Intercrop weedy check. It was observed that, P+1HW and P+2HW significantly ($p \leq 0.05$) increased carbohydrate (3.61%, 5.61%, 3.73% and 5.75%), protein (13.30%, 15.20%, 5.78% and 14.62%) and lipid contents (60.25%, 87.46%, 56.61% and 64.87%) in maize, cowpea and their respective intercrop. It can be concluded that the use of pendimethalin and 1 supplementary hand weeding effectively suppress weed-crop competition and increase the proximate composition of maize and cowpea.

Keyword: hand weeding, intercrop, pendimethalin, proximate composition, weed

INTRODUCTION

Integrated weed control, which involve the combination of cultural, biological and chemical weed control methods, is considered the best option, because it provides stable and long-term pest control, leading to increase and healthier crop production (Rajeshkumar *et al*. 2017). Weed constitutes a major constraint to crop production and it has been observed to be a limiting factor in crop production, because it suppresses the development and growth of crops by competing with crops for nutrients, space, light and water and also providing a conducive environment for disease carrying organisms (Osipitan 2017).

Intercropping involves the cultivation of multiple crop simultaneously on the same plot of land and the combination of cereals and legumes is popular among farmers in Africa, due to the ability of the legumes to combat erosion and increase soil fertility. It offers farmers the opportunity to engage nature's principle of diversity on their farms. Flexibility, maximization of profit, minimization of risk, soil conservation and soil fertility improvement are some of the beneficial reasons encouraging smallholder farmers to indulge in intercropping (Masvaya *et al.* 2017).

Maize (*Zea mays*) which was domesticated from America is an annual crop of immense significance. It is a cereal crop belonging to the Family Poaceae, due to its high feeding value, it is used as a major source of carbohydrate to both human and animal feed. It is well accepted as feed ingredient and has high nutritive values as it contains 72% starch, 10% protein, 4.8% oil, 9.5% fibre, 3.0% sugar and 1.7% ash (Dei 2017).

Cowpea (*Vigna unguiculata* (L) Walp.) is a leguminous crop belonging to the Family Fabaceae known as Pappilinaceae. It is a warm weather crop which is well suited to drier regions of the tropics like Nigeria. Grain legumes as important source of proteins, vitamins dietary fiber and biologically active phytochemicals (Cakir *et al*. 2019). Leguminous crops tend to enhance soil fertility by supplementing soil nitrogen through its atmospheric fixation (Yuvaraj *et al*., 2020).

Intercropping maize with cowpea, is a common practice on small farms in Nigeria and has gone a long way to improve the already limited fertility profile of many farm plots (Segun-Olasanmi and Bamire 2010). Farmers commonly use maize-cowpea intercropping to secure food production by averting risk and to maximize utilisation of land and labour, through decreasing the weed population and their competitive ability (Tsubo *et al*. 2005). The objective of this study is to determine the effect of different weed control practices on the proximate composition of maize, cowpea and their intercrop.

MATERIALS AND METHODS

Source of Maize and Cowpea

The maize grains (*Zea mays* L.) variety SAMMAZE-33 and the cowpea seeds (*Vigna unguiculata* L. Walp) variety SAMPEA-7, (IAR 48), were purchased from Institute for Agricultural Research (IAR), Ahmadu Bello University, Zaria, Nigeria

Site Description

The study was carried out in 2017 and 2018 cropping season at the botanical garden, located at the University of Ilorin, Ilorin in the Southern Guinea savannah ecological zone of Kwara State (Latitude 8º 24′N, and 8º 36′N and Longitude 4º 10′E, and 4º 36′E), Nigeria (Abdulkareem *et al*. 2015), and is 307 m above sea level. The climate of the research area is characterized by mean annual precipitation of 98.8 mm, mean annual temperature of 26.2 ℃, mean annual maximum temperature of 32.5 ℃ and mean annual minimum temperature of 21.2 ℃. The mean monthly meteorological data (rainfall, ambient air minimum and maximum temperature and relative humidity) of 2017 and 2018 cropping seasons for Ilorin were obtained from Lower Niger River Basin Development Authority, Ilorin, Kwara State, Nigeria.

Experimental Layout and treatment Details

The plot layout, followed a randomized complete block design with three replicates. The gross plots measured 41.5 m x 14 m in dimension. Each block measured 4.0 m x 3.0 m (12 m^2). Cowpea seeds variety (SAMPEA -7) were sown at 0.3m within a row and maize seeds variety sown at 0.4m within a row and the ridges were 0.75 m apart. Cowpea - maize intercrop i.e planting both crops on same row (50 % cowpea + 50 % maize) were sown at 0.3 m and within a row. Maize and cowpea, were planted on the same day at the depth of 0.3 m. Two seeds were planted in each hill and were later thinned to 1, two weeks after planting to maintain a plant population of 33,000 per hectare in sole maize and 40,000 per hectare in sole cowpea. In intercrop, a combined plant population of 40,000 per hectare (Salama *et al*. 2022). The space between blocks and experimental units was 0.5 m and 1.0 m, respectively.

There are eight (8) treatments which are as follows: $T_{1=}$ Maize/Cowpea sole crop with herbicide weed control; $T_{2=}$ Maize/Cowpea sole crop with herbicide followed by one hand weeding at 3 weeks after sowing (WAS); T_3 = Maize/Cowpea sole crop with herbicide followed by two- hand weeding at 3 and 6 (WAS); T_4 = Maize/Cowpea sole weedy check; T_5 = Maize + Cowpea intercrop crop with herbicide weed control; T_6 = Maize + Cowpea intercrop with herbicide with one hand weeding at 3 WAS; T_7 = Maize + Cowpea intercrop with herbicide with two- hand weeding at 3 and 6 WAS; T_8 = Maize + Cowpea intercrop weedy check.

Data Collection

Proximate Analysis of Air Dried Maize and Cowpea

The proximate composition (such as moisture, crude fibre, crude protein, ash, carbohydrate and crude fat) of the harvested maize and cowpea grain was carried out using the Association of Official Analytical Chemists method (AOAC 2019).

Data Analysis

Data collected were analyzed using One Way Analysis of Variance (ANOVA) of Statistical Package for Social Science (SPSS) software version 20. The data was reported as an average of the two cropping sessions. The level of significance used in the F ratio was $p< 0.05$. Where F ratio is significant, the differences between the treatment means were separated using Duncan Multiple Range Test (DMRT) (Midway *et al*. 2020).

RESULTS

Soil Physico-chemical Properties

The mean physico-chemical properties of soil for the two years is shown in Table 1. The pH was found to be slightly acidic, containing 86.2 % sand, 6.2 % clay and 7.6 % silt and textural class of sandy loam. Other properties of the soil of the experimental field are as shown below:

Table 1: Chemical and physical properties of soil of the experimental site

Chemical properties	Mean±SD
pH	6.55±0.35
ECEC (cmol)	2.8±0.03
Al^{3+} + H^{+} (cmol)	0.015±0.01
Base sat (%)	26.10±0.35
OC (%)	0.47±0.02
OM (%)	0.73±0.08
$CaCO_3$ (%)	0.48±0.04
Total N (%)	0.17±0.03
Av. P (mg/kg)	3.97±0.13
Ca (cmol)	4.50±0.33
Mg (cmol)	0.45±0.04
Na (cmol)	0.15±0.04
K^{+} (cmol)	0.1±0.01
Mn (mg/kg)	18.77±0.33
Fe (mg/kg)	19.75±0.21
Cu (mg/kg)	0.45±0.07
Zn (mg/kg)	9.31±0.04
Sand (%)	86.2±0.0
Clay (%)	6.2±0.0
Silt (%)	7.6±0.0
Textural class	Sandy loam

Proximate composition of Maize

Crude Ash

Ash content of maize grain was significantly (P≤0.05) affected by different weed control treatments (Table1). The values for ash contents ranged between 4.07-6.15 %, plots receiving pendimethalin plus two hand weeding at 3 and 6 WAS significantly recorded the highest ash contents value (6.11 %) compared to other weed control methods. Other weed control methods such as pendimethalin plus one supplementary hand weeding at 3 WAS (5.28 %) and sole pendimethalin (5.11 %) showed values that were statistically at par but greater than what was recorded in weedy check (4.07 %) (Table 2). In intercropping system, the highest crude Ash was recorded in pendimethalin plus two hand weeding at 3 and 6 WAS (6.15 %) and followed by pendimethalin plus one hand weeding at 3 WAS (5.69 %). Plots treated with application of sole pendimethalin (4.60 %) showed no statistical difference from that of weedy check which recorded the lowest value (4.42 %) (Table 2).

Carbohydrate

Various weed control practices showed a significant effect on the carbohydrate content of maize grains (Table1). The carbohydrate contents of harvested maize grains ranged from 46.55 -61.00 %. Significantly highest carbohydrate content was obtained in pendimethalin plus two hand weeding at 3 and 6 WAS (57.66 %) compared to other treatments (Table 2). This was followed by pendimethalin plus one hand weeding at 3 WAS (52.04 %), sole pendimethalin (48.46 %) and weedy check (46.55 %) were statistically at par when compared to other weed control practices (Table 2). In intercropping system, significantly highest number of carbohydrate was recorded in plots under the application of pendimethalin plus two hand weeding at 3 and 6 WAS (61.00 %), this was comparably higher than what was recorded in sole cropping system for the same treatment (Table 2). Other weed control followed in increasing order of pendimethalin plus one hand weeding at 3 WAS (55.30 %) > sole pendimethalin (52.36 %) > weedy check control (48.16 %).

Crude Fibre

The crude fibre contents of air dried maize showed significant variation among the weed control methods (Table 2). The crude fibre ranged between (2.90-7.98 %) in maize. In sole cropping system, significantly highest crude fibre was recorded in plots treated with pendimethalin plus two hand at 3 and 6 WAS (7.98 %) and followed in increasing order by pendimethalin plus one hand weeding at 3 WAS (5.95 %), sole pendimethalin (4.54 %) and weedy check which had the least (3.04 %) (Table 2). A similar trend was observed for the intercropping systems, significantly highest crude fibre value was observed in plots under pendimethalin plus two hand weeding at 3 and 6 WAS (8.20 %) compared with other weed control practices. This was followed in order pendimethalin with one supplementary hand weeding at 3 WAS (6.16 %) > sole pendimethalin (4.75 %) > weedy check which recorded the lowest value (2.90 %). (Table 2).

Crude Protein

All weed control methods recorded significant differences in crude protein contents (Table 2). Crude protein ranged from 16.06-36.03 %. Significantly, higher protein content was recorded in plot under pendimethalin plus two hand weeding at 3 and 6 WAS (27.43 %), followed by pendimethalin plus one hand weeding at 3 WAS (24.24 %), sole pendimethalin (19.85 %) and weedy check (16.06 %) (Table 2). In the cropping system, similar trend was observed for the crude protein content, pendimethalin plus two hand weeding at 3 and 6 WAS (36.02 %) > pendimethalin plus one hand weeding at 3 WAS (34.22 %) > sole pendimethalin (29.40 %) > weedy check (18.64 %). However, the values were greater in intercrop than in sole in all weed control practices (Table 2).

Crude Lipid

It was observed from the data in Table 2, that maize grain was significantly influenced by different weed control methods in term of crude lipid contents. The crude lipid ranged from 2.61-5.96 %. It was observed that maize grains from plots under pendimethalin plus two hand weeding at 3 and 6 WAS in both cropping systems had the highest crude lipid of 5.76 % in sole and 5.96 %, in intercropping system. The lowest values were recorded in weedy check (2.61 %), (2.62 %) in sole and intercrop, respectively when compared to other weed control strategies.

Table 2: Proximate composition (%±SD) of maize as effected by weed control

Maize	Moisture Content	Ash Conten	Carbohydrate content	Crude fibe	Crude protei	Crude Lipic
T1=(M+H)	3.12^{bc}±0.15	5.11^{c}±0.12	48.46^{d}±2.26	4.54^{c}±0.71	19.85^{f}±0.27	3.01^{c}±0.18
T2=(M+H+h)	4.18^{a}±0.46	5.28^{C}±0.15	52.04^{c}±2.29	5.95^{b}±0.16	24.21^{e}±0.55	3.59^{b}±0.06
T3=(M+H+2h)	4.33^{a}±0.25	6.11^{a}±0.08	57.66^{b}±0.84	7.98^{a}±0.29	27.43^{d}±0.35	5.76^{a}±0.17
T4=(M+Wd)	1.98^{d}±0.18	4.07^{e}±0.15	46.55^{d}±0.96	3.04^{d}±0.13	16.06^{g}±0.39	2.61^{d}±0.19
T5=M(I+H)	3.47^{b}±0.19	4.60^{d}±0.16	52.36^{c}±0.92	4.75^{c}±0.23	29.40^{c}±0.44	3.03^{c}±0.06
T6=M(I+H+h)	4.34^{a}±0.37	5.69^{b}±0.11	55.30^{b}±1.31	6.16^{b}±0.17	34.22^{b}±0.45	3.81^{b}±0.03
T7=M(I+H+2h)	4.53^{a}±0.95	6.15^{a}±0.15	61.00^{a}±1.15	8.20^{a}±0.34	36.20^{a}±1.80	5.96^{a}±0.06
T8=M(I+Wd)	3.04^{c}±0.14	4.42^{d}±0.11	48.16^{d}±0.77	2.90^{d}±0.11	18.64^{f}±0.16	2.62^{d}±0.13
Mean	3.62±0.87	5.18±0.75	52.69±4.95	5.44±1.93	25.75±7.06	3.80±1.29

N. B. Column means followed by the same superscript are not significantly different at $P \leq 0.05$

T_1= Cowpea sole crop plus pendimethalin alone; T_2= Cowpea sole crop plus pendimethalin plus one hand weeding at 3 WAS; T_3= Cowpea sole crop plus pendimethalin plus two- hand weeding at 3 and 6 WAS; T_4= Cowpea sole weedy check; T_5= Maize-Cowpea intercrop crop plus pendimethalin alone; T_6= Maize-Cowpea intercrop plus pendimethalin plus one hand weeding at 3 WAS; T_7=Maize-Cowpea intercrop plus pendimethalin plus two- hand weeding at 3 and 6 WAS; T_8= Maize-Cowpea intercrop weedy check

Proximate Composition of Cowpea

Moisture

The moisture contents in cowpea seeds was significantly influenced by different weed control methods (Table 3). The moisture content values ranged from 3.38–6.56 %. Sole cropping recorded the highest moisture content in plots under the application of pendimethalin plus two hand weeding at 3 and 6 WAS (6.56 %) which was followed by pendimethalin plus one hand weeding at (6.16 %) at 3 WAS, followed by sole pendimethalin (6.02 %) and weedy check recorded the least (4.80 %). In intercropping system, significantly highest moisture content was obtained in plots with application of pendimethalin plus two hand weeding at 3 and 6 WAS (6.18 %) followed in increasing order of pendimethalin plus one hand weeding at 3 WAS (5.52 %) which was statistically at par with sole pendimethalin (4.29 %) while weedy check recorded the lowest (3.38 %) (Table 3).

Crude Ash

Ash content of cowpea grains was significantly ($P \leq 0.05$) affected by different weed control treatment (Table 3). The values for ash contents fell between 4.18 – 5.90 % in the two cropping systems. Plots receiving pendimethalin plus two hand weeding at 3 and 6 WAS significantly recorded the highest ash contents value (5.59 %) compared to other weed control methods. Other weed control methods showed increased values in order of pendimethalin plus one supplementary hand weeding at 3 WAS (5.28 %) followed by sole pendimethalin (5.06%) and weedy check (4.77 %) recorded the lowest value (Table 3). In intercropping system, the highest value for crude ash was recorded in pendimethalin plus two hand weeding at 3 and 6 WAS (5.90 %), followed by pendimethalin plus one hand weeding at 3 WAS (5.38 %), followed by plots under application of sole pendimethalin (5.03 %) which showed significant differences from the value recorded in weedy check (4.18 %).

Carbohydrate

In the two growing sessions, various weed control managements showed significant effects on carbohydrate contents of cowpea seeds as indicated by Table 3. In sole cowpea, carbohydrate contents of harvested seeds ranged between 30.60-56.12 %. Significantly highest carbohydrate content was obtained in pendimethalin plus two hand weeding at 3 and 6 WAS (46.53 %) compared to other treatments (Table 3). This was followed by pendimethalin plus one hand weeding at 3 WAS (43.59 %), sole pendimethalin (36.96 %) and weedy check (30.66 %) with the lowest value compared to other weed control practices (Table 3). In intercropping system, significantly highest number of carbohydrate was recorded in plots under the application of pendimethalin plus two hand weeding at 3 and 6 WAS (56.12 %). Other weed control managements followed in decreasing order of pendimethalin plus one hand weeding at 3 WAS (52.03 %) > sole pendimethalin (49.18 %) > weedy check control (43.09 %).

Crude Fibre

The crude fibre content of air-dried cowpea showed significant variation among the weed control method (Table 3). The crud fiber ranged between (6.69-9.91 %). In sole cropping system, significantly highest crude fibre was recorded in plots treated with pendimethalin plus two hand at 3 and 6 WAS (9.91 %) followed in decreasing order by pendimethalin plus one hand weeding at 3 WAS (9.39%), sole pendimethalin (8.96 %) and weedy check which had the least (7.79 %) (Table 3). A similar trend was observed in intercropping systems, significantly highest crude fibre value was observed in plots under pendimethalin plus two hand weeding at 3 and 6 WAS (9.81 %) compared with other weed control practices. This was followed in order pendimethalin with one supplementary hand weeding at 3 WAS (9.28 %) > sole pendimethalin (8.10 %) > weedy check which recorded the lowest value (6.69 %). (Table 3).

Crude Protein

Significant differences were recorded in different weed control methods for crude protein contents (Table 3). Cowpea crude protein ranged from 31.45-46.28 %. Significantly, higher protein content was recorded in plot under pendimethalin plus two hand weeding at 3 and 6 WAS (46.28 %) in sole cropping, followed by pendimethalin plus one hand weeding at 3 WAS (40.18 %), sole pendimethalin (36.97 %) and weedy check recorded the least value (34.83 %) as showed by Table 3. In intercropping system, the trend observed was similar with results obtained in sole cropping for the crude protein content. Plots under pendimethalin plus two hand weeding at 3 and 6 WAS had the highest value (40.77 %) followed by pendimethalin plus one hand weeding at 3 WAS (35.57 %). The value recorded in weedy check was slightly higher (33.54 %) than what was recorded in sole pendimethalin (31.45 %) (Table 3)

Crude Lipid

It was observed from the data in Table 3, that crude lipid in cowpea seeds was significantly influenced by different weed control methods. The crude lipid ranged from 3.22-7.85 %. It was observed that cowpea seeds from plots under pendimethalin plus two hand weeding at 3 and 6 WAS in both cropping systems had the highest crude lipid of 7.85 % in sole and 6.65 %, in intercropping system (Table 3), followed by pendimenthalin plus one hand weeding (4.19%): (4.04%), followed by sole pendimenthalin (3.59 %): (3.61 %). The lowest values were recorded in weedy check (3.28 %):(3.22 %).

Table 3: Proximate composition (%±SD) of cowpea as effected by weed control

Cowpea	Moisture Content	Ash Content	Carbohydrate content	Crude fiber	Crude protein	Crude Lipid
T1=(C+H)	$6.02^{b}\pm0.14$	$5.06^{cd}\pm0.22$	$36.96^{f}\pm1.85$	$8.96^{b}\pm0.33$	$36.97^{cd}\pm0.24$	$3.59^{d}\pm0.26$
T2=(C+H+h)	$6.16^{ab}\pm0.33$	$5.28^{bc}\pm0.15$	$43.59^{e}\pm1.58$	$9.39^{ab}\pm0.18$	$40.18^{bc}\pm1.88$	$4.19^{c}\pm0.27$
T3=(C+H+2h)	$6.56^{a}\pm0.07$	$5.59^{ab}\pm0.10$	$46.55^{d}\pm1.21$	$9.91^{a}\pm0.15$	$46.28^{a}\pm1.42$	$7.85^{a}\pm0.14$
T4=(C+Wd)	$4.80^{d}\pm0.28$	$4.77^{d}\pm0.53$	$30.60^{g}\pm1.42$	$7.79^{c}\pm0.32$	$34.83^{def}\pm1.18$	$3.28^{d}\pm0.37$
T5=C(I+H)	$5.29^{c}\pm0.16$	$5.03^{d}\pm0.27$	$49.18^{c}\pm1.37$	$8.10^{c}\pm0.13$	$31.45^{f}\pm1.12$	$3.61^{d}\pm0.12$
T6=C(I+H+h)	$5.52^{c}\pm0.06$	$5.38^{bc}\pm0.18$	$52.03^{b}\pm0.86$	$9.28^{ab}\pm0.42$	$35.57^{de}\pm0.71$	$4.04^{c}\pm0.13$
T7=C(I+H+2h)	$6.18^{ab}\pm0.13$	$5.90^{a}\pm0.06$	$56.12^{a}\pm0.55$	$9.81^{a}\pm0.43$	$40.77^{b}\pm4.67$	$6.65^{b}\pm0.11$
T8=C(I+Wd)	$3.38^{e}\pm0.37$	$4.18^{e}\pm0.13$	$43.09^{e}\pm1.04$	$6.69^{d}\pm0.55$	$32.54^{ef}\pm1.31$	$3.22^{d}\pm0.12$
Total	5.49±1.00	5.15±0.54	44.76±7.91	8.74±1.11	37.32±4.96	4.55±1.66

N. B. Column means followed by the same superscript are not significantly different at $P \leq 0.05$

T_1= Cowpea sole crop plus pendimethalin alone; T_2= Cowpea sole crop plus pendimethalin plus one hand weeding at 3 WAS; T_3= Cowpea sole crop plus pendimethalin plus two- hand weeding at 3 and 6 WAS; T_4= Cowpea sole weedy check; T_5= Maize-Cowpea intercrop crop plus pendimethalin alone; T_6= Maize-Cowpea intercrop plus pendimethalin plus one hand weeding at 3 WAS; T_7=Maize-Cowpea intercrop plus pendimethalin plus two- hand weeding at 3 and 6 WAS; T_8= Maize-Cowpea intercrop weedy check

DISCUSSION

Proximate composition of maize

The effect of different weed control treatments on proximate composition in maize grain showed significant difference in the two cropping seasons. The results obtained for maize moisture content did not aligned with Ape *et al*. (2016), who reported moisture content of 7.16 % in maize. The percentage recorded is lower to what was reported by Sule-Enyisi (2014), which ranged between 11.6 - 20.0 %, and also stated that lower moisture content in the investigated grains implies that the grains will be less vulnerable to deterioration.

In both years the percentage crude ash in maize grain obtained is higher to the values recorded by Adegbite *et al*. (2016); Omovbude *et al*. (2017), who reported 3.76 - 4.39 % and 2.64 - 2.91 % respectively. The differences could be linked to varietal differences as well as agronomic practices used to raise the crops.

Carbohydrate value obtained in this study is lower to the values reported by Adegbite *et al*. (2016), who gave a range of 64.02 to 67.68 % and Omovbude *et al*. (2017) who reported a range of 64.31-79.28 %. The variation in carbohydrate content could be due to varietal differences, genetic makeup and the agronomic constitution.

The crude fibre content reported in this study is comparable to the value reported by Adegbite *et al*. (2016) who recorded 6.18 – 7.68 %, but higher than the values of Omovbude *et al*. (2017) who reported crude fibre of 2.8 %. The higher crude fibre content recorded in this study, could be attributed to effective weed control measures, genetic composition, varietal differences and agronomy practices.

The percentage protein range of maize grain in this study is higher compared to the values reported by Adegbite *et al.* (2016) and Omovbude *et al*. (2017), who reported 9.4 % and 11.62 – 14.44 % respectively. The higher percentage value of crude protein obtained in this study could be as a result the variety used and the agronomic practices.

The results obtained in this study disagreed with the results of Adegbite *et al*. (2016) and Omovbude *et al*. (2017), who reported lipid content of 4.74 % and 4.56 – 4.86 % respectively. The difference in the results could be as a result of agronomy practices and variety used.

Generally, the lowest values of food content in maize grain (crude ash, crude fibre, crude lipid, crude protein, and carbohydrate) recorded in weedy check plots might be attributed to its high weed density. The high weed population present in the weedy check plots competed with maize for growth resources such as water, light, and nutrients which made it less available to the crops. The results agreed with findings of Ghosh *et al*. (2020) who noted reduced food content on pea (*Pisum sativum* L.) plants in weedy plots. On the other hand, the high food contents in maize crop observed in other weed control practices could be attributed to remarkable weed control measures by the treatments compared to weedy check. Differences observed as a result of cropping systems could also be associated with competition between the components crops, agronomic practices adopted in raising the crops, climatic and soil conditions.

Due to the significantly high protein content for the improved varieties, they could be selected for formulating infant feeds. Likewise, due to the lower carbohydrate content and significantly higher crude fibre of the improved varieties used in this work, they would be suitable in making meals for diabetic patients. We also discovered the same trend with regards to lipid and ash contents.

Proximate composition of cowpea

The proximate composition of the cowpea seeds showed significant difference due to different weed control methods in the two cropping seasons. The moisture content value recorded is lower than that reported Aletan (2018), who reported moisture content of 9.78 % in cowpea. The percentage recorded is higher to what was reported by Olayinka *et al*. (2019) which ranged between 5.57 - 5.90 %. The value of the moisture content of cowpea seeds implies that, it can be stored for a long period of time. The variation observed in the moisture content could be due to varietal differences and agronomic practices. The crude ash content in cowpea seeds obtained is higher to the value recorded by Aletan (2018) and Olayinka *et al*. (2019) who reported 4.28 % and 4.10-4.24 % respectively. The differences could be attributed to genetic variations as well as agronomic practices used to raise the crops. The carbohydrate value obtained due to various weed control practices aligned with the value reported by Olayinka *et al*., (2019), who gave a range of 56.20 to 56.96 %. The crude fibre content recorded in relation to the diet is adequate, because it is present at moderate level. The intake of high fibre foods or supplements improves blood glucose, aids weight loss and lower blood pressure (Beretta *et al*. 2018). The crude protein content of cowpea recorded is higher than the value obtained by Aletan (2018) and Olayinka *et al*. (2019), who reported 28.56 – 23.62 % and 17.73 – 17.91 %, respectively. The higher value of crude protein obtained in this study shows that cowpea is a good source of protein (Aletan 2018). Due to the significantly high protein content recorded in this study, the varieties could be used for formulating infant feeds.

The lipid content value obtained from the analysis of the cowpea seeds due to different weed control treatments is higher than that reported by Liman (2019) and Olayinka *et al*. (2019) who reported a range of 3.30 – 3.80 % and 2.13-2.46 % respectively. The variation observed in the crude lipid content could as a result of genetic make-up, and agronomic practices.

CONCLUSION

The results showed that the plots treated with pendimethalin plus two supplementary hand weeding significantly increased the biochemical composition of the crops. The integration of pendimethalin with hand weeding has been shown to effectively enhanced weeds suppression and increase proximate composition of maize and cowpea and their intercrop. It can be concluded that intercropping maize with cowpea was found to increase the proximate composition of the harvested grains.

REFERENCES

Abdulkareem, K.A., Animasaun, D.A., Oyedeji, S., Olabanji O.M. (2015) Morphological characterization and variability study of African yam beans [*Sphenostylis stenocarpa (Hochst Ex. A. Rich)*], Global *Journal of Pure Applied Sciences* 21: 21-27.

Adegbite, J.A., Lajide, L., Aladesanwa, R.D. Aiyesanmi, A.F., Abiodun, O.A. Adepeju, A.B., Oladapo, S.A. (2016) Effect of herbicide application on residue content and nutritional composition of maize from a pilot maize farm, *American Journal of Agricultural Science* 3(3): 35-39.

Aletan, U.I. (2018) Comparison of the proximate and mineral composition of two cowpea varieties obtained from Mile 12 market, Lagos, *Communication in Physical Sciences* 3(1): 43-48.

Ape, D.I., Nwogu, N.A., Uwakwe, E.S., Ikedinobi, C.S. (2016) Comparative and proximate analysis of maize and sorghum bought from Ogbete main market of Enugu State, Nigeria, *Greener Journal of Agricultural Science* 6(9): 272-275.

AOAC. (2019). *Official Method of Analysis* (21st Edition). Volume 1. Association of Official Analytical Chemists. Inc., Maryland, U.S.A. https://www.aoac.org/official-methods-of-analysis-21st-edition-2019/

Beretta, M.V., Bernaud, F.R., Nascimento, C., Steemburgo, T., Rodrigues, T.C. (2018) Higher fiber intake is associated with lower blood pressure levels in patients with type 1 diabetes, *Archives of Endocrinology and Metabolism* 62(1): 47-54.

Cakir, O., Ucarli, C., Tarhan, C., Pekmez, M., Turgut-Kara, N. (2019) Nutritional and health benefits of legumes and their distinctive genomic properties, *Food Science and Technology* 39(1): 1-12.

Dei, H.K. (2017). Assessment of maize (*Zea mays*) as feed resources for poultry. In: M. Malafi(ed), *Poultry Science.* pp. 1-32. Intech Open, Rijeka,

Ghosh, D., Brahmachari, K., Brestic, M., Ondrisik, P., Hossain, A., Skalicky, M., Bell, R. W. (2020) Integrated weed and nutritional management, improve yield, nutrient uptake and economics of maize in the rice-maize cropping system of Eastern India. *Agronomy* 10: 1906-1921.

Liman, B. (2019) Nutritional and toxicological studies on wild cowpea (*dekindtiana var. Pubescen)*, *InternationaI Research. Journal of Public and Environmental Health* 6(3): 32-44.

Masvaya, E.N., Nyamangara, J., Descheemaeker, K., Gi ller, K.E. (2017) Is cowpea-maize intercropping a viable option for smallholder farm in the risky environments of semi-arid southern Africa? *Field Crops Research* 209: 73-87.

Midway, S., Robertson, M., Flinn, S., Kaller, M. (2020) Comparing multiple comparisons: Practical guidance for choosing the best multiple comparisons test, *Peerj* 8: 10387.

Olayinka, B.U., Lawal, A.R., Abdulbaki, S.A., Ayinla, A.A., Oladokun, L.T. Udo, O.F., Akinwumi, M.A., Etejere, E.O. (2019) Bioprodcutivity and grain quality of two cowpea varieties in relation to frequency of hand weeding, *Journal of Applied Sciences and Environmental Management* 23(6): 1013-1020.

Omovbude, S., Oroka, F.O. & Udensi, E.U. (2017) Effect of different weed control practices on proximate composition, nutrient concentration and uptake of maize (*Zea mays* L.), *IOSR Journal of Agricultural and Veterinary Sciences* 10(2): 98-104.

Osipitan, O.A. (2017) Weed interference and control in cowpea production: A review. *Journal of Agricultural Sciences* 9(12): 11-20.

Rajeshkumar, A., Venkataraman, N.S., Ramadass, S., Ajaykumar, R., Thirumeninathan, S. (2017) A Study on inter-cropping system and weed management practices on weed interference and productivity of maize. *International Journal of Chemical Studies* 5(5): 847-851.

Salama, H.S.A, Nawar, A.I., Khalil, H.E. (2022) Intercroppingpattern and N fertilizer schedule affect the performance of additively intercropped maize and forage cowpea in the Mediterranean region. *Agronomy*, 12, 107

Segun-Olasanmi, A.O., Bamire, A.S. (2010) Analysis of costs and returns to maize-cowpea intercrop production in Oyo state,

Nigeria. Poster presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, September, 19-23, 2010.

Sule, E.I., Umoh, V.J., Whong, C.M.Z., Abdullahi, I.O., Alabi, O. (2014) Chemical and value of maize and maize products obtained from selected markets in Kaduna State, Nigeria, *African Journal of Food Science and Technology* 5(4): 100-104.

Tsubo, M., Walker, S., Ogindo, H.O. (2005) A simulation model of cereal–legume intercropping systems for semi-arid regions. II. Model application. *Field Crops Research*., 93, 23-33.

Yuvaraj, M., Pandiyan, M. & Gayathri, P. 2020. Role of legumes in improving soil fertility status. In: M. Hasanuzzaman, (ed), *Legume Crops – Prospects, Production and Uses.* pp. 1-11, Intech Open, Rijeka