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Effect of Different Weed Control Practices On Proximate Composition, Nutrient Concentration and Uptake of Maize (Zea Mays L.*)*

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Abstract: *A field experiment was conducted during 2004 and 2005 cropping seasons to determine effect of different weed control practices on proximate composition, nutrient concentration and nutrient uptake of maize (Zea maysL.) at the Teaching and Research Farm of Ambrose Alli University, Ekpoma, Nigeria. Seven treatments were used for the experiment, viz no weeding (control), Primextra (3.0kg a.i./ha), mulching (wood shavings), one- hoe weeding at 3 weeks after planting (WAP), two hoe- weedings at 3 and 7 WAP, cover cropping with melon minus hoe-weeding, cover-cropping with melon plus one hoe-weeding at 3WAP. The seven treatments were laid out in randomized complete block design with four replicates. Results showed that mulched plot with wood shavings had the lowest weed density and highest proximate composition, grain nutrient concentration, ear leaf concentration and nutrient uptake followed by Primextra treated plot .The study recommends that small holder farmers to adopt mulching technique with wood shaving to improve the nutritional quality of maize grain since it does not involve any technical rigor besides signifying a non-chemical weed control.*

Key words: *maize, nutrient concentration, nutrient uptake, proximate composition, weed density*

I. Introduction

Maize (*Zea mays* L.*)* belongs to the grass family of plant known as Poaceae . In Nigeria ,it is grown in several zones from coastal swamps of the south to the dry savanna lands of the north [1] It is an important food, fodder and industrial crop grown both commercially and at subsistence level in Nigeria [2]. Proximate composition of the grains by [3] showed that crude protein ranged from 10.67 to 11.25% ,lipid (4.17 to 5%), crude fibre (2.07 to 2.97%), and carbohydrate (65.63 to 70.23%) while [4] noted that crude ash ranged from 1.4 and 3.3%. The mineral composition of the maize grain consists of 1.88% nitrogen, 0.41% phosphorous, 0.38% potassium, 0.10% calcium and 0.12% magnesium [5]. Despite the usefulness of this crop, its production is hampered as result of weed infestation. In Nigeria, adverse weed infestation in maize fields contributed to drastic reduction of maize yield [6]. Yield loss as result of weed infestation in maize had been reported by several researchers. For instance, [7] reported yield of 51-100% while [8] reported 60-81% In maize, weeds are controlled using biological, cultural, , chemical, preventive and integrated management practices. Over the years weed control in maize by these various practices had been geared toward yield increase of the grain without paying too much attention on its proximate composition, nutrient concentration in the ear leaf and the grain, and nutrient uptake by these various weed control practices. Hence the objective of study were to determine the effect of different weed control practices on proximate composition, nutrient concentration and uptake of maize.

II. Materials and Methods

A field experiment was conducted in 2004 cropping season and repeated in 2005 at the Teaching and Research Farm of Ambrose Alli University (6°45N and longitude 6°8E; 313m above sea level) in the forest – savanna transition zone of Nigeria. The total rainfall in 2004 and 2005 were 1786.6mm and 2176.7mm respectively. The rainfall data were obtained at Edo State Agricultural Development Project (EADP), Irrua substation. Soil samples were randomly collected from 15 spots (0-15 cm depth) over the entire field using auger before the commencement of the experiment. The samples were bulked and mixed thoroughly for analysis. The characteristics of the soil used in 2004 were: nitrogen: 1.07 g/kg phosphorous: 15.40mg/kg, potassium:0.27cmol/kg, calcium:5.04cmo/kg, magnesium: 2.01 cmol/kg, carbon:15.70g/kg pH (H_2O, 1: 1): 5.70, exchangeable acidity: 0.40cmol/kg and effective cation exchange capacity (ECEC):8.00cmol/kg. The characteristics of the adjacent soil used in 2005 were as follow:nitrogen: 1.06g/kg, phosphorous:15.20mg/kg, potassium:0.28cmol/kg, calcium5.05cmol/kg, magnesium:3.14mg/kg, carbon:16.70g/kg, pH (H_2O, 1: 1): 5.40, exchangeable acidity: 0.40cmol/kg and Effective Cation Exchange Capacity (ECEC):9.16cmol /kg..

Land preparation was done manually. Each plot size was 3m x 4m with an alley way of 1m among plots and 1m between replicates. There were thus, a total of 28 plots occupying an experimental area of 27m x19m (514m^2) approximately 0.05ha. There were seven treatments involved in the experiment, namely: no-weeding (control), Primextra® (3.0kga.i./ha), mulching (wood shavings), one hoe weeding (3WAP), Two hoe-weeding (3 and7WAP), Melon cover – crop minus hoe- weeding and melon cover-crop plus one hoe weeding at3WAP. The treatments were arranged in a complete block design (RCBD) with four replicates. A plant spacing of 75cm x 25cm was used in each cropping season. Two seeds of maize (cultivar DMRESR – W, obtained the International Institute of Tropical Agriculture (IITA) were planted per hole and thinned to one seedling per stand at 2WAP, giving a population density of 53, 333 plants/ha. One day after planting, four plots were sprayed with Primextra® at 3.0kg a.iha^{-1} using a hand operated CP3 knapsack sprayer calibrated to deliver approximately 250lha^{-1} spray volume at a pressure of 210kpa with red poliject nozzle (swath width½m). A local variety of melon (*Colocynthus vulgaris* L.) was planted within the alleys of maize, planting the same day in each of the cropping seasons. Three seeds of melon were planted per hole at a spacing of 50cm x 30cm giving population density of 66667 plants ha^{-1} and the seedlings were thinned to one per stand at 3WAP. Eight (8) tha^{-1} of wood shavings, in each of the cropping seasons, were weighed with a spring balance fixed to a horizontal bar supported on three 1.5m fork – sticks, were uniformly spread over the appropriate treatment plots the same day maize was sown. The first hoe-weeding for sole maize/melon inter-crop was carried out at 3WAP in each season. Three days after the first weeding urea fertilizer containing 46% Nitrogen was applied at the rate of 39.56 kg N ha^{-1} and 40.48kg N ha^{-1} in 2004 and 2005 respectively to make up the critical level of nitrogen. These were carried out because the level of nitrogen in the soil was inadequate compared to the critical level of 1.5gkg^{-1} [9] [10]. The second weeding was carried out at 7WAP in sole maize plots only. Data of common weeds present at the experimental site before the trials in both 2004 and 2005 cropping seasons were estimated by using 0.5 x 0.5m quadrats. The weeds were visually counted and identified [11] and classified based on growth cycle and habit. Level of weed density was classified into three as follows: [+] = low density; [++] = medium density and [+++] = high density. The weed density at present at the various intervals of sampling during the experimentation was extrapolated by the quadrat technique. Two ear leaf samples were randomly selected from the centre row of each plot at mid silk and oven dried at 80^{O}C for 24hrs. for the determination of nutrient concentration (N, P, K, Mg, Ca and Na) using the methods described by [12] thereafter the Nutrient uptake was derived from the product of the dry matter and concentration (%) in leaf tissues. Nutrient concentration (N, P, K, Mg, Ca and Na) and Proximate composition (lipid crude protein, crude ash, crude fiber and carbohydrate) of the grains were also determined by [12] method .

III. Results and Discussion

Weed present at experimental site before planting

Common weeds at the experimental site before the trial in 2004 and 2005 cropping seasons are presented in Table1.The most dominant weed species were: *Chromoleana odorata* Kings & Robinson, *Euphorbia heterophylla* L., *Euphorbia hirta* L *Calopogonium mucunoides* Desv, *Panicum maximum* Jacq. Nine weeds family were identified of which Poaceae was the most common (23.08%) followed by Asteraceae (19.23%), and cyperaceae (15.38%) in both years.

Weed density

The effect of weed control practices on weed density of maize is presented in Table2. The weed density differed significantly $p<0.05$ throughout the sampling periods . Low weed density were recorded at 3WAP under the various weed control practices in both years except in Primextra treated and mulch plots where the weeds were significantly considerably lower. At the other sampling periods the no weeding differed significantly from other treatments by having the highest weed population. Weed population was superior at 12WAP with the no weeding plot producing the highest weed density and mulch plot the lowest . The probable reason for high weed population in no weeding plots in both cropping season could be attributed to lack of weed control measures when compared with others methods of weed control. [13] noted that the higher weeds density in weedy check plots may be attributed to the open soil surface and niches available to weeds for free and aggressive growth. The lower weed density recorded in mulched plot might be attributed to its ability to smother weeds. [14] noted that very little weed growth occurs under the mulch as the mulches prevent penetration of light or exclude certain wavelengths of light that are needed for the weed seedlings to grow. Good weed control recorded in Primextra treated plots may be attributed to its higher herbicidal activity. This finding is also in a line with that of [15] who reported reduced weed infestation in herbicide treated plot of maize in comparison with the control plot

Proximate composition of the grain

The effect of different weed control practices on proximate composition in maize grain is presented in Table3. There was significant difference ($P<0.05$) among the weed control practices on the proximate composition of the grain in comparison to no weeding (control) in both cropping seasons . In 2004, crude protein ranged from 11.62 to 14.44 % while in 2005, it ranged from 13.60 to 14.43 %. The highest level of crude protein was produced in both years on plots that were mulched with wood shaving while the lowest were from no weeding plots. The percentage protein fell within the range of 10.67 –11.25 of maize grain in Nigeria as reported by [3].The lipid content differed significantly in both cropping seasons. In 2004, the lipid content ranged from 4.56 to 4.86% plot while in 2005, it ranged from 4.43 to 4.84 %. In both years the mulched plot had the highest lipid content while the un weeded plot had the lowest. The percentage lipid fell within the range of 4.17 – 5.0 [3]

Crude ash ranged from 2.70 to 2.91% in 2004 while it ranged from 2.64 to 2.85% in 2005. In 2004, the highest crude protein content (2.91%) was produced in wood shaving plot which was statistically at *par* with Primextra® treated plot(2.87%) while the lowest (2.70%) was produced in no weeding plot which was at *par* with melon cover minus no hoe weeding (2.71%). In 2005, the highest level of crude ash (2.85 %)was produced in mulched plot but at *par* with that of Primextra® treated plots (2.83%) while the lowest was in no weeding plot (2.64%). In both years the percentage crude ash fell within the range of 1.4 – 3.3% [4]. Crude ranged from 2.40 to 2.80% in 2004 while in 2005 it ranged from 2.35 to 2.80%. The highest crude fibre content (2.80%) was in wood shaving plot in 2004 while the lowest was in no weeding plot (2.40%) which was at *par* with melon cover plot without weeding (2.43%). In 2005, wood shaving plot had the highest crude fibre content while no weeding plot had the lowest. The Crude fibre fell within the range of 2.07 – 2.97% [3]. Carbohydrate content ranged from 64.71 to79.28% in 2004 while in 2005 it ranged from 64.31 to 79.21%. In both cropping seasons, the highest carbohydrate content was recorded in plots mulched with wood shavings while the lowest was on no weeding plots. The carbohydrate content fell within the range 65.63 –70.23%) [3]. Carbohydrate value by difference weed control practices was higher than others proximate substances and this confirmed that maize grain is mainly of energy giving food.

Generally, the lowest values of food content in maize grain (lipid crude protein, crude ash, crude fibre and carbohydrate) recorded in no weeding plots might be attributed to its high weed density .The high weed population present in the no weeding plots compete with maize plants for growth resources such as water, light and nutrients The results agreed with findings of [16] who noted reduced food content on pea *(Pisum sativum* L.) plants in an weedy plots. On the other hand, the high food content in maize crop could be attributed to remarkable weed control measures by other weed control practices particularly by plots mulched with wood shavings and that of Primextra treated

Ear Leaf Dry Weight And Nutrient Concentration

The effect of different weed control practices on ear leaf dry weight and nutrient concentration in ear leaf of maize is presented in Table 4. The ear dry weight differed significantly among the various weed control treatments. In 2004, dry weight of ear leaf ranged from 1063.66 to 1973.32kg/ha while in 2005, it ranged from 978.66 to1946.65kg/ha. In both cropping seasons the highest ear leaf dry weight was recorded in plots mulched with wood shavings while the lowest was in the no weeding plots. In 2004, N ranged from 0.41 to 2.79% while in 2005, it ranged from 0.40 to 2.61% . In 2004, wood shaving plots had the highest N content while the no weeding plot had the lowest (0.40%) statistically at *par* with melon cover –crop (-Hoe-weeding) (0.50%) One hoe-weeding at 3WAP (0.79%), melon cover –crop+Hoeweeding at (3WAP) (0.80%) . In 2005, the highest N content was recorded in wood shaving (2.61%) which was statistically at par with Primextra treated plot (1.90%) while the lowest was in the no weeding (0.40%) melon cover –crop (-Hoe-weeding) (0.49%) one hoe-weeding at 3WAP (0.76%), melon cover –crop+Hoeweeding at (3WAP) (0.92%),

The N content fell within the range of 2.25 – 3.30% established by [17].The P content ranged from 0.20 to 0.38% in 2004 while in 2005, it ranged from 0.19 to 0.37 %. P content was higher in plots mulched with wood shaving in both cropping seasons and lower in no weeding plots. The P content fell slightly above the ranged of 0.18 – 0.32% [17]. There were no significant differences ($p> 0.05$) among the various weed control practices in the levels of K content in both cropping seasons. Ca content ranged from 0.22 to 0.50% in 2004 while in 2005 it ranged from 0.21 to 0.48%. Plots mulched with wood shavings had the highest level of Ca while the lowest was in the no weeding plots. The Ca content fell slightly above the ranged of 0.40 – 0.80 % [17]. Mg content ranged from 0.23 to 0.49% in 2004 while in 2005, it ranged from 0.20 to 0.47%. In both years the highest level of Mg was in mulched plot while the lowest was in no weeding plots. Mg content fell slightly above 0.13- 0.25% [17]. Na content ranged from 0.37 to1.18% while in 2005, it ranged from 0.36 to 1.17%. The highest level of Na (1.18 and 1.17%) was in plot mulched with wood shavings which was at *par* with plot treated with Primextra(0.79 and 0.78%), plot hoe weeded twice at 3 and 7WAP (0.71 and 0.70%) and Melon cover –crop plus one Hoeweeding at (3WAP) (0.67 and 0.66%) while the lowest was in no weeding plot(0.37

and 0.36%)which was at *par* with melon cover –crop (-Hoe-weeding,) (0.38 and 0.38%) one hoe-weeding at 3WAP (0.47 and 0.46%) and melon cover –crop+Hoeweeding at (3WAP) (0.67 and 0.66%) in 2004 and 2005 cropping seasons respectively

Nutrient uptake in ear leaf

The effect of different weed control practices on nutrient uptake of ear leaf of maize is in Table5. The nutrient uptake differed significantly among the various weed control practices in both cropping seasons. In 2004, N uptake ranged from 4.36 to 55.06kg/ha while in 2005, it ranged from 3.95 to 54.12kg./ha. In 2004, plots that were mulched with wood shavings had the highest N uptake while plots that were unweeded had the lowest (4.36kg/ha) but statistically at par with that of melon cover –crop (-Hoe-weeding) (5.36kg/ha), one hoe-weeding 3WAP (9.10kg/ha), melon cover –crop+Hoeweeding (3WAP) (10.53kg/ha), two hoe-weedings at 3 &7WAP (18.62kg/ha). In 2005, plots that were mulched with wood shavings had the highest N uptake while plots that were unweeded had the lowest (3.95kg/ha) but statistically at *par* with that of melon cover –crop (-Hoe-weeding) (4.97kg/ha), one hoe-weeding at 3WAP (8.96kg/ha) melon cover –crop+Hoeweeding (3WAP) (10.03kg/ha). In 2004, P uptake ranged from 2.13 to 7.50 kg/ha while in 2005, it ranged from 1.86 to 7.20 kg/ha. In 2004, plots that were mulched with wood shavings had the highest P uptake (7.50kg/ha) which was at *par* with that of Primextra treated plot (7.06kg/ha) while plots that were unweeded had the lowest 2.13kg/ha but statistically at *par* with that of melon cover –crop (-Hoe-weeding) (2.47kg/ha). In 2005, plot mulched with wood shavings had the highest P uptake (7.50kg/ha) which was at *par* with that of Primextra treated plot (6.76 kg/ha) while the lowest was in no weeding plot(1.86kg/ha) which was at *par* with that of melon cover –crop (-Hoe-weeding) (2.23 kg/ha). In 2004, K uptake ranged from 21.06 to 46.96kg/ha while in 2005 ranged from 19.08 to 46.33 kg/ha. In 2004, K uptake was higher (46.96 kg/ha) in mulched plot but statistically at par with Primextra plot(45.33 kg/ha), two hoe-weedings at3 &7WAP (39.96kg/ha), while lower in no weeding plot(21.06kg/ha), but at par with that of melon cover –crop (-Hoe-weeding) (21.44kg/ha), melon cover –crop+Hoeweeding (3WAP) (27.52kg/ha). In 2005, K uptake was higher in mulched plot (46.33kg/ha) which was at *par* with Primextra treated plot(.44.40 kg/ha), two hoe-weedings at 3 &7WAP (39.26kg/ha), while the lowest was in no weeding plot (19.08 kg/ha), at par with that of Melon cover –crop (-Hoe-weeding) (19.96kg/ha) ,One hoe-weeding 3WAP (24.04kg/ha), melon cover –crop+Hoeweeding (3WAP)(26.51kg/ha). In 2004, Ca uptake ranged from 2.34 to 9.87kg/ha while in 2005 it ranged from 2.06 to 9.34kg/ha.Ca content in 2004 was higher in plot mulched with wood shavings while lower in no weeding (2.34kg/ha) which was at *par* with that of melon cover –crop (-Hoe-weeding) (2.47kg//ha) In 2005, Ca uptake was higher in in mulched plot while it was lower in no weeding(2.06kg/ha), but at par with that of Melon cover –crop (-Hoe-weeding) (2.23kg/ha). In 2004, Mg content ranged from 2.44 to 9.67 kg/ha while in 2005, it ranged from 1.96 to 9.15kg/ha. In 2004, the highest Mg uptake was in mulched plot while the lower was in no weeding. Mg uptake in 2005 was higher in mulched plot and lower in no weeding (1.96kg/ha) which was statistically the same with that of Melon cover –crop (-Hoe-weeding)(2.23kg/ha). In 2004, Na content ranged from 3.94 to 23.29 kg/ha while in 2005 it ranged from 3.52 to 22.78 kg/ha. The highest Na uptake in 2004 was in mulched plot(23.29kg/ha) which was at *par* with Primextra treated plot (23.29kg/ha), two hoe-weedings3 &7WAP (13.52kg/ha) and the lowest in no weeding (3.94kg/ha) which was at *par* with one hoe-weeding 3WAP (5.65kg/ha) Melon cover –crop (-Hoe-weeding) (4.07kg/ha) and Melon cover –crop+Hoeweeding (3WAP) (8.87kg/ha). In 2005, the highest Na uptake was in mulched plot (22.78kg/ha) which was at par with Primextra treated plot (15.06 kg/ha), Two hoe-weedings 3 &7WAP (13.15kg/ha) while the lowest was in no weeding (3.52kg/ha) which was at *par* with melon cover –crop (-Hoe-weeding) (3.85 kg/ha) One hoe-weeding at 3WAP (5.42kg/ha) and melon cover –crop+Hoeweeding (3WAP) (8.49 kg/ha) and two hoe-weedings at 3 &7WAP (13.15kg/ha) .Nutrient uptake plays a fundamental role in plant growth and development as its provides the essential elements to plants. Generally, all the weed control practices increased the nutrient uptake of maize when compared to no weeding plots. The highest nutrients uptake were in mulched and Primextra treated plots. The probable reason for the high uptake of nutrients might be due to lesser competition for growth resources between weeds and maize plants. This finding is in agreement with that of [18] who noted higher uptake of nutrients by various weed management strategies in maize.

Nutrient concentration in the grain

The effect of different weed control practices on nutrient concentration in maize grain is presented in Table 6. The nutrient concentration of the grain differed significantly among the various weed control practices in both cropping seasons. In 2004, N ranged from 2.40 to 2.92% while in 2005, it ranged from 2.39 to 2.91% . In 2004, plots that were mulched with wood shavings had the highest N while plots that were unweeded had the lowest (2.40%) but statistically at *par* with that of melon cover –crop (-Hoe-weeding) (2.42%.) In 2005, the highest N was in mulched plots while the lowest was in the un weeded plots. N levels in both years were below the limit of 1.88% established by [5]. In 2004, P content ranged from 0.19 to 0.27% while in 2005, it ranged

from 0.18 to 0.26%. In 2004, the highest P was in mulched plot (0.27%) which was at *par* with Primextra treated plot (0.26%) while the lowest was in no weeding plot. In 2005, the highest P was in mulched plot (0.26%) which was at *par* with Primextra treated plot (0.25%) while the lowest was in no weeding plot. The P levels were below the limit of 0.41% [5]. In 2004, K content ranged from 0.18 to 0.25% while in 2005 it ranged from 0.17 to 0.24% .In both years, the highest K content was in mulched plot while the lowest was in no weeding plot. K levels were below the limit of 0.38 % [5]. Ca level ranged from 0.27 to 0.36% while in 2005 it ranged from 0.26 to 0.34%. In both years , the highest Ca was in mulched plot while the lowest was in no weeding plot. Ca level was above the limit of 0.10 % [5]. In 2004, Mg ranged from 0.10 to 0.17% while in 2005 it ranged from 0.09 to 0.16%. The highest level of Mg in both years was in mulched plot while the lowest in no weeding. Mg level was above the limit of 0.10 % [5]. In 2004, Na level ranged from 0.19 to 0.26% while in 2005 it ranged from 0.18 to 0.25% . In both years, the highest Na content was in mulched plot while the lowest was in no weeding plot.

IV. Conclusion

The results of this study had shown that lowest weed density was obtained under plot mulched with wood shavings. The mulched plot also had the highest proximate composition, grain nutrient concentration, ear leaf concentration and nutrient uptake followed by Primextra treated plot The study recommends that small holder farmers to adopt mulching technique with wood shaving to improve the nutritional quality of maize grain since it does not involve any technical rigor besides signifying a non-chemical weed control.

Table1. Common weeds at the experimental site before the trial in 2004 and 2005 cropping seasons

Family	Weed species	Growth form	Density	
			2004	2005
Amaranthaceae	*Amaranthus spinosus* L	ABL	++	++
Amaranthaceae	*Amaranthus viridis* L	ABL	++	++
Asteraceae	*Ageratum conyzoides* L.	ABL	++	++
Asteraceae	*Tridax procumbens* L.	ABL	++	++
Asteraceae	*Aspilia africana* (Pers) C.D. Adams	PBL	++	+
Asteraceae	*Chromoleana odorata* Kings & Robinson	PBL	+++	+++
Asteraceae	*Syndrella nodiflora* Gaertn.	ABL	++	+
Cucurbitaceae	*Momordica charantia* L	PBL	+	+
Euphorbiaceae	*Euphorbia heterophylla* L.	ABL	+++	+++
Euphorbiaceae	*Euphorbia hirta* L	ABL	+++	+++
Euphorbiaceae	*Phyllanthus amarus* Schum. &Thonn	ABL	++	+
Fabaceae	*Calopogonium mucunoides* Desv	ABL	+++	+++
Fabaceae	*Mucuna pruriens* (L.) DC	PBL	+++	++
Malvaceae	*Sida acuta* Burm F	PBL	++	++
Malvaceae	*Sida cordifolia* Burm F	PBL	++	+
Poaceae	*Cynodon dactylon* L. Pers	PG	+++	++
Poaceae	*Digitaria horizontali*s Willd	PG	++	++
Poaceae	*Eleusine indica* (L.) Gaertn.	AG	++	++
Poaceae	*Panicum maximum* Jacq.	PG	+++	+++
Poaceae	*Pennisetum purpureum* L	PG	++	+
Poaceae	*Rottboellia cochinchinnensis* Lour clayton	PG	++	++
Portulacaceae	*Talinum triangulare* (Jacq.) Willd	PBL	++	++
Cyperaceae	*Cyperus escunlentus* L	PS	++	++
Cyperaceae	*Cyperus rotundus* L.	PS	++	++
Cyperaceae	*Mariscus alternifolius* Vahl	PS	+	++
Cyperaceae	*Mariscus flabelliformis* L	PS	+	++

[+] = low density; [++] = medium density and [+++] = high density. ABL=Annual broad leaf, PBL = Perennial broad leaf, AG = Annual grass, PS =Perennial sedge.

Table 2. Effect of weed control practices on weed density (weed/m^2) of maize

Treatment	3WAP	6WAP	9WAP	12WAP
2004				
No weeding (control)	9.5a	112.5a	174.00a	207.80a
Primextra ® at 3.0kg a.i./ha	0.00b	1.75d	10.00d	14.00f
Mulching (wood shavings)	0.00b	0.00d	2.75e	7.50g
One hoe-weeding at 3WAP	9.25a	11.58c	114.00b	125.20c
Two hoe-weedings at 3 &7WAP	9.53a	10.75c	12.50d	40.70e
Melon cover –crop (-Hoe-weeding)	9.53a	60.10b	50.60c	129.50b
Melon cover –crop+Hoeweeding (3WAP)	9.25a	10.75c	11.5d	51.70d
LSD (P =0.05)	0.876	0.826	0.294	0.678
2005				
No weeding (control)	9.75b	114.25a	177.50a	213.80a

Primextra ® at 3.0kg a.i./ha	0.00c	1.25d	11.00d	15.00f
Mulching (wood shavings)	0.00c	0.00d	3.50f	8.50g
One hoe-weeding at 3WAP	10.50ab	10.00c	116.00b	127.70c
Two hoe-weedings at 3 &7WAP	10.25ab	9.75c	13.50d	46.50e
Melon cover –crop (-Hoe-weeding)	10.03ab	58.75b	51.00c	133.30b
Melon cover –crop+Hoeweeding (3WAP)	10.75a	10.25c	12.5e	58.67d
LSD (P =0.05)	0.886	0.679	0.294	0.678

Values followed by the same letter(s) in a column are not significantly different at 5% level using LSD

Table3 . Effect of different weed control practices on proximate composition (%) in maize grain

Treatment/Year	Crude protein	Lipid	Crude ash	Crude fiber	Carbohydrate
2004					
No weeding (control)	13.62f	4.56f	2.70d	2.40e	64.71g
Primextra ® at 3.0kg a.i./ha	14.21b	4.75b	2.87a	2.76b	78.15b
Mulching (wood shavings)	14.44a	4.86a	2.91a	2.80a	79.28a
One hoe-weeding at 3WAP	14.07d	4.53e	2.72d	2.61d	68.96e
Two hoe-weedings at 3 &7WAP	14.13c	4.64c	2.84b	2.71c	78.06c
Melon cover –crop (-Hoe-weeding)	13.71e	4.57e	2.71d	2.43e	64.84f
Melon cover –crop+Hoeweeding (3WAP)	14.06d	4.61d	2.76c	2.70c	78.04d
LSD (P =0.05)	0.005	0.004	0.004	0.004	0.013
2005					
No weeding (control)	13.60d	4.43c	2.64c	2.35e	64.31d
Primextra ® at 3.0kg a.i./ha	14.12b	4.61b	2.83a	2.71b	78.12b
Mulching (wood shavings)	14.43a	4.82a	2.85a	2.80a	79.21a
One hoe-weeding at 3WAP	14.06b	4.50b	2.71b	2.60c	68.94d
Two hoe-weedings at 3 &7WAP	14.10b	4.60b	2.81a	2.69b	78.03c
Melon cover –crop (-Hoe-weeding)	13.69c	4.56b	2.70b	2.41d	64.80e
Melon cover –crop+Hoeweeding (3WAP)	14.05b	4.60b	2.73b	2.70b	78.01c
LSD (P =0.05)	0.008	0.004	0.005	0.004	0.004

Values followed by the same letter(s) in a column are not significantly different at 5% level using LSD

Table 4. Effect of different weed control practices on ear leaf dry weight (kg/ha) and nutrient concentration (%) in ear leaf of maize

Treatment/Year	Ear leaf dry weight)	N	P	K	Ca	Mg	Na
2004							
No weeding (control)	1063.66g	0.41c	0.20g	1.98a	0.22g	0.23g	0.37b
Primextra ® at 3.0kg a.i./ha	1962.65b	1.95b	0.36b	2.31a	0.36b	0.41b	0.79a
Mulching wood shavings	1973.32a	2.79a	0.38a	2.38a	0.50a	0.49a	1.18a
One hoe-weeding at 3WAP	1202.13e	0.79c	0.28d	2.04a	0.25e	0.30d	0.47b
Two hoe-weedings at 3 &7WAP	1902.99c	0.98c	0.30c	2.10a	0.30c	0.36c	0.71a
Melon cover –crop (-Hoe-weeding)	1071.99f	0.50c	0.23f	2.00a	0.23f	0.24f	0.38b
Melon cover –crop+Hoeweeding (3WAP)	1317.12d	0.80c	0.26e	2.09a	0.28d	0.34e	0.67ab
LSD (P =0.05)	0.391	0.808	0.004	0.675	0.004	0.004	0.61
2005							
No weeding (control)	978.66g	0.40b	0.19g	1.95a	0.21g	0.20g	0.36b
Primextra ® at 3.0kg a.i./ha	1930.45b	1.90a	0.35b	2.30a	0.36b	0.40b	0.78a
Mulching (wood shavings)	1946.65a	2.61a	0.37a	2.38a	0.48a	0.47a	1.17a
One hoe-weeding at 3WAP	1178.84e	0.76b	0.27d	2.04a	0.25e	0.23e	0.46b
Two hoe-weedings at 3 &7WAP	1878.32c	0.92b	0.29c	2.09a	0.29c	0.33c	0.70a
Melon cover –crop (-Hoe-weeding)	1013.33f	0.49b	0.22f	1.97a	0.22f	0.22f	0.38b
Melon cover –crop+Hoeweeding (3WAP)	1280.32d	0.78b	0.25e	2.07a	0.26d	0.27d	0.66ab
LSD (P =0.05)	0.391	0.787	0.004	1.254	0.004	0.004	0.61

Values followed by the same letter(s) in a column are not significantly different at 5% level using LSD

Table 5. Effect of different weed control practices on nutrient uptake (kg/ha) in ear leaf of maize

Treatment/Year	N	P	K	Ca	Mg	Na
2004						
No weeding (control)	4.36c	2.13d	21.06b	2.34e	2.44g	3.94b
Primextra ® at 3.0kg a.i./ha	38.27b	7.06a	45.33a	7.07b	8.05b	15.51a
Mulching (wood shavings)	55.06a	7.50a	46.96a	9.87a	9.67a	23.29a
One hoe-weeding at 3WAP	9.10c	3.37c	24.53b	3.01c	3.61f	5.65b
Two hoe-weedings at3 &7WAP	18.62c	5.71b	39.96a	5.71d	6.85c	13.52a
Melon cover –crop (-Hoe-weeding)	5.36c	2.47d	21.44b	2.47e	2.57e	4.07b
Melon cover –crop+Hoeweeding (3WAP)	10.53c	3.42c	27.52b	3.73c	4.52d	8.87b
LSD (P =0.05)	16.46	0.761	12.78	0.761	0.761	12.431

2005						
No weeding (control)	3.95d	1.86d	19.08c	2.06e	1.96e	3.52b
Primextra ® at 3.0kg a.i./ha	36.68b	6.76a	44.40a	6.95b	7.72b	15.06a
Mulching (wood shavings)	54.12a	7.20a	46.33a	9.34a	9.15a	22.78a
One hoe-weeding at 3WAP	8.96d	3.18c	24.04c	2.95d	2.71d	5.42b
Two hoe-weedings at 3 &7WAP	22.91bc	5.45b	39.26b	5.45c	6.20c	13.15ab
Melon cover –crop (-Hoe-weeding)	4.97d	2.23d	19.96c	2.23e	2.23e	3.85b
Melon cover –crop+Hoeweeding (3WAP)	10.03cd	3.20c	26.51bc	3.37d	3.51d	8.49b
LSD (P =0.05)	15.944	0.795	14.829	0.789	0.790	12.281

Values followed by the same letter(s) in a column are not significantly different at 5% level using LSD

Table 6.Effect of different weed control practices on nutrient concentration (%) in maize grain

Treatment/Year	N	P	K	Ca	Mg	Na
2004						
No weeding (control)	2.40e	0.19e	0.18g	0.27g	0.10f	0.19g
Primextra ® at 3.0kg a.i./ha	2.71b	0.26a	0.24b	0.34b	0.16b	0.25b
Mulching (wood shavings)	2.92a	0.27a	0.25a	0.36a	0.17a	0.26a
One hoe-weeding at 3WAP	2.48d	0.22c	0.21e	0.30e	0.14d	0.22e
Two hoe-weedings at3 &7WAP	2.59c	0.24b	0.23c	0.32c	0.15c	0.24c
Melon cover –crop (-Hoe-weeding)	2.42e	0.23bc	0.20f	0.29f	0.13e	0.21f
Melon cover –crop+Hoeweeding (3WAP)	2.55c	0.21d	0.22d	0.31d	0.14d	0.23d
LSD (P =0.05)	0.053	0.011	0.008	0.007	0.007	0.004
2005						
No weeding (control)	2.39e	0.18d	0.17f	0.26f	0.09g	0.18g
Primextra ® at 3.0kg a.i./ha	2.70b	0.25a	0.23b	0.33b	0.15b	0.24b
Mulching(wood shavings)	2.91a	0.26a	0.24a	0.34a	0.16a	0.25a
One hoe-weeding at 3WAP	2.46d	0.22b	0.19e	0.27e	0.13d	0.21e
Two hoe-weedings at 3 &7WAP	2.57c	0.23b	0.22c	0.30c	0.14c	0.23c
Melon cover –crop (-Hoe-weeding)	2.40d	0.22b	0.19e	0.29d	0.11f	0.20f
Melon cover –crop+Hoeweeding (3WAP)	2.54c	0.20c	0.21d	0.30c	0.12e	0.22d
LSD (P =0.05)	0.061	0.010	0.008	0.008	0.007	0.004

Values followed by the same letter(s) in a column are not significantly different at 5% level using LSD

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