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

Omovbude, Sunday¹, Oroka, Frank O². And Udensi, Ekea Udensi¹
¹Department of Crop and Soil Science, University of Port Harcourt, East West Road, Choba P.M.B, 5323 Port Harcourt, Nigeria
²Department of Agronomy, Delta State University, Asaba Campus, Nigeria

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 mays L) at the Teaching and Research Farm of Ambrose Ali 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- weedicings 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, preventative and integrated management practices. Over the years weed control on 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 Ali 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 (H₂O, 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, magnesium3.14mg/kg, carbon:16.70g/kg, pH (H₂O, 1: 1): 5.40, exchangeable acidity: 0.40cmol/kg and Effective Cation Exchange Capacity (ECEC):9.16cmol/kg.

DOI: 10.9790/2380-10020198104 www.iosrjournals.org 98 | Page
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 x 19m (514m²) approximately 0.05ha. There were seven treatments involved in the experiment, namely: no-weeding (control), Primextra® (3.0kga./ha), mulching (wood shavings), one hoe weeding (3WAP), two hoe-weeding (3 and 7WAP), 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 replications. 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. i. ha⁻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 width/5m). 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) that 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 1.5kgkg⁻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°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 mucanoides Desv, Panicum maximum Jacq. Nine weeds family were identified of which Puaceae 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 Primalextra treated and mulch plots where the weeds were significantly considerably lower. At the other sampling periods the no weeding differed 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 Primalextra 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 Table 3. 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 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 (2.43%). In 2005, wood shaving plot had the highest crude fibre content while no weeding plot had the lowest. The Carbohydrate content fell within the range of 2.07 – 2.97% [3].

Carbohydrate content ranged from 64.71 to 79.28% 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 a 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 1973.32 kg/ha while in 2005, it ranged from 978.66 to 1946.65 kg/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 3(WAP) (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 to 0.18% 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 Table 5. The nutrient uptake differed significantly among the various weed control practices in both cropping seasons. In 2004, N uptake ranged from 4.36 to 55.06 kg/ha while in 2005, it ranged from 3.95 to 54.12 kg/ha. In 2004, plots that were mulched with wood shavings had the highest N uptake while plots that were unweeded had the lowest (4.36 kg/ha) but statistically at par with that of melon cover –crop (-Hoe-weeding) (5.36 kg/ha), one hoe-weeding 3WAP (9.10 kg/ha), melon cover –crop+Hoeweeding (3WAP) (10.53 kg/ha), two hoe-weedings at 3 & 7WAP (18.62 kg/ha). In 2005, plots that were mulched with wood shavings had the highest N uptake while plots that were unweeded had the lowest (3.95 kg/ha) but statistically at par with that of melon cover –crop (-Hoe-weeding) (4.97 kg/ha), one hoe-weeding at 3WAP (8.96 kg/ha) melon cover –crop+Hoeweeding (3WAP) (10.03 kg/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 (7.50 kg/ha) which was at par with that of Primextra treated plot (7.06 kg/ha) while plots that were unweeded had the lowest 2.13 kg/ha but statistically at par with that of melon cover –crop (-Hoe-weeding) (2.47 kg/ha). In 2005, plot mulched with wood shavings had the highest P uptake (7.50 kg/ha) which was at par with that of Primextra treated plot (6.76 kg/ha) while the lowest was in no weeding plot (1.86 kg/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 46.96 kg/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 at 3 & 7WAP (39.96 kg/ha), while lower in no weeding plot (21.06 kg/ha), but at par with that of melon cover –crop (-Hoe-weeding) (21.44 kg/ha), melon cover –crop+Hoeweeding (3WAP) (27.52 kg/ha). In 2005, K uptake was higher in mulched plot (46.33 kg/ha) which was at par with Primextra treated plot (44.40 kg/ha), two hoe-weedings at 3 & 7WAP (39.26 kg/ha), while the lowest was in no weeding plot (19.08 kg/ha), at par with that of Melon cover –crop (-Hoe-weeding) (19.96 kg/ha). One hoe-weeding 3WAP (24.04 kg/ha), melon cover –crop+Hoeweeding (3WAP) (26.51 kg/ha). In 2004, Ca uptake ranged from 2.34 to 9.87 kg/ha while in 2005 it ranged from 2.06 to 9.34 kg/ha. Ca content in 2004 was higher in plot mulched with wood shavings while lower in no weeding (2.34 kg/ha) which was at par with that of melon cover –crop (-Hoe-weeding) (2.47 kg/ha). In 2005, Ca uptake was higher in mulched plot while it was lower in no weeding (2.06 kg/ha), but at par with that of Melon cover –crop (-Hoe-weeding) (2.23 kg/ha). In 2004, Mg content ranged from 2.44 to 9.67 kg/ha while in 2005, it ranged from 1.96 to 9.15 kg/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 (1.96 kg/ha) which was statistically the same with that of Melon cover –crop (-Hoe-weeding) (2.23 kg/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 (23.29 kg/ha) which was at par with Primextra treated plot (23.29 kg/ha), two hoe-weedings 3 & 7WAP (13.52 kg/ha) and the lowest in no weeding (3.94 kg/ha) which was at par with one hoe-weeding 3WAP (5.65 kg/ha) Melon cover –crop (-Hoe-weeding) (4.07 kg/ha) and Melon cover –crop+Hoeweeding (3WAP) (8.87 kg/ha). In 2005, the highest Na uptake was in mulched plot (22.78 kg/ha) which was at par with Primextra treated plot (15.06 kg/ha), two hoe-weedings 3 & 7WAP (13.15 kg/ha) while the lowest was in no weeding (3.52 kg/ha) which was at par with melon cover –crop (-Hoe-weeding) (3.85 kg/ha) One hoe-weeding at 3WAP (5.42 kg/ha) and melon cover –crop+Hoeweeding (3WAP) (8.49 kg/ha) and two hoe-weedings at 3 & 7WAP (13.15 kg/ha). Nutrient uptake plays a fundamental role in plant growth and development as it 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 shavings to improve the nutritional quality of maize grain since it does not involve any technical rigor besides signifying a non-chemical weed control.

#### Table 1. Common weeds at the experimental site before the trial in 2004 and 2005 cropping seasons

<table>
<thead>
<tr>
<th>Family</th>
<th>Weed species</th>
<th>Growth form</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amaranthaceae</td>
<td>Amaranthus spinosus L</td>
<td>ABL</td>
<td>++</td>
</tr>
<tr>
<td>Amaranthaceae</td>
<td>Amaranthus viridis L</td>
<td>ABL</td>
<td>++</td>
</tr>
<tr>
<td>Asteraceae</td>
<td>Ageratum conyzoides L</td>
<td>ABL</td>
<td>++</td>
</tr>
<tr>
<td>Asteraceae</td>
<td>Tridax procumbens L</td>
<td>ABL</td>
<td>++</td>
</tr>
<tr>
<td>Asteraceae</td>
<td>Aspilia africana (Pers) C.D. Adams</td>
<td>PBL</td>
<td>++</td>
</tr>
<tr>
<td>Asteraceae</td>
<td>Chromoleana odorata Kings &amp; Robinson</td>
<td>PBL</td>
<td>+++</td>
</tr>
<tr>
<td>Asteraceae</td>
<td>Syndrella nodiflora Gaertn</td>
<td>ABL</td>
<td>++</td>
</tr>
<tr>
<td>Cucurbitaceae</td>
<td>Momordica charantia L</td>
<td>PBL</td>
<td>+</td>
</tr>
<tr>
<td>Euphorbiaceae</td>
<td>Euphorbia heterophylla L</td>
<td>ABL</td>
<td>+++</td>
</tr>
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<td>Euphorbiaceae</td>
<td>Euphorbia hirta L</td>
<td>ABL</td>
<td>+++</td>
</tr>
<tr>
<td>Euphorbiaceae</td>
<td>Phyllanthus amarus Schum. &amp;Thonn</td>
<td>ABL</td>
<td>++</td>
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<tr>
<td>Fabaceae</td>
<td>Calopogonium mucunoides Desv</td>
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<td>+++</td>
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<td>Fabaceae</td>
<td>Mucuna pruriens (L.) DC</td>
<td>PBL</td>
<td>+++</td>
</tr>
<tr>
<td>Malvaceae</td>
<td>Sida acuta Burm F</td>
<td>PBL</td>
<td>++</td>
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<tr>
<td>Malvaceae</td>
<td>Sida cordifolia Burm F</td>
<td>PBL</td>
<td>++</td>
</tr>
<tr>
<td>Poaceae</td>
<td>Cynodon dactylon L. Pers</td>
<td>PG</td>
<td>++</td>
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<td>Poaceae</td>
<td>Digitaria horizontalis Wild</td>
<td>PG</td>
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<tr>
<td>Poaceae</td>
<td>Elesine indica (L.) Gaertn</td>
<td>AG</td>
<td>++</td>
</tr>
<tr>
<td>Poaceae</td>
<td>Panicum maximum Jacq.</td>
<td>PG</td>
<td>++</td>
</tr>
<tr>
<td>Poaceae</td>
<td>Pennisetum purpureum L</td>
<td>PG</td>
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<td>Poaceae</td>
<td>Rottboelia cochinchinensis Lour clayton</td>
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<td>Portulacaceae</td>
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<td>Cyperus esculentus L</td>
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<td>++</td>
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<td>Cyperaceae</td>
<td>Cyperus rotundus L</td>
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<td>Cyperaceae</td>
<td>Mariusca fimbriiformis L</td>
<td>PS</td>
<td>++</td>
</tr>
</tbody>
</table>

[+] = 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/m²) of maize

<table>
<thead>
<tr>
<th>Treatment</th>
<th>3WAP</th>
<th>6WAP</th>
<th>9WAP</th>
<th>12WAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>No weeding (control)</td>
<td>9.5a</td>
<td>112.5a</td>
<td>174.00a</td>
<td>207.80a</td>
</tr>
<tr>
<td>Primextra® @ 3/kg a.i./ha</td>
<td>0.00b</td>
<td>1.75d</td>
<td>10.00d</td>
<td>14.00f</td>
</tr>
<tr>
<td>Mulching (wood shavings)</td>
<td>0.00b</td>
<td>0.00d</td>
<td>2.75e</td>
<td>7.50g</td>
</tr>
<tr>
<td>One hoe-weeding at 3WAP</td>
<td>9.25a</td>
<td>11.58c</td>
<td>114.00b</td>
<td>125.20c</td>
</tr>
<tr>
<td>Two hoe-weedings at 3 &amp; 6WAP</td>
<td>9.53a</td>
<td>10.75c</td>
<td>12.50d</td>
<td>40.70e</td>
</tr>
<tr>
<td>Melon cover +crop + Hoe-weeding</td>
<td>9.53a</td>
<td>60.10b</td>
<td>50.60c</td>
<td>129.50b</td>
</tr>
<tr>
<td>Melon cover +crop + Hoe+weeding (3WAP)</td>
<td>9.75a</td>
<td>10.75c</td>
<td>11.5d</td>
<td>51.79d</td>
</tr>
<tr>
<td>LSD (P =0.05)</td>
<td>0.876</td>
<td>0.826</td>
<td>0.294</td>
<td>0.678</td>
</tr>
</tbody>
</table>

2005

| No weeding (control)          | 9.75b      | 114.25a    | 177.50a    | 213.80a    |
Effect of different weed control practices on proximate composition, nutrient concentration and...

Table 3. Effect of different weed control practices on proximate composition (%) in maize grain

<table>
<thead>
<tr>
<th>Treatment/Year</th>
<th>Crude protein (%)</th>
<th>Lipid (%)</th>
<th>Crude ash (%)</th>
<th>Crude fiber (%)</th>
<th>Carbohydrate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2004</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No weeding</td>
<td>13.62f</td>
<td>4.56f</td>
<td>2.70d</td>
<td>2.40e</td>
<td>64.71g</td>
</tr>
<tr>
<td>Primextra @ 3.0kg a.i/ha</td>
<td>14.21b</td>
<td>4.75b</td>
<td>2.87a</td>
<td>2.76b</td>
<td>78.15b</td>
</tr>
<tr>
<td>Mulching</td>
<td>14.44a</td>
<td>4.86a</td>
<td>2.91a</td>
<td>2.80a</td>
<td>79.28a</td>
</tr>
<tr>
<td>One hoe-weeding at 3WAP</td>
<td>14.07d</td>
<td>4.53e</td>
<td>2.72d</td>
<td>2.61d</td>
<td>68.96e</td>
</tr>
<tr>
<td>Two hoe-weedings at 3 &amp; 7WAP</td>
<td>14.13c</td>
<td>4.64c</td>
<td>2.84b</td>
<td>2.71c</td>
<td>78.06c</td>
</tr>
<tr>
<td>Melon cover –crop (Hoe-weeding)</td>
<td>13.71e</td>
<td>4.57e</td>
<td>2.71d</td>
<td>2.43e</td>
<td>64.84f</td>
</tr>
<tr>
<td>Melon cover –crop+Hoewing (3WAP)</td>
<td>14.06d</td>
<td>4.61d</td>
<td>2.76c</td>
<td>2.70c</td>
<td>78.04d</td>
</tr>
<tr>
<td>LSD (p=0.05)</td>
<td>0.005</td>
<td>0.004</td>
<td>0.000</td>
<td>0.004</td>
<td>0.013</td>
</tr>
<tr>
<td><strong>2005</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No weeding</td>
<td>13.60d</td>
<td>4.43c</td>
<td>2.64c</td>
<td>2.35e</td>
<td>64.31d</td>
</tr>
<tr>
<td>Primextra @ 3.0kg a.i/ha</td>
<td>14.12b</td>
<td>4.61b</td>
<td>2.83a</td>
<td>2.78b</td>
<td>78.12b</td>
</tr>
<tr>
<td>Mulching</td>
<td>14.43a</td>
<td>4.82a</td>
<td>2.85a</td>
<td>2.80a</td>
<td>79.21a</td>
</tr>
<tr>
<td>One hoe-weeding at 3WAP</td>
<td>14.06b</td>
<td>4.50b</td>
<td>2.71b</td>
<td>2.60c</td>
<td>68.94d</td>
</tr>
<tr>
<td>Two hoe-weedings at 3 &amp; 7WAP</td>
<td>14.10b</td>
<td>4.60b</td>
<td>2.81a</td>
<td>2.69b</td>
<td>78.03c</td>
</tr>
<tr>
<td>Melon cover –crop (Hoe-weeding)</td>
<td>13.69c</td>
<td>4.56b</td>
<td>2.70b</td>
<td>2.41d</td>
<td>64.80e</td>
</tr>
<tr>
<td>Melon cover –crop+Hoewing (3WAP)</td>
<td>14.05b</td>
<td>4.60b</td>
<td>2.73b</td>
<td>2.70c</td>
<td>78.01c</td>
</tr>
<tr>
<td>LSD (p=0.05)</td>
<td>0.008</td>
<td>0.004</td>
<td>0.000</td>
<td>0.004</td>
<td>0.004</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Treatment/Year</th>
<th>Ear leaf dry weight (kg/ha)</th>
<th>N (%)</th>
<th>P (%)</th>
<th>K (%)</th>
<th>Ca (%)</th>
<th>Mg (%)</th>
<th>Na (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2004</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No weeding</td>
<td>1063.66g</td>
<td>0.41c</td>
<td>0.20g</td>
<td>1.98a</td>
<td>0.22g</td>
<td>0.23g</td>
<td>0.37b</td>
</tr>
<tr>
<td>Primextra @ 3.0kg a.i/ha</td>
<td>1962.65b</td>
<td>1.95b</td>
<td>0.36b</td>
<td>2.31a</td>
<td>0.36b</td>
<td>0.41b</td>
<td>0.79a</td>
</tr>
<tr>
<td>Mulching</td>
<td>1973.32a</td>
<td>2.79a</td>
<td>0.38a</td>
<td>2.38a</td>
<td>0.50a</td>
<td>0.49a</td>
<td>1.18a</td>
</tr>
<tr>
<td>One hoe-weeding at 3WAP</td>
<td>1202.13e</td>
<td>0.79c</td>
<td>0.26d</td>
<td>2.04a</td>
<td>0.25e</td>
<td>0.30d</td>
<td>0.47b</td>
</tr>
<tr>
<td>Two hoe-weedings at 3 &amp; 7WAP</td>
<td>1902.99c</td>
<td>0.98c</td>
<td>0.30c</td>
<td>2.10a</td>
<td>0.30a</td>
<td>0.36c</td>
<td>0.71c</td>
</tr>
<tr>
<td>Melon cover –crop (Hoe-weeding)</td>
<td>1071.99f</td>
<td>0.50c</td>
<td>0.23f</td>
<td>2.03a</td>
<td>0.23f</td>
<td>0.24f</td>
<td>0.38b</td>
</tr>
<tr>
<td>Melon cover –crop+Hoewing (3WAP)</td>
<td>1317.12d</td>
<td>0.80c</td>
<td>0.26e</td>
<td>2.09a</td>
<td>0.28d</td>
<td>0.34e</td>
<td>0.67ab</td>
</tr>
<tr>
<td>LSD (p=0.05)</td>
<td>0.39i</td>
<td>0.80i</td>
<td>0.004</td>
<td>0.675</td>
<td>0.004</td>
<td>0.004</td>
<td>0.61</td>
</tr>
<tr>
<td><strong>2005</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No weeding</td>
<td>978.66g</td>
<td>0.40b</td>
<td>0.19g</td>
<td>1.95a</td>
<td>0.21g</td>
<td>0.20g</td>
<td>0.36b</td>
</tr>
<tr>
<td>Primextra @ 3.0kg a.i/ha</td>
<td>1930.45b</td>
<td>1.90a</td>
<td>0.35b</td>
<td>2.30a</td>
<td>0.40b</td>
<td>0.40b</td>
<td>0.78a</td>
</tr>
<tr>
<td>Mulching</td>
<td>1946.65a</td>
<td>2.61a</td>
<td>0.37a</td>
<td>2.38a</td>
<td>0.48a</td>
<td>0.47a</td>
<td>1.17a</td>
</tr>
<tr>
<td>One hoe-weeding at 3WAP</td>
<td>1178.84e</td>
<td>0.76b</td>
<td>0.27d</td>
<td>2.04a</td>
<td>0.25e</td>
<td>0.23e</td>
<td>0.46b</td>
</tr>
<tr>
<td>Two hoe-weedings at 3 &amp; 7WAP</td>
<td>1878.32c</td>
<td>0.92b</td>
<td>0.29c</td>
<td>2.09a</td>
<td>0.29c</td>
<td>0.33c</td>
<td>0.70a</td>
</tr>
<tr>
<td>Melon cover –crop (Hoe-weeding)</td>
<td>1013.33f</td>
<td>0.49b</td>
<td>0.22f</td>
<td>1.97a</td>
<td>0.22f</td>
<td>0.22f</td>
<td>0.38b</td>
</tr>
<tr>
<td>Melon cover –crop+Hoewing (3WAP)</td>
<td>1280.32d</td>
<td>0.78b</td>
<td>0.25e</td>
<td>2.07a</td>
<td>0.26d</td>
<td>0.27d</td>
<td>0.66ab</td>
</tr>
<tr>
<td>LSD (p=0.05)</td>
<td>0.39i</td>
<td>0.78i</td>
<td>0.004</td>
<td>1.254</td>
<td>0.004</td>
<td>0.004</td>
<td>0.61</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Treatment/Year</th>
<th>N (%)</th>
<th>P (%)</th>
<th>K (%)</th>
<th>Ca (%)</th>
<th>Mg (%)</th>
<th>Na (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2004</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No weeding</td>
<td>4.36c</td>
<td>2.13d</td>
<td>21.06b</td>
<td>2.34e</td>
<td>2.44g</td>
<td>3.94b</td>
</tr>
<tr>
<td>Primextra @ 3.0kg a.i/ha</td>
<td>38.27b</td>
<td>7.06a</td>
<td>45.33a</td>
<td>7.07b</td>
<td>8.05b</td>
<td>15.51a</td>
</tr>
<tr>
<td>Mulching</td>
<td>55.06a</td>
<td>7.50a</td>
<td>46.96a</td>
<td>9.87a</td>
<td>9.67a</td>
<td>23.29a</td>
</tr>
<tr>
<td>One hoe-weeding at 3WAP</td>
<td>9.10c</td>
<td>3.37c</td>
<td>24.33b</td>
<td>3.01c</td>
<td>3.61f</td>
<td>5.65b</td>
</tr>
<tr>
<td>Two hoe-weedings at 3 &amp; 7WAP</td>
<td>16.62c</td>
<td>3.71b</td>
<td>39.96a</td>
<td>5.71d</td>
<td>6.85c</td>
<td>13.52a</td>
</tr>
<tr>
<td>Melon cover –crop (Hoe-weeding)</td>
<td>5.36c</td>
<td>2.47d</td>
<td>21.44b</td>
<td>2.47c</td>
<td>2.57e</td>
<td>4.07b</td>
</tr>
<tr>
<td>Melon cover –crop+Hoewing (3WAP)</td>
<td>10.53c</td>
<td>3.42c</td>
<td>27.52b</td>
<td>3.73c</td>
<td>4.52d</td>
<td>8.87b</td>
</tr>
<tr>
<td>LSD (p=0.05)</td>
<td>16.46</td>
<td>0.761</td>
<td>12.78</td>
<td>0.761</td>
<td>0.761</td>
<td>12.431</td>
</tr>
</tbody>
</table>

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

DOI: 10.9790/2380-10020198104
Values followed by the same letter(s) in a column are not significantly different at 5% level using LSD

<table>
<thead>
<tr>
<th>Treatment/Year</th>
<th>Treatment</th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Ca</th>
<th>Mg</th>
<th>Na</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>No weeding (control)</td>
<td>2.40e</td>
<td>0.19</td>
<td>0.18</td>
<td>0.27</td>
<td>0.10</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>Primextra ® at 3.0kg a.i/ha</td>
<td>2.71b</td>
<td>0.26</td>
<td>0.24</td>
<td>0.34</td>
<td>0.16</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Mulching (wood shavings)</td>
<td>2.92a</td>
<td>0.27a</td>
<td>0.25</td>
<td>0.36</td>
<td>0.17a</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>One hoe-weeding at 3WAP</td>
<td>2.48d</td>
<td>0.22</td>
<td>0.21</td>
<td>0.30</td>
<td>0.14</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Two hoe-weedings at 3 &amp; 7WAP</td>
<td>2.59c</td>
<td>0.24b</td>
<td>0.23c</td>
<td>0.32c</td>
<td>0.15c</td>
<td>0.24c</td>
</tr>
<tr>
<td></td>
<td>Melon cover –crop (-Hoe-weeding)</td>
<td>2.42e</td>
<td>0.23c</td>
<td>0.20f</td>
<td>0.29f</td>
<td>0.13c</td>
<td>0.21f</td>
</tr>
<tr>
<td></td>
<td>Melon cover –crop+Hoeweeding (3WAP)</td>
<td>2.55c</td>
<td>0.21d</td>
<td>0.22d</td>
<td>0.31d</td>
<td>0.14d</td>
<td>0.23d</td>
</tr>
</tbody>
</table>

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

Reference