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Sensitivity of Melon [Citrillus colocynthis (L.) Schrad] and Weeds to Doses of Pre-Emergence Herbicides

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Abstract
This study was conducted between 2014 and 2015 to determine the sensitivity of melon and weeds to selected pre-emergence herbicide rates in a humid agro-ecology zone of Nigeria. The field trial had thirteen treatments consisting of : seven rates of Primextra [Primextra-Gold® (atrazine (370 g/l) + Metolachlor (290 g/l SC)], Raft (Terbutylazine 250g/L + Atrazine 250g/L) at 2.0 kg ai ha^{-1} , ForceTop (Pendimethalin 500g/L) at 2.0 kg ai ha^{-1}, and three weeded control and a weedy check. Results from this study showed that melon and weeds were significantly sensitive to the herbicide rates. While the herbicide treatments had between 31-100% mortality depending on rate of the herbicide applied, the hand weeded treatments recorded between 19% and 60% melon mortality. Primextra at lower rates had similar effect on weeds as the weeded control, and gave good growth of melon. Primextra at 1.98kg a.i/ha, Force top at 2.0kg/ha and Raft at 2.0kg a.i/ha gave acceptable (≥ 70 %) weed control but caused lasting and unrecoverable injury. Melon may tolerate ≤ 1.00kgai/ha of Primextra, and may be susceptible to phytotoxic rates above 1.0 kg ai/ha. All herbicide rates above 1.0kg/ha gave acceptable (≥70%) weed density and biomass reduction. The importance of the present study is that farmers can intercrop maize and with Primextra Gold applied pre-emergence at a rate ≥ 0.25k ai/ha but ,< 0.5kg ai ha or relay melon into maize or any piece of land treated with Primextra at rates not exceeding 1.5 kg/ha at about 10 days after application.
Keywords: Herbicides, Phytotoxicity, Melon, and Weed

1.0 INTRODUCTION

Melon (*Colocynthis citrullus* L.*),* popularly known as egusi-melon is an important crop in Nigeria and most other African countries. It thrives in hot regions with rich light soil and can tolerate periods of low rainfall, it is highly drought tolerant annual cucurbit and is widely distributed in parts of West Africa. It is especially very common within the savannah and forest vegetation belts including Cote d'Ivoire to Cameroon (Ekpo *et al.,* 2010). It is rarely cultivated as sole crop in traditional cropping system where it provides some weed suppression effect when intercropped with other crops; it is also cultivated for its seeds which are prepared into condiments used in preparing soup and various dishes (Olaniyi, 2008; NAERLS-PCU 2005). Melon performs best when grown singly, but it will give adequate yield when intercropped with other crops, and requires fertile, well drained, loamy soil, medium to near neutral pH, gentle but regular rainfall, interspaced with plenty of sun shine for increase in yield (Olaniyi, 2008). In southern Nigeria, *egusi*-melon is usually grown mixed with other crops such as cassava and maize by most famers who practice mixed cropping (Ekpo *et al*., 2010). It is mostly grown by the rural women, but in recent times it has become a commercial crop that is no longer gender sensitive. It is very useful in crop economy for local consumption and industrial purposes (Lagoke et al, 1983 It will not do well under shade and does not also tolerate intensive or prolong rainfall, it dies prematurely under such conditions. In the southern part of Nigeria, melon intercropping pattern includes the following: maize/melon/cassava, maize/yam/cassava, maize/melon/yam/cassava, maize/melon, and melon/yam but melon/maize intercrop combination is dominant. This is due largely to the fact that they are short duration or short season crops, they provide food, and most importantly they generate income to the farmers early in the season. Egusi-melon is abundant in Nigeria, where it is cultivated in over an area of 361,000 ha, with yield of about 347,000 tonne per annum. The major problem limiting productivity and increased land use for melon cropping system in the southern part of Nigeria are weeds. Farmers have been trying a lot of herbicides in a bit to control weeds perceived as problem to increased productivity. Some of the common herbicides are Primextra (Atrazine + S-metolachlor), Raft (Terbutylazine + Atrazine) and Force-Top or Pendalin (Pendimethalin). The most popular among these herbicides is Primextra, because of its broad spectrum activity and availability even in the local communities. It is available in various formulations depending on the Manufacturer or Registrant. Melon is sensitive to Primextra, which is a broad spectrum pre-emergence herbicide used in Nigeria especially in southern Nigeria for weed control in a wide range of an intercropped system involving melon. Farmers have been doing a lot of herbicide mixing to be able to see how they can reduce the effect of Primextra on melon; this has caused more problems instead of solving the problem. Also they have been using various dilution rates to avoid the problem, but this has also created a problem of not knowing the appropriate rate that will not be toxic to melon and will still control weed. Therefore the objective of the study was to evaluate the response of melon and weeds to selected rates of three common herbicides used in the area, with Primextra as the focus herbicide.

2.0 MATERIALS AND METHODS

2.1 Experimental site description

The study was carried out at the Faculty of Agriculture Research and Teaching Farm, University of Port Harcourt, Choba, Rivers State, Nigeria between September 15th 2014 and January 18th 2015. The experimental site is located at latitude 04° 54´ 538'N and longitude 006° 55´ 329'E and at an altitude of 17 meters above sea level. Weather data presented in Figure 1 shows rainfall, relative humidity and temperature distribution during the study. This data showed that total rainfall within the period of this study (September 2014 – January 2015) was 554.4mm, mean relative humidity was 67.3%, and mean temperature was 27.7^{oc}.

2.2 Land preparation and Experimental Design

The experimental site was slashed and tilled manually using cutlass and hoe, respectively the land was levelled using a shovel. Soil samples were collected at a depth of 15 cm diagonally across the plot and bulked, and after thorough mixing a sub sample was taken to the laboratory for chemical analysis. The soil of the study site belong to the Ultisol (udults) class with silt 6.0 %, clay 5.0%, sand 88.5% (Sandy loam) pH 4.30, TOC 1.91%, TON 0.096 %, 8.66 mg/kg P, 1.84 mg/kg K, 0.63 mg/kg Mg and 1.93 mg/kg Ca.

2.3 Treatments plan and application

The trial consisted of 13 treatments (Table 1) laid out in an experimental plot size of 3 m x 3m each in a randomized complete block design (RCBD), with three replications.

Table 1: Treatment plan

S/NO	TREATMENT	DESCRIPTION
1	Primextra Gold at 0.25kg ai/ha	Primextra-Gold 660SC (Atrazine (370g ai/l + S-Metolachlor 290 g/l SC), Syngenta Crop Protection AG, Basle, Switzerland
2	Primextra Gold at 0.50kg ai/ha	
3	Primextra Gold at 0.75kg ai/ha	
4	Primextra Gold at 1.00kg ai/ha	
5	Primextra Gold at 1.25kg ai/ha	
6	Primextra Gold at 1.50kg ai/ha	
7	Primextra Gold at 1.98kg ai/ha	
8	Raft at 2.00kg ai/ha	Terbutylazine 250g/L + Atrazine 250g/L
9	Force top at 2.0kg ai/ha	Pendimethalin
10	Weed x 1	At three (3) weeks after planting (3 WAP)
11	Weed x 2	At 3 and 6 WAP
12	Weed free	Weekly weeding
13	Unweeded check	Unweeded after land preparation

Melon seed was planted at a plant spacing of 0.75m x 0.5m with 3seeds per hill and thinned to one seed per hill to reflect the specified population of 26,666 plants/ha. The herbicide treatments were applied after tilling and the same day after planting (0 WAP) with a hand pump CP 15 knapsack sprayer fitted with a red jet nozzle and calibrated to deliver spray volume of 200L/ha

2.4 Data collection

For melon, data was collected on the following; melon emergence, melon seedling height, mortality rate, melon ground cover rate, flowering, fruit number, melon vine weight, fruit and seed weight. Weed data collected were, weed density, weed biomass, and weed ground cover. Melon seedling height was assessed using three plants per three linear meter randomly selected per plot at 2 and 4WAP. Melon seedling mortality at 2 and 6 WAP was calculated according to the following formula:

$$\text{Melon Mortality (\%)} = 1 - \left[\frac{\text{Seedling emergence of treatment}}{\text{Mean emergence of untreated control}}\right] \text{X } 100\ \%$$ **(Song *et al.*, 2006)**

Percentage flowering rate was taken by counting flowers in two diagonal transects of the plot using 50cm by 50cm quadrat with five sub division measuring 10cm by 10cm each. In using the quadrat, flowers that fall within the 10cm square was counted, and expressed as the percentage of the total 10cm square points per quadrant to represent percentage flowering. Melon vine and weed ground cover was determined using line-intercept method used in vegetation cover assessment (Martin and Paddy, 1994). Vine weight was assessed by cutting the entire vine per plot and taking the weight. Fruit number was determined by counting, and fruit weight was determined by gathering all the fruits and weighing them right on the field. Melon seeds were extracted from each plot by allowing a few weeks after gathering for the melon fruit to soften and the seeds washed and dried. Thereafter, the seed weight per plot was assessed and expressed as seed yield per hectare from the total plot area harvested. Data on weed density and biomass were assessed from 3 quadrat measuring 25cm by 25cm at 4 and 12 WAP (harvest), by clipping the weeds at ground level using cutlass. The weed samples were oven dried at

80°C for 48hours and weighed using a weighing balance (MP 2001 electronic balance, SHP0100511374). Data were also collected on relevant weather information throughout the period of the study (Figure 1)

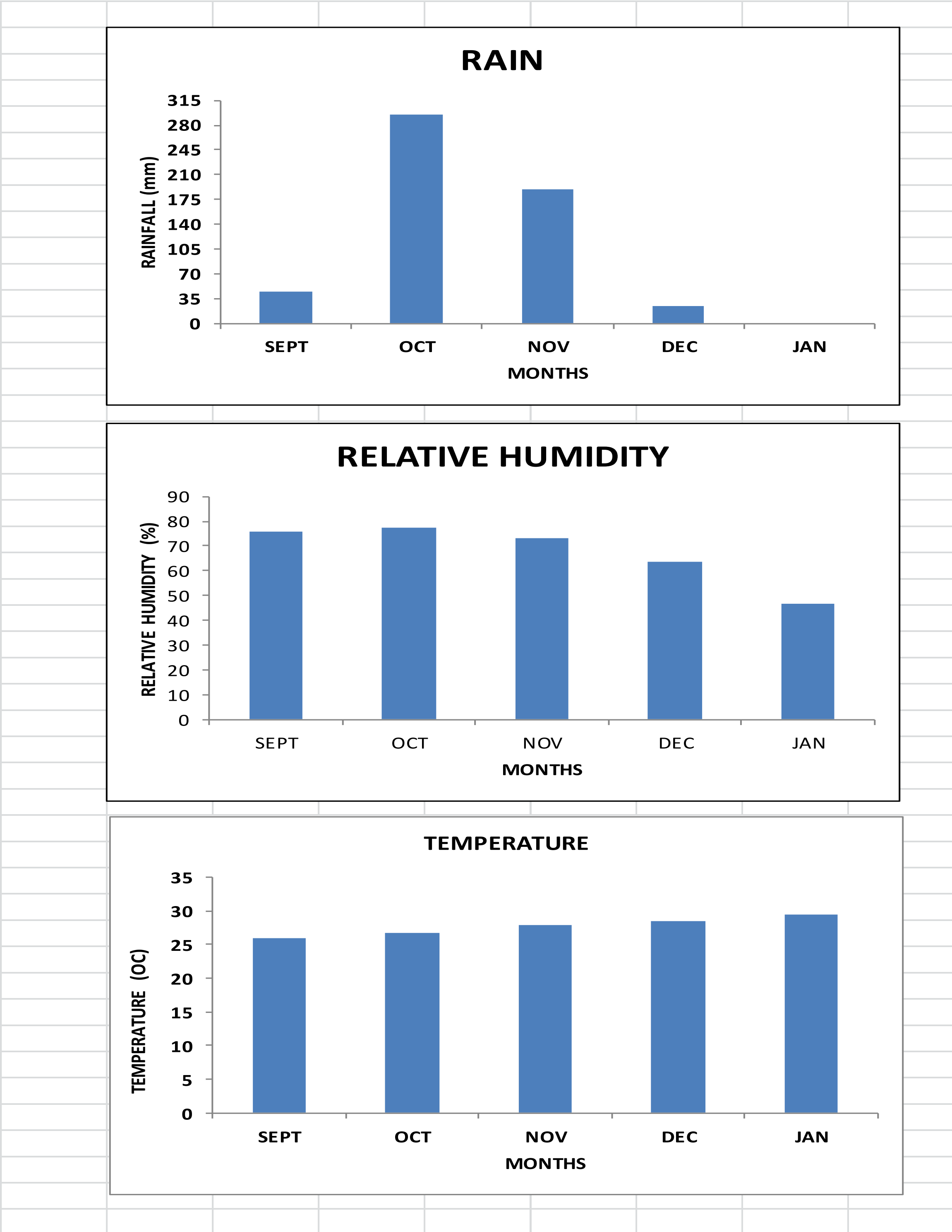

Figure1: Rainfall, relative humidity and mean temperature distribution at University Park campus of University of Port Harcourt site of the experiment from September 2014 (Start of Trial) to January 2015 (End of trial). Source of weather data: Geography Department University of Port Harcourt, 2014-2015

2.5 Statistical Data Analysis:

Analysis of Variance (ANOVA) was done using general linear model procedure (PROC GLM) of SAS 9.2 (SAS Institute Inc., 1999) for RCBD experiment. Means were separated using Duncan multiple range test (DMRT) and LSD at 5% level of probability procedures according to Gomez and Gomez (1984).

3.0 RESULTS

3.1 Effect of treatments on melon seedling height and mortality

In terms of melon seedling height, all weeding treatments had significantly taller melon stands at 2WAP compared to the herbicide treatments. The herbicide treatments did not differ in their effect on melon seedling height at 2WAP (Table 2). However, Primextra at 1.98kg/ha had the shortest melon seedling plants stands compared to the rest of herbicide treatments. At 4WAP, lower rates of the herbicide Primextra had taller melon seedlings compared to all the weeding treatments but the differences were not significant. At 2WAP melon mortality rate did not differ significantly between the lower rates of herbicide (0.25kg/ha – 0.75kg/ha). However, mortality was higher with all rates compared to the weeding treatments except weed x 1. Melon mortality rate at 6 WAP was highest with the herbicide treatments compared to the weeded treatments. The unweeded treatment did not differ significantly from the Primextra rates of 0.25kg/ha and 0.50kg/ha in terms of melon mortality (Table 2).

Table 2: Effect of treatment on melon emergence, height and mortality

Treatment	Melon seedling height (cm)		Melon mortality (%)	
	2WAP	4WAP	2WAP	6WAP
Pm x-0.25 kg ai/ha	3.24^{b}	24.29^{abc}	22.2^{ef}	41.67^{abcd}
Pox 0.50 kg ai/ha	2.88^{bc}	24.14^{abc}	20.8^{ef}	63.61^{abc}
Pox 0.75 kg ai/ha	3.16^{b}	27.82^{ab}	41.7b^{cdef}	77.78^{ab}
Pox 1.00 kg ai/ha	2.53^{bcd}	13.77^{abcde}	48.6^{abcde}	76.39^{ab}
Pox 1.25 kg ai/ha	3.29^{b}	10.51^{bcde}	58.3^{abcd}	83.33^{a}
Pox 1.50 kg ai/ha	2.63^{bcd}	7.81^{cde}	61.1^{abc}	59.72^{abc}
Pox 1.98kg ai/ha	1.50^{d}	0.00^{e}	75.0^{a}	31.94^{abcd}
Raft 2.0 kg ai/ha	1.70^{cd}	0.43^{e}	70.8^{ab}	0^{d}
Force top 2.0 kg ai/ha	2.35^{bcd}	3.50^{e}	29.2^{def}	61^{abc}
Weed x 1 (3WAP)	4.66^{a}	31.19^{a}	33.3^{cdef}	37.50^{abcd}
Weed x 2(3+6WAP)	4.82^{a}	19.54^{abcd}	15.3^{f}	19.44^{cd}
Weed free	4.70^{a}	24.45^{abc}	19.4^{ef}	27.78^{abcd}
Unweeded check	5.09^{a}	14.59^{abcde}	15.3^{f}	22.22^{bcd}
LSD (@5%)	**1.07**	**15.63**	**27.37**	**48.33**
P-value	**<.0001**	**0.0020**	**0.0003**	**0.0298**

Means followed by the same alphabet are not significantly different at 5% level of probability according to Duncan Multiple Range Test

3.2 Effect of treatments on weed density and biomass

At 4WAP, unweeded check had the highest number of weeds (Table 3). Similarly, at 4 WAP Primextra gold at 1.00kg ai/ha, weed x1 and weed x2, Force Top, Raft and Primextra rate at 0.25kg ai/ha did not differ significantly from each other on their effect on weed density (Table 3). Primextra at 0.50kg ai/ha, 0.75kg ai/ha, 1.25kg ai/ha, 1.50kg ai/ha and 1.98kg ai/ha did not differ significantly from each other on their effect on weed density. Weedfree treatment had a significantly higher effect in reducing weed than all the other treatments (Table 3). At 12 WAP all the other treatments significantly reduced weed density, when compared to the unweeded check. All the herbicide treatments significantly reduced weed density at 12WAP, than weed x 1. However the effect of the herbicide on weed density was comparable to the weed x 2. Weedfree treatment had the greatest lowering effect on weed density. Unweeded check and weed x 1 had similar effect on weed density at 12 WAP. Also, all the herbicide treatments, irrespective of rate, had similar effect on weed density at this period (Table 3). But the weedfree treatment at 12WAP was significantly better than all treatments in lowering weed density.

At 4WAP, the unweeded check had a significantly higher weed biomass compared to the rest of the treatments, while the Weedfree treatment had the lowest weed biomass of all the treatments (Table 3). However, the Weedfree treatment and all the herbicide treatments were not significantly different from each other in lowering weed biomass (Table 3). At 12WAP (harvest), the unweeded check recorded the highest weed biomass value. Though, treatment effect on weed biomass was variable, there were no significant differences between treatments at 12 WAP (Table 3). All the herbicide treatments did not differ significantly from each other in lowering weed biomass at 12 WAP. Weedfree and weed x 2 were significantly superior to weed x 1 in reducing weed biomass at 12 WAP (Table 3).

Table 3: Effect of treatment on weed density and biomass

Treatment	Weed density		Weed biomass	
	4 WAP	12 WAP	4 WAP	12 WAP
Pm x-0.25 kg ai/ha	26^{b}	11^{c}	24.18^{b}	39.64^{bcd}
Pmx 0.50 kg ai/ha	17^{cde}	9^{c}	4.44^{b}	52.98^{bcd}
Pmx 0.75 kg ai/ha	17^{cde}	8^{c}	6.93^{b}	26.84^{cd}
Pmx 1.00 kg ai/ha	19^{bcd}	11^{c}	5.69^{b}	118.58^{ab}
Pmx 1.25 kg ai/ha	15^{de}	11^{c}	10.84^{b}	52.27^{bcd}
Pmx 1.50 kg ai/ha	14^{de}	9^{c}	3.20^{b}	19.38^{cd}
Pmx 1.98kg ai/ha	10^{e}	8^{c}	2.84^{b}	62.40^{bcd}
Raft 2.0 kg ai/ha	19^{bcd}	12^{bc}	9.78^{b}	86.22^{abcd}
Force top 2.0 kg ai/ha	19^{bcd}	11^{c}	7.64^{b}	158.58a
Weed x 1 at 3WAP	19^{bcd}	16^{ab}	6.22^{b}	108.62^{abc}
Weed x 2 at 3+6WAP	23^{bc}	9^{c}	14.58^{b}	17.42^{d}
Weed free	0^{f}	0^{d}	0^{b}	0^{d}
Unweeded check	51^{a}	20^{a}	335.28^{a}	164.27^{a}
LSD (@5%)	**6.80**	**4.12**	**25.44**	**78.66**
***P*-value**	**<.0001**	**<.0001**	**<.0001**	**0.0020**

Means followed by the same alphabet are not significantly different at 5% level of probability according to Duncan Multiple Range Test

3.3 Effect of treatments on melon and weed ground cover

). At 6WAP, weed x 1 had the highest melon ground cover of (≥ 25%) and this was significantly higher than all the herbicide treatments except Primextra rates of 0.25kg ai/ha and 0.5 kg ai/ha (Figure 2A). The three hand weeded treatments had similar effect on melon cover at 6WAP. The effect of the herbicide treatments on ground cover at this period did not differ significantly, though higher herbicide rates had lower or no melon ground cover. Weed cover at 6WAP was highest with the unweeded check followed by weed x 2 and Primextra at 0.25kg ai/ha (Figure 2A). The weedfree treatment had the lowest weed cover at 6WAP which was significantly different from all other treatments except for weed x 1, Primextra at 1.50 and 1.98kg ai/ha. The rest of the herbicide treatments did not differ in their effect on weed ground cover. Greater than or equal to 80% of the treatments not covered with either melon or weeds were from weed x 2 and herbicides treatments, Primextra rates of 1.25kg ai/ha to 1.98kg ai/ha, Raft at 2.0kg ai/ha and Force top at 2.0kg ai/ha, while ≥ 50 to 77% soil cover was from Primextra rates of 0.25kg ai/ha to 1.00kg ai/ha and weed x1(Figure 2A). At 10 WAP the weeded treatment had a significantly higher melon ground cover ≥70% to 90% when compared to herbicide treatments and the unweeded check. Primextra rates of 0.25kg ai/ha to 1.25kg ai/ha had significantly higher melon cover compared to unweeded check and the herbicide treatment rates of Primextra rate of 1.50kg ai/ha and 1.98kg ai/ha, Raft at 2.0kg ai/ha and Force Top at 2.0kg ai/ha (Figure 2B). The effect of unweeded check on melon cover was not significantly superior to the above mentioned herbicide rates. At 10WAP, weed ground cover was significantly higher with the unweeded check (≥ 80%) compared to all other treatments. The treatments weed x 2 and weedfree recorded a significantly lower weed cover (0-5%) compared to weed x 1 and the herbicide treatments. The herbicide treatments at this period were not significantly different on their effect on weed ground cover which ranges between ≥ 17 to 20% weed cover (Figure 2B). At 10WAP, the following herbicide treatments, Primextra at 1.50kg ai/ha and 1.98kg ai/ha, Force Top at 2.0 kg ai/ha and Raft at 2.0kg ai/ha had ≥ 70% of the soil uncovered with either melon or weeds, and this was significantly greater when compared to all other treatments. Primextra rates of 0.25kg ai/ha to 1.25kg ai/ha had higher bare soil cover (≥ 27 to 37%) than the weeded treatments, but the differences were not significant for 0.25kg ai/ha and 1.00kg ai/ha Primextra rates. The unweeded check had the lowest soil cover (≥ 5%) compared to the three hand weed treatments (≥ 9% to 17%) but the differences were not significant (Figure 2B).

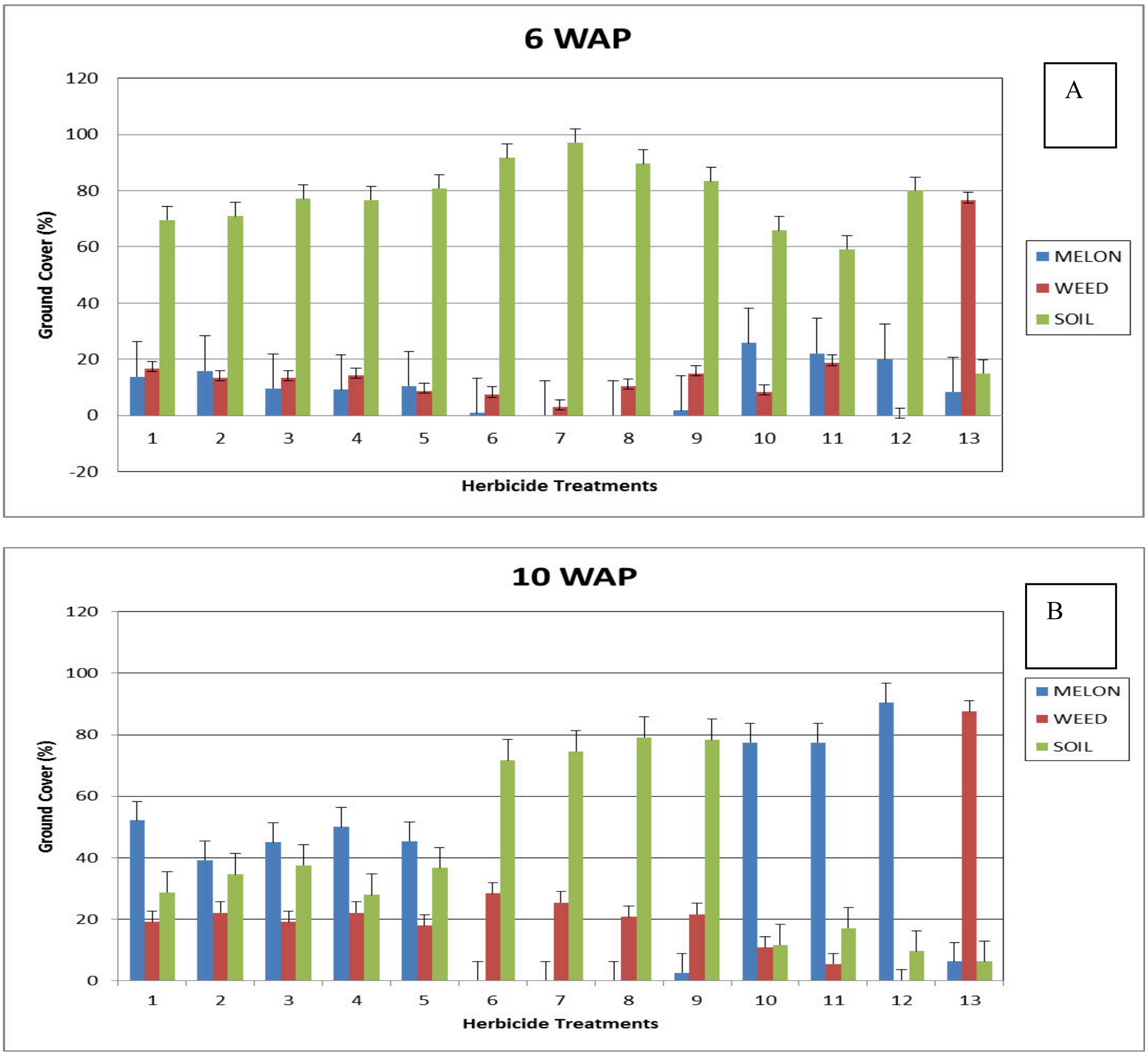

Figure 2: Percentage ground cover rate of melon and weed at (A), 6 WAP (B) and 10 WAP (Legend: Melon= melon ground cover, Weed =Weed ground cover and Soil = bare soil ground cover) (Herbicide Treatments: 1=Primextra-Gold (PmG) at 0.25k g ai/ha,; 2=PmG at 0.50kg ai/ha; 3= PmG at 0.75kg ai/ha; 4= PmG at 1.00kg ai/ha; 5= PmG at 1.250kg ai/ha; 6= PmG at 1.50kg ai/ha; 7= PmG at 1.98 kg ai/ha; 8= Raft at 2.00kg ai/ha; 9= ForceTop at 2.00kg ai/ha; 10=weed x1 (WAP); 11=weed x 2; 12=weed x 2 (3+6 WAP); 13=Unweeded check

3.4 Effect of herbicide on melon flowering

At 6WAP, hand weeded x 2 had a significantly higher flowering compared to the other treatments (Table 4). The lower rates of Primextra 0.25kg ai/ha, and 0.50kg ai/ha, weed x 2 and weed-free were superior in producing flowers compared to the rest of the treatments (Table 4). Herbicides rates of 1.50 and 1.98kg ai/ha of Primextra, and Raft and Force top at 2.0kg ai/ha each, did not flower, but this effect was not significantly different from Primextra rates of 0.75 to 1.25kg ai/ha. Similarly at 10WAP, flowering superiority was in this order weed x 2 (15.53%) > weed x1(12.22%) > Primextra at 0.25kg ai/ha (9.55%) > weedfree (6.65 %). Except for Primextra at 0.25kg ai/ha, the herbicide rates did not differ in their effect on flowering. Also except weed x2, the weeded treatments did not differ significantly (Table 4).

Table 4: Effect of treatments on melon flowering

Herbicide treatments	Melon Flowering rate (%)	
	6WAP	**10 WAP**
Pm x-0.25 kg ai/ha	8.88^{ab}	9.55^{abc}
Pmx 0.50 kg ai/ha	7.99^{ab}	4.22^{cd}
Pmx 0.75 kg ai/ha	3.11^{bc}	3.33^{cd}
Pmx 1.00 kg ai/ha	2.67^{bc}	2.89^{d}
Pmx 1.25 kg ai/ha	2.22^{bc}	1.77^{d}
Pmx 1.50 kg ai/ha	0^{c}	0^{d}
Pmx 1.98kg ai/ha	0^{c}	0^{d}
Raft 2.0 kg ai/ha	0^{c}	0^{d}
Force top 2.0 kg ai/ha	0^{c}	0.89^{d}
Weed x1 at 3wap	4.22^{bc}	12.22^{ab}
Weed x2 at 3&6wap	12.0^{a}	15.55^{a}
Weed free	6.66^{abc}	6.65^{bcd}
Unweeded check	5.33^{bc}	5.33^{cd}
LSD (@5%)	**5.88**	**5.87**
P-value	0.0029	<.0001

Means followed by the same alphabet are not significantly different at 5% level of probability according to Duncan Multiple Range Test

3.5 Effect of treatments on melon fruit number, fruit, and vine and seed weight

Melon fruit number per hectare for weed x 2 and weedfree treatments (approximately 28,000 fruits /ha) were significantly higher than that of weed x 1 (17,700 fruits /ha), unweeded check (3,300 fruits /ha) and the herbicide treatments (with approximately 0 to 7,400 fruit/ha) except Primextra rate at 0.25 kg/ha (with about 19, 600 fruits /ha). Primextra at 0.25 kg ai/ha had a higher fruits number (19,600 fruits/ha) than hand weed x 1 treatment (17,700) and Primextra at 0.5kg ai/ha (15,556 fruits/ha) but the differences were not significant. Primextra rates of 0.75kg ai/ha to 1.98 kg ai/ha, Raft at 2.0 kg ai/ha and ForceTop at 2.0kg ai/ha did not differ significantly on their effect on melon fruit number (Table 5). Melon vine weight was highest with the hand weed x 2 treatment (290,200kg/ha), and lowest with the unweeded check (111,111kg/ha). The three hand weeded treatments did not differ significantly from the unweeded check on their effect on melon vine weight. Similarly the herbicide treatments did not differ significantly on their effect on melon vine weight; however, at higher rates of herbicides, vine weight was completely reduced or lost (Table 5). In terms of fruit weight the weedfree (5370 kg /ha) treatment was significantly higher than all the treatments except weed x 1 (3981 kg/ha) and weed x 2 (3333 kg/ha). There were complete loss of fruit weight with primextra at 1.98kg ai/ha, and Raft at 2.0kg ai/ha (Table 5). Fruit weight did not differ significantly between the herbicide treatments and the unweeded check but primextra rates at 1.00kg/ha, 0.25 kg/ha and 0.50kg ai/ha had the highest fruit weight among the herbicide treatments in that order (Table 5). Melon seed weight followed the same trend as the fruit weight. Seed weight, was highest with the weedfree treatment (130.59 kg/ha), and this was significantly different from all the other treatments except at weed x 1(99.7 kg /ha). The effect of hand weed x 1 and weed x 2 on melon seed weight was similar. However, seed weight in weed x 2 treatment though higher than most of the herbicide treatment, the differences were not significant (Figure 3). Melon seed weight did not differ significantly among the herbicide treatments and between the herbicide treatments and the unweeded check. Primextra rates of 0.25 kg /ha, 0.5 kg/ha and 1.0 kg /ha had higher melon seed weight compared to the other herbicide rates (Figure 3). The lowest value of seed weight was recorded at 1.98kg ai/ha rate of Primextra and Raft at 2.0 kg ai/ha

Table 5: Effect of treatment on melon fruit number, fruit, and vine and seed weight

Treatment	Fruit no./ha	Vine weight (kg/ha)	Fruit weight (kg/ha)
Pm x-0.25 kg ai/ha	19630^{ab}	129629^{abc}	2444^{bcd}
Pmx 0.50 kg ai/ha	1556^{bc}	185185^{abc}	2370^{bcde}
Pmx 0.75 kg ai/ha	6296^{cd}	166666^{abc}	814de
Pmx 1.00 kg ai/ha	7407^{cd}	92592^{abc}	2519^{bcd}
Pmx 1.25 kg ai/ha	4074^{d}	37037^{bc}	1556^{cde}
Pmx 1.50 kg ai/ha	2222^{d}	74074^{bc}	926de
Pmx 1.98kg ai/ha	0^{d}	0^{c}	0^{e}
Raft 2.0 kg ai/ha	0^{d}	0^{c}	0^{e}
Force top 2.0 kg ai/ha	1481^{d}	148148^{abc}	444de
Weed x1 at 3wap	17778^{b}	222222^{ab}	3981^{ab}
Weed x2 at 3&6wap	28148^{a}	296296^{a}	3333^{abc}
Weed free	28148^{a}	240740^{ab}	5370^{a}
Unweeded check	3333^{d}	111111^{abc}	370de
LSD (@5%)	**9473**	**181965**	**2084.7**
***P*-value**	**< 0001**	**0.0530**	**0.0002**

Means followed by the same alphabet are not significantly different at 5% level of probability according to Duncan Multiple Range Test

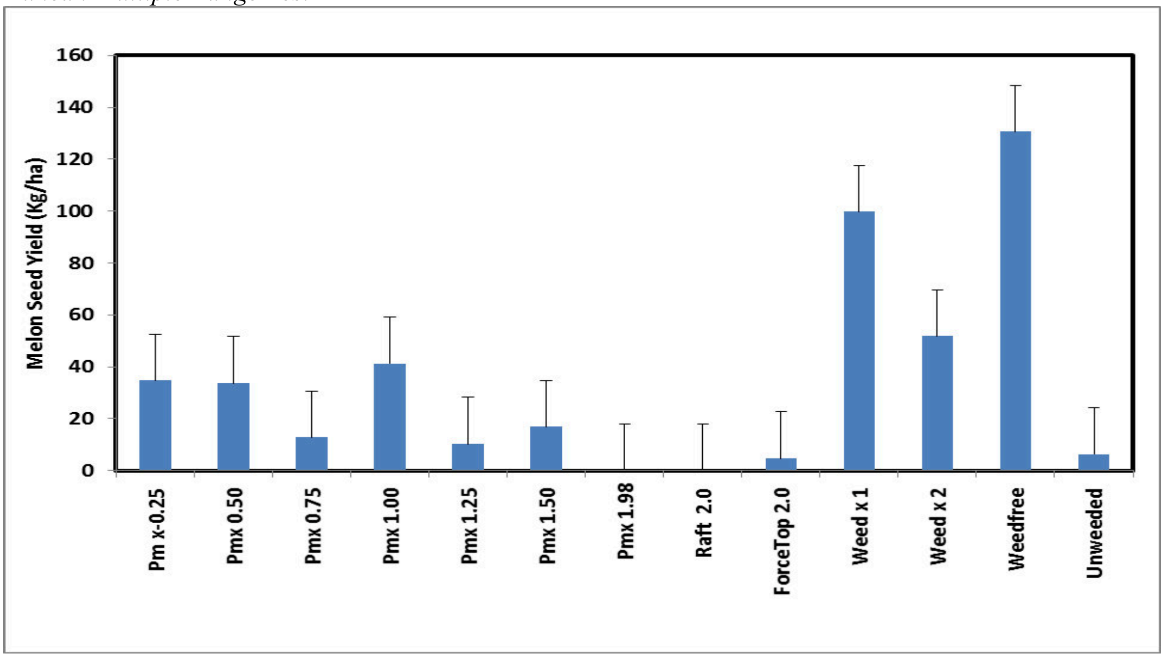

Fig 4: Effect of treatment on melon seed yield (Error bars are standard of the mean)

4.0 DISCUSSION

Melon emergence and seedling height were recorded in other to assess melon mortality due herbicide effect or toxicity. Melon seedling height/vine length determined showed that melon tolerate rates of Primextra up to 1.25 kg ai/ha. While the herbicide treatments had between 31% to 100% mortality depending on rate of the herbicide applied, the hand weeded treatments recorded between 19% and 60% mortality at the same periods. Melon mortality was significantly lower in the three hand weeded treatments compared to all rates of herbicides. Melon was sensitive to all rates of the Primextra and the other herbicides. However, rates higher than 1.25 kg ai/ha were completely phytotoxic to the melon. At this rate of usage melon may require a waiting period after application, before planting. This result may confirm the reports of Ekpo et al. (2010), that good emergence and ground cover of melon was achieved in plots treated with Primextra 10 days after planting.

The effect of Primextra rates on weed density especially with the lower rates of application have demonstrated that the herbicide even at the lower rates still offers some level of weed control. This result confirms the efficacy of herbicides in reducing weed density and biomass by other researches (Chikoye et al., 2001).This may however, explain some of the variable effects observed with the unweeded check plot with respect to yield components of melon when compared to Primextra treated plots. Hence, the observed lower fruit number, melon fruit weight and seed yield of melon in the unweeded check when compared to Primextra treated plots at lower rate and also weed x1 weed x2 and weedfree may be attributed to weed competition. This result confirms the general effect of weed competition on crop yield and various researchers had reported this (Chikoye et, al 2004; Udensi et al 1999). Apart from the weedfree treatment, weed x 2 treatment had lower weed density and biomass comparable with the herbicide treatments; this could be as a result of the melon cover which complemented the weeding. The efficiency of *egusi*-melon and other leguminous cover crops in weed suppression in various cropping systems have been reported by Ashokan *et al*.(1981), Wahua (1985), Obiefuna (1989), Akobundu *et al.* 2000 and Akinyemi and Tijani-Eniola (2001). Therefore our result may have been a contribution from melon weed suppression ability as reported by previous researchers (Wahua 1985; Obiefuna 1989; Akobundu *et al.* 2000).

At 6 WAP ≤ 20% melon and weed cover were observed especially with the lower rates of herbicides and weeded treatments. Melon ground cover by 10 WAP was ≥ 50 % while weed cover was ≥ 20 % for rates of Primextra between 0.25 and 1.25 kg ai/ha. High rates of herbicides 1.50 to 2.0 kg ai/ha had ≤ 30 % weed cover and ≥1 % melon cover. The three hand weeded treatments had ≥ 80 % melon cover and < 20 % weed cover. The unweeded check had the lowest melon cover ≤ 10 % and weed cover ≥ 80 %

At all the sampling periods melon never got up to 100 % covering, meaning that the higher rates of Primextra (probably from 1 to 1.50 kg ai/ha) may slow or inhibit growth initially, but the plant may survive.

Melon fruit number were higher at lower rates of Primextra and the hand weeded plots, the lowest rate was recorded at Primextra at 1.98kg ai/ha, Raft 2.0kg ai/ha. . However, the low vine and fruit weights observed with higher rate of primextra in this study have also been reported for similar trial that looked at the effect of timing of melon planting after application of primextra (Boa, 2012). In terms of fruit weight weedfree plot had the highest number, which did not differ significantly with the hand weeded plots (weed x1 and weed x 2), and with the lower rates of Primextra . Weed free plots had the highest number of fruit and seed weight which did not differ significantly from the weed x1 and weed x 2. The lower rate of Primextra did not differ significantly on their effect. However, the herbicides used in this study especially at higher rates produced both lower fruit and seed weights. This result show that the higher rates of the herbicides used in this study may not be appropriate for application as pre-emergence immediately after planting melon, but may require a waiting period between application and planting. Melon is likely to tolerate lower rates of these herbicides (0.25 to about 1.00 kg/ha) (Stephenson et al 1988).

5.0 CONCLUSION

The result of this study showed that Primextra rates had significant effect on melon and weeds. Lower rates of Primextra used in this study had good melon establishment resulting in good ground cover and high flowering. However, the weeded once and unweeded treatments and lower Primextra rates 0.25 kg ai/ha to 0.5 kg ai/ha had little or no lasting effect on weeds especially late emerging weeds, and hence did not result in efficient weed control. The import of the present study is that farmers can comfortably relay melon into maize or any piece of land treated with Primextra and the other herbicides at rates ≥ 1.0 kg ai/ha but not exceeding 1.5 kg ai/ha at about 10 days after application. Similarly, if there are no alternatives herbicides, other than Primextra, farmers can intercrop melon with maize or any other crops that will require the use of Primextra for pre-emergence weed control at a rate of application not exceeding 0.30 kg /ha of Primextra. The present findings may or may not be limited to the agro-ecological characteristics of the study site, so it is recommended for further evaluation in different agro-ecologies. The importance of this study is that farmers can comfortably cultivate melon using the lower rates of Primextra and can also intercrop maize and melon using the lower rates of Primextra gold. Where the use of herbicide is not affordable or available farmers can use good land preparation followed by one weeding.

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