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Effect of Mexican Sunflower (*Tithonia diversifolia* (Helms) A. Gray) Interference in the Performance of Melon (*Citrulus lanatus* Thumb. Mansfd)

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Abstract: Good weed management strategy is based on good understanding of the intricate interactions involved in weed-crop association. Based on this assertion, field experiments were conducted to study the interference effect of *Tithonia diversifolia* on melon. Ten treatments were investigated in a randomized complete block experiment (RCBD) with three replications. Result showed that *Tithonia* interference reduced melon growth significantly (p = 0.05) with increasing length of interference. *Tithonia* interference in melon for smore than 4 weeks after planting (WAP) was as bad as not weeding at all while interference free period of not more than 2 WAP was equally inadequate and produced plants that were as stunted as those not weeded at all. Melon seed yield was significantly better when exposed to a minimum of 4 WAP *Tithonia* interference free period or a maximum of 2 WAP *Tithonia* interference than other treatments (p = 0.05). Highest seed yield (2825 kg ha^{-1}) was produced by melon plants exposed only 2 WAP interference. However plot with the highest yield was not statistically significant to yield from melon plot with at least 6 weeks of initial weed freeness and the control plot (240, 2646 and 2627 kg ha^{-1}, respectively) and for weed free melon plots of 6 and 8 weeks, respectively. Onset of crop/weed interaction affected both the dry matter and plant density of *Tithonia* significantly (p = 0.05). These parameters decreased with increased delay in the onset of crop/weed interaction. The implication of these findings is discussed.

Key words: Sunflower, effect, melon, performance, strategy

INTRODUCTION

Melon (*Citrulus lanatus*) Thunb., a member of the family Curcubitacea and a low growing crop is an important crop in Nigerian agriculture. Melon is grown in mixture with crops like maize, okra, yam and cassava and can also be grown as a sloe crop in Nigeria by farmers to increase their income[1]. The popularity of melon centres on its nutritious seeds which is highly valued in cookery[2]. The highly nutritious seeds containing 46% oil and 36% protein[3,4]; is eaten as soup condiments and fried cake. Melon plant, due to its characteristic spreading nature, had been investigated by various workers for biological weed control in other crops and crop mixtures[1]. The positive results from such investigations coupled with good yield, even under relatively harsh environmental conditions including low soil fertility and harsh weather had further enhanced melon popularity.

Unfortunately, the spreading pattern of growth of melon has more often than not been mistaken by farmers for superiority in all weed situations. However, it has been posited that for melon to perform very well and successfully control weed in other crops, it should be given a head start ahead of weeds on such plots[3]. Since weeds vary in growth habits and effects on crop and weed situations also vary from place to place[5], it is expected that practices that favour crops' growth will vary from place to place and with weed(s) encountered.

In Nigeria, *Tithonia diversifolia*, a member of the family Asteraceae has become of significant agronomic importance and its moving toward becoming a noxious weed. Growing predominantly in the south western Nigeria and found almost throughout the country[6]. *Tithonia* out-competes most crops by virtue of its rapid growth rate.

Due to paucity of information in on the effect of *Tithonia diversifolia* and most arable crops most especially melon, this research becomes more imperative since a clear understanding of weed-crop interaction is very essential for effective weed control in crop production. The threatening nature of the weed calls for a thorough understanding of the weed-crop interaction. The main objective of this work therefore is to ascertain the effects *Tithonia diversifolia* interference on the performance of melon with a view to mapping out an effective control strategy.

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Table 1: List of treatments

Treatment symbol	Treatment definition
T_1	*Tithonia* infestation free condition for the first 2 weeks after planting (WAP) followed by infestation to harvesting
T_2	*Tithonia* infestation-free condition for the first 4 WAP followed by infestion to harvesting
T_3	*Tithonia* infestation-free condition for the first 6 WAP followed by infestation till harvesting
T_4	*Tithonia* infestation free condition for the first 8 WAP followed by infestation till harvesting.
T_5	*Tithonia* infestation-free from planting to harvesting
T_6	*Tithonia* infestation for the first 2 WAP followed by clean weeding till harvesting.
T_7	*Tithonia* infestation for the first 4 WAP followed by clean weeding till harvesting.
T_8	*Tithonia* infestation for the first 6 WAP followed by clean weeding till harvesting.
T_9	*Tithonia* infestation for the first 8WAP followed by clean weeding till harvesting.
T_{10}	*Tithonia* infestation throughout plant life.

MATERIALS AND METHODS

Field experiments were carried out during the rainy seasons of 2000 and 2001 at the Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso. (8° 10'N and 40° 10'E), Nigeria. On the experimental site, *Tithonia diversifolia* dominated the field and this plant accounted for more than 90% of the total weed population of the plot. Other weeds present were *Imperata cylindrical*, *Cyperus* sp. and *Mariscus* sp.

The experimental soil was sandy loam with a pH of 6.4. Nitrogen (N) and potassium (K) contents were 0.31% and 0.38 meq 100 g^{-1}, respectively. The available phosphorus (P) content of the soil was 6.38 ppm. The mean annual rainfall over the two years was 1623 mm while the mean monthly temperature was 26.6°C.

The experimental plot measured 19×27 m and consisted of three replicates each of ten treatments in a randomized complete block arrangement. Each block measure 19×9 m and were separated by an alley of 1.5 m. The treatment plot size was 3×4 m.

The soil was disc ploughed twice and harrowed before lay-out was carried out. Ploughing was done immediately after land preparation on the 18th of June and 3rd of July respectively for 2000 and 2001 trials. The experiment treatments are listed in Table 1. Melon seeds, (the local black-edge variety) were obtained from the National Horticultural Research Institute (NIHORT), Ibadan, Nigeria and were planted at a spacing of 1×1 m. Three seeds were planted/hill and these were thinned to 2 plants/hill after 10 days to give a plant population of 20,000 plants ha^{-1}. Melon seedling were treated with insecticide (Cypermethrim) from 10-25 days after planting (DAP) against *Epilachna* sp. attack.

Weed free condition on the plots was achieved by weekly land-hoeing the plots[7], starting from 1 week after planting (WAP). Weeds other than *Tithonia* on the crop-weed mixtures were roughed weekly to allow for a virtually pure Crop-*Tithonia* competition. The weedy control was never weeded after land preparation.

Data were collected for vine length using the meter rule and leaf area[8]. Number of branches and leaves and plants population at 1st weeding and flowering were also measured by physical counting. Total number of fruits (pod) per plant was counted. The pod diameter was measured using a rope and ruler to obtain the circumference of the pod and then deducing the diameter from the formula:

$$\pi D = O_{ce} \quad (6)$$

Where: $\pi = 3.14$

D = Diameter

O_{ce} = Circumference

The number of melon seeds/pod was counted and weighed and sundried seeds were measured. *Tithonia* weed density per 0.25 m^2 quadrat was assessed by physical counting at flowering and the dry matter yield was determined using the oven drying method. Melon data over the two years were subjected to the statistical analysis. Analysis of variance was carried out and means were compared using the Least Significant Difference (LSD) at 5% level of probability.

RESULTS

The effects of *Tithonia* interference on the growth of melon is presented in Table 2. *Tithonia* interference affected melon growth significantly ($p = 0.05$). All the growth parameters of melon measured were significantly influenced by the duration of interference. The number of branches, vine length and leaf area of melon increased with decreasing period of weed interference up to infestation for only the first 2 WAP. Treatment 2 (T_2) Treatment 6 (T_6) were similar in these attributes and were statistically significantly ($p = 0.05$) (Table 2). *Tithonia* interference for more than 4 WAP (T_7) led to a significant reduction in number of leaves, vine length and number of branches per plants as well as leaf area. Similarly, beyond 4 WAP, *Tithonia* interference led to a drastic reduction in plant population.

In summary, *Tithonia* infestation for more than 4 WAP in melon was as bad as not weeding at all since there were no significant differences ($p = 0.05$) in the growth of melon so infested and the weedy control plot. Melon plot kept free for only 2 weeks (T_1) was equally as bad as the weedy check plot.

Table 2: Effects of *Tithonia* interference on the growth parameters of melon

Treatment	No of leaves per plant	No of branches per plant	Vine length cm	Leaf area cm^2	Melon stand count at flowering
T_1	169.9	9.40	157.60	32.20	91.80
T_2	220.6	15.10	164.41	34.90	98.50
T_3	253.5	18.70	191.90	34.90	99.30
T_4	251.9	20.00	152.20	43.20	99.30
T_5	280.2	22.00	157.00	51.10	98.30
T_6	279.5	21.80	154.60	51.10	97.00
T_7	201.2	15.50	146.20	42.20	83.40
T_8	48.8	3.60	87.30	28.80	47.80
T_9	31.4	2.00	78.60	25.80	49.50
T_{10}	33.8	3.30	63.50	20.00	43.30
LSD (5%)	28.6	27.41	10.40	9.94	8.48

Table 3: Effects of *Tithonia* interference on the yield of melon

Treatment	No of leaves per plant	No of branches per plant	Vine length cm	Leaf area cm^2	Melon stand count at flowering
T_1	1.50	5.30	37.50	5.70	667.00
T_2	1.60	8.70	40.30	6.90	860.00
T_3	1.80	10.40	55.00	12.50	2402.00
T_4	1.90	10.70	58.40	13.20	2646.00
T_5	2.00	10.40	65.30	14.60	2627.00
T_6	1.80	10.20	63.30	14.20	2825.00
T_7	1.50	6.30	50.60	7.50	885.00
T_8	1.20	2.00	14.30	1.10	95.00
T_9	1.10	1.70	11.30	0.70	21.00
T_{10}	1.10	1.60	11.40	0.40	04.00
LSD (5%)	0.23	2.44	13.12	3.84	224.80

Table 4: Effect of onset crop/weed interaction on *Tithonia* density and dry matter yield

Treatment	*Tithonia* density/m^2	*Tithonia* dry matter yield
W1	73	3.29
W2	47	1.25
W3	50	0.46
W4	31	0.15
W5	82	3.59
LSD (5%)	4.57	0.89

Key: W1-weed/crop interaction from 2WAP, W2-weed/crop interaction from 4 WAP, W3-weed/crop interaction from 6 WAP, W4-weed/crop interaction from 8 WAP, W5-weed/crop interaction for life

In Table 3 the interference of *Tithonia* is also highly significant on the yield and yield attributes of melon ($p = 0.05$). The number of melon fruits produced per plant as well as the fruit size (diameter) were significantly affected by duration of *Tithonia* interference ($p = 0.05$). the size and number of fruits produced when melon was weed free for at least 4 WAP (T_2 and above) or weedy for at most 2 WAP (T_6) were similar and it was statistically significant ($p = 0.05$) and these were better than those of plots kept weed-free for only 2 WAP (T_1) and those infested for up to 4 WAP (T_7) (Table 3. Melon yield from T_1 plots and T_7 plots were comparable and were better than those of kept weedy for 6 WAP and above (T_8-T_{10}) and is highly significantly ($p = 0.05$). Melon plants infested by *Tithonia* for up to 6 WAP had yields as those not weeded at all.

Seed yield of melon was also affected by *Tithonia* interference (Table 3). Seed increased with increasing period of weed-free. There were no significant differences between the seed yield and yield attributes of melon exposed to at least 6 weeks of weed freeness or at most 2 weeks of *Tithonia* interference after planting (T_3,T_4 and T_6) and the control (T_5) ($p = 0.05$). Both the seed weight and number of melon seeds per pod were significantly better when the melon plants void of *Tithonia* infestation for at least 6 weeks or at most 2 weeks of *Tithonia* interference than all other treatments. However, seed yield from melon exposed to only 2 and 4 weeks or weed freeness (T_1 and T_2) and those exposed to 4 weeks of *Tithonia* interference (T_7) were not significantly ($p = 0.05$) different but were superior to those exposed to *Tithonia* interference for 6 weeks and above (T_8-T_{10}). Seed yield of melon exposed to interference for up to 6 weeks and above were not different from those of weedy check.

Tithonia dry matter and density were significantly affected by the onset of weed crop interaction (Table 4). *Tithonia* density and dry matter yield decreased with increasing age of the crop at onset of weed/crop interaction. The dry matter yield of the weed on plots that were weed-free for only 2 WAP was not significantly difference from those of the weedy control ($p = 0.05$).

DISCUSSION

The performance of melon plants was better on plots that were m inimally exposed to *Tithonia* interference than those exposed to prolonged interference due to shorter exposure of the plants to the detrimental effects of the weed on the crop. A low growing crop, melon is completely overshadowed by aggressive large and close canopy forming plants such as *Tithonia,* thereby

reducing the photosynthetic activities of the crop and hence stunted growth. It has been reported that when melon is growing with erect crops, its performance is reduced[5]. This is an indication to melon's abhorrence for shade as in the case in this experiment. As the age of crop at the onset of crop/weed competition increased, *Tithonia* weed density and dry matter yield reduced due to drastic reduction in seedling recruitment capability of *Tithonia* weed. Increasing age of crop at the onset of weed/crop interaction allows for canopy formation in melon which tends to reduce emergence of weed seedling and intercepts insolation necessary for weeds photosynthetic activities[9, 10]. This finding is congruent to what has been reported that though melon, being a cover crop, could be used as a smother plant for weed control, an initial weed-free period of between 3-4 WAP is essential to give the crop an advantage over the weed[3]. Thus, melon plants that were weed free for at least 6 WAP were as good as those that were weed free for life in this experiment. While those with shorter weed free period were generally poor both in growth and yield.

In summary, it could be deduced from this experiment that *Tithonia* is very debilitating to melon performance if not controlled promptly. Thus, from the results of this experiment, in line with earlier reports of other scientists, the critical periods for *Tithonia* removal in melon is 3-4 weeks after planting (WAP)[3]. Giving a good land preparation, one weeding at 3 WAP will be adequate to guarantee at least 5 weeks of weed free growth for melon growing on plots infested by *Tithonia diversifolia*.

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