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Influence of Metolachlor on Physiological Growth Character of Tomato (*Lycopersicon esculentum* L.)

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Abstract

A field trial was carried out to investigate the effects of various concentrations (0, 1, 2, 3kg.a.i/ha) of metolachlor on physiological growth character of tomato. Results of this study showed that weeds were decreased in proportion to applied concentration of metolachlor. Metolachlor at 3kga.i/ha did not improve physiological growth character of tomato in spite of effective weed reduction. Tomato leaf area ratio (LAR) declination with age was higher in the plots sprayed with metolachlor at 1-2kg.a.i /ha than those obtained in the weedy control plots. The relative growth rate (RGR) and net assimilation rate (NAR) of tomato in the weedy control plots were adversely affected as from 6th week after transplanting .This period coincides with high weed density. However, the relative growth rate (RGR) and net assimilation rate (NAR) of tomato in plots sprayed with metholachlor at 1-2kg.a.i/ha showed vigorous growth till 7th week after transplanting(WAT) before showing declination. These results suggest that metolachlor at 1-2kg.a.i/ha could be an effective and safe herbicide for application in transplanted tomato.

Key words: Tomato, *Lycopersicon esculentum*, weed, metolachlor.

Introduction

Tomato, *Lycopersicon esculentum* L., is an important vegetable crop with edible fruit commonly grown in the tropics. It has a variety of uses such as serving as condiments for stew baking of bread as well as sources of vitamins A and C (Ayodele, 1976). It can also be processed into canned tomato soup, sauce and paste (Atherton and Rudich, 1986). Weed interference has been reported to exert a considerable influence on tomato growth. Weaver and Tan (1983) reported that weed interference decreased tomato yield and this reduction in yield was apparent if weeds were allowed to remain in the crop longer than 25 days after transplanting. Akobundu (1987) observed that weeding frequency is high in tomato production. This is because the plant does not develop crop canopy that effectively shades the ground

at any stage in its life cycle. Most popular method of weed control in this crop throughout the tropics is manual weeding. This is because the process is simple and the farm size is small (Akobundu, 1987). However, hand weeding becomes obviously tedious where large acreage is cultivated. Usoroh (1988) observed that in reducing drudgery normally associated with manual weeding and yield loss due to weed competition, chemical weed control via herbicides become imperative to enable the crop to attain its growth potential.

In arable crop setting many growth rate studies have been carried out to evaluate the performance of various test crops. Adelana (1976) used net assimilation rate (NAR), crop growth rate (CGR) and relative growth rate (RGR) to determine the growth rate of tomatoes under staked and unstaked control treatments. Also, Adeyemi (1999) used leaf area index (LAR), leaf area ratio (LAR) and relative growth rate (RGR) to evaluate the growth rate of cacao seedlings under different weed control treatments.

This study was designed to investigate the growth rate of tomato under selective soil applied herbicide metolachlor using weed flora present on the field of study. It is expected that knowledge of growth rate under chemical weed control treatment can be an important and helpful guide in determining the herbicide concentration that will be effective in weed control and safe for tomato.

Materials and Methods

Seeds of *Lycopersicon esculentum* (var.Roma) were obtained from seed unit of Kwara Agricultural Development Project (KWADP) in August 2000. The seeds were spread on a tray to identify and remove foreign particles. Thereafter, the seeds were packed in paper envelope and stored at room temperature (24-27^{O}C) until they were used for the study.

Experimental layout

Field experiment was conducted on sandy soil at Shao, Kwara State (8^0 3^{11}N, 4^0 4^{11}E) between themonths of September and December, 2000. A plot size of 7m by 6m^2 was used. The plot consisted of 4 rows having sub plots, each size of 3m^2 with approximately 0.3m in between row spacing. These subplots were of randomised block design where treatments were allotted randomly with five replicates.

Spraying Technique

Three different levels of 1, 2, and 3kg.a.i/ha of metolachlor and no herbicide treatment control were studied. The various herbicide concentrations were sprayed using knapsack sprayer using time volume method.

Field plating

Tomato seedlings of uniform size previously raised in the nursery were transplanted on the field when they were

three- week-old, at spacing 0.6m between and within the subplot of $3m^2$thus producig twelve seedlings of tomato per subplot vo. Metolachlor was applied as pre-transplanting with knapsack of 20litres capacity, calibrated to deliver a spray lume o f 166L/ha following procedure explained in the spraying technique. No weeding was carried out in the weedy control plot, i.e 0kg/ha, thereby subjecting the seedlings in this treatment to weedy condition throughout the period of the investigation. Diseases and pests were controlled by treating the seeds with Apron Plus 50SD (10% metalaxy, 6%carboxin and 34%furothiocarb) at the rate of 2.5g/500gseeds). The field was fertilized with NPK 20-10-10 applied at the rate of 60kg/ha three weeks after transplanting. Each sub plot was manually irrigated with 20 litres of water at three day intervals throughout the dry season to maintain normal crop growth.

Weed count (density) was carried out using 0.5x $0.5m^2$ quadrat. All weeds rooted within $0.25m^2$ quadrat position adjacent to the crop plant were taken at weekly interval for weed density estimation. Five tomato plants were harvested at soil level for above ground dry matter determination at weekly interval over nine weeks period per treatment .Tomato leaves, stems and fruit were harvested and oven dried at 80^oC to constant weight. Leaf area was determined using graphical method.

Growth analysis of tomato plants was estimated from the primary data of leaf area and dry matter accumulation using various formulae for growth analysis.

Leaf area ratio was calculated using the method of Adeyemi, (1999), and Abayomi and Adedoyin (2004) as,

LAR =Leaf area/Shoot dry weight

Relative growth rate was estimated as,

$RGR = LogeW_1\text{-}logeW_2/t_2\text{-}t$

While net assimilation rate (NAR) was estimated using the formula of Evan (1972), Abayomi and Adedoyin (2004) as,

$NAR= (W_2\text{-}W_1)(\log_e l_2\text{-}\log_e L_1)/(L_2\text{-}L_1)(t_2\text{-}t_1)$

Where W_1 is the initial and W_2 is the final (dry) weights of the plant shoot;

L_1 and L_2 are the leaf area at t_1 and t_2;

t_1 and t_2 are time interval at which the observation were made.

Results and Discussion

Weed density

The results of this study have shown that there was low weed infestation about ($130.4n/m^2$) with low number of

weeds emerging per unit area (Figure 1). This could be due to severe drought condition during the period of the experiment which delayed weed emergence and initial tomato growth (LNRB 2000). The number of weeds emerging per unit area in transplanted tomato field was reduced in proportion to the applied concentration of the herbicide sprayed plots compared with weedy control plots (Figure 1). Most effective weed control was given by metolachlor at 2-3kg/ha (Akobundu1987, Kristen *et al*. 2004). Considering the weed species that were encountered in this study, P*anicum laxum, Rhychelytrum repens* and *Tridax procumbens* were effectively controlled by metolachlor 2-3kg.a.i./ ha. However, the herbicide is less effective against *Imperata cylindrical, Sesamum alatum* and seedling of *Hymnocardia acida* even at higher dose of 3kg.a.i/ha.

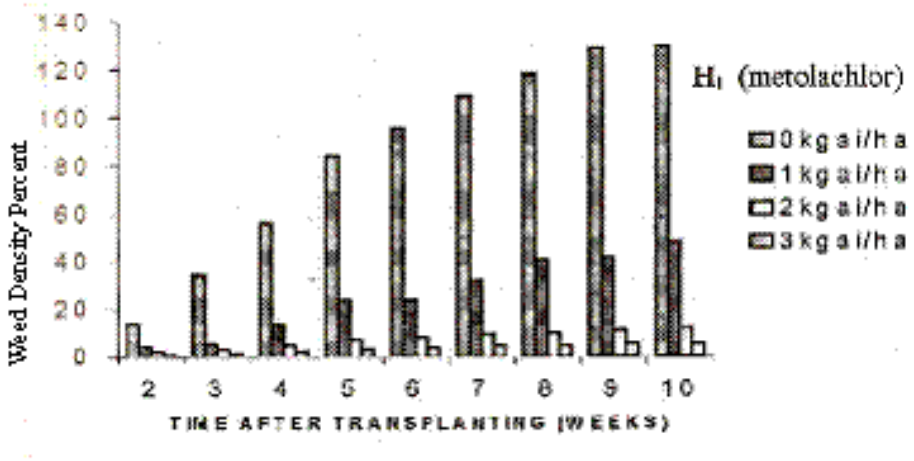

Figure 1: Effect of soil applied metolachlor on weed density in tomato (*Lycopersicon esculentum*).

Growth analysis

Leaf area ratio (LAR) generally declined with age of tomato plants after each rate attained its maximum peak (Figure 2).The decrease in leaf area ratio observed could be due to continuous increase in plant biomass without a corresponding increase in leaf area coupled with senescence and death of old leaves. This trend was observed to be lower in the weedy control plots or plots sprayed with metolachlor at 3kg.a.i/ha compared with plots sprayed with metolachlor at 1- 2kg.a.i/ha. A reduction in LAR with age has been observed as a feature in annual plants (Higgs and James 1969). Adelana (1976) and Adeyemi (1999) have reported similar observation in their studies of tomato (*Lycopersicon esculentum*) and cocoa seedlings (*Theobroma cacao*) respectively.

The relative growth rate and net assimilation rate (Figures 3 and 4) after each rate attained their respective peak followed trend similar to leaf area ratio. This further suggests that growth and development of tomato either gross or net of tomato plants under weedy control plots were adversely affected by weed infestation as from 6th week after transplanting when the weed interference was high. The increase in growth rate with age under the plots sprayed with metolachlor at 1-2kg.a.i/ha till 7th week after transplanting was because tomato plant is still showing vigorous growth when the leaf area and dry matter were still increasing as the plant size increases. The declination in RGR with age

could be attributed to the fall in leaf area ratio and net assimilation rate. Thus the yield per unit area showed a decrease with age after each rate attained its peak. The declination in NAR could be due to reduction in photosynthetic activity of the leaves as they become senescent and died. The findings were consistent with the results of studies carried out on *T. cacao* by Adeyemi (1999). It could therefore be concluded from this study that metolachlor at 1-2kg/ha could be considered effective and safe herbacide for application in tomato plots.

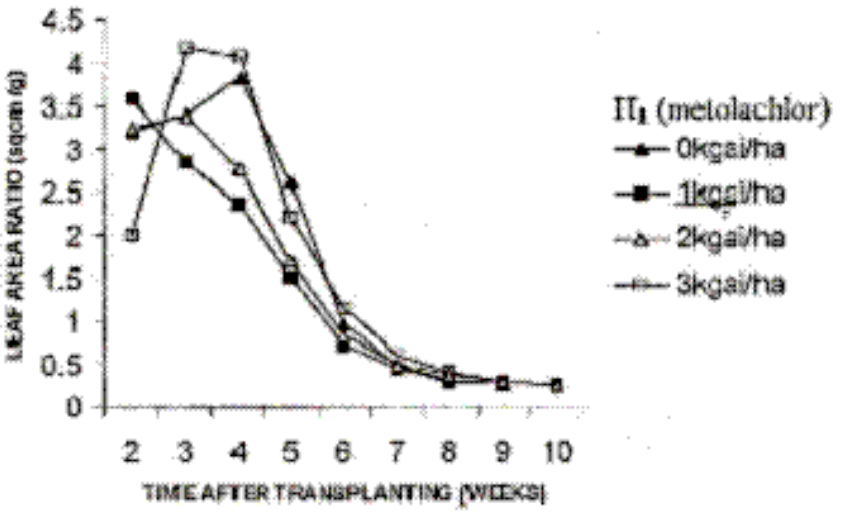

Figure 2: Effect of soil applied metolachlor on leaf area ratio of tomato (*Lycopersicon esculentum*).

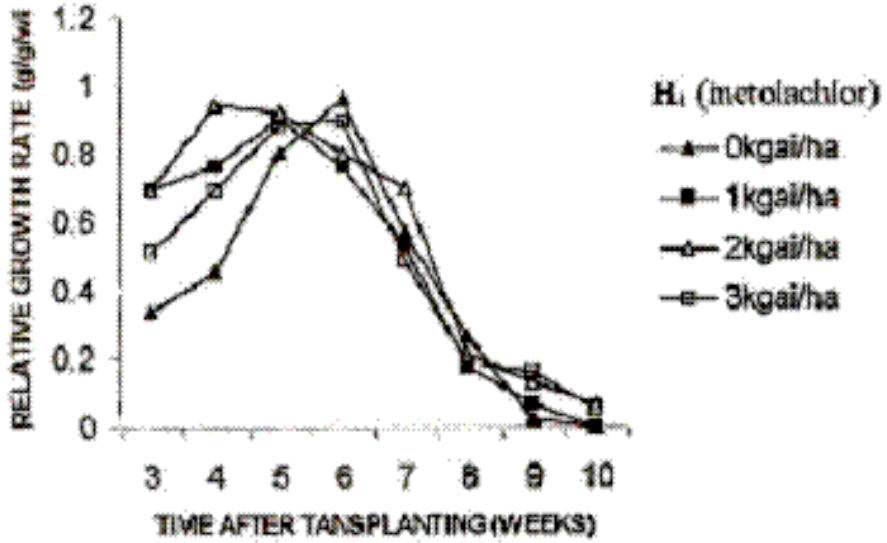

Figure 3: Effect of soil applied metolachlor on relative growth rate of tomato (*Lycopersicon esculentum*).

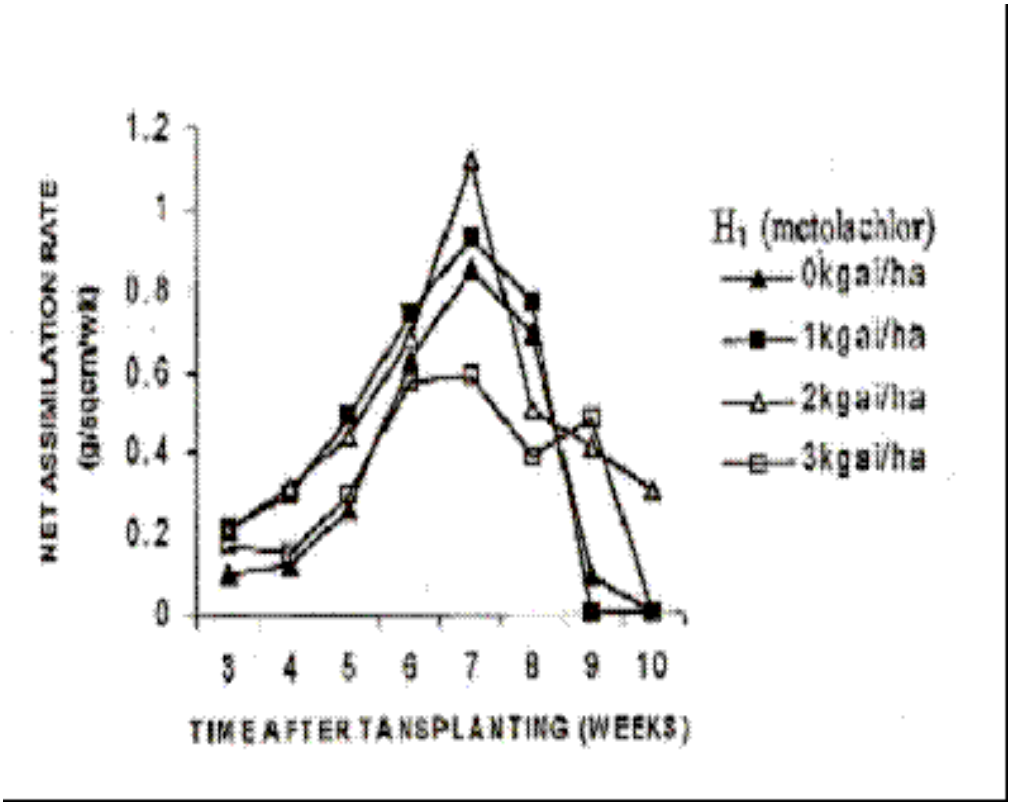

Figure 4: Effect of soil applied metolachlor on net assimilation rate of tomato (*Lycopersicon esculentum*).

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