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Sensitivity of tomato (*Lycopersicon esculentum*) to residual effects of Imazaquin (Scepter).

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ABSTRACT: Sensitivity of tomato (*Lycopersicon esculentum*) to Imazaquin (scepter) residue was investigated. Imazaquin which is an imidazolinone herbicide (2-(4,5 dihydro-4-methyl)-4-(1-methylethyl)-5-oxo-1H-imidazol-2yl)-3-quinone carboxylic acid) is one of the chemicals used in weed control in legume crops. Three concentrations (0.125, 0.250 and 0.375 kg/ha) of the herbicide were sprayed on 36 pots filled with loamy soil together with the control pots which were not sprayed with herbicide were left for different time intervals (4, 6 and 8 weeks) before tomato seeds were planted. Results obtained from this study revealed that none of the three concentrations of the herbicide used inhibited germination of tomato seeds in the time intervals. Stem height at 6 weeks after planting was better in herbicide concentration of 0.250 kg/ha in all the time intervals (31.33, 29.67 and 27.33 cm for 4, 6 and 8 weeks respectively, than in the control (30.33, 26.00 and 25.11 cm respectively) and least in concentration 0.375 kg/ha (22.33, 21.50 and 20.05 cm). At 12 weeks after planting, the stem height and fruit fresh weight per plant were better in concentration 0.250 kg/ha (20.23, 14.53, 7.16 g) for all the time intervals than the control (14.54, 11.49 and 4.55 g) and least in concentration 0.375 kg/ha (4.08, 3.36 and 1.81 g). Fruit number per plant was highest in control (1.78, 1.67 and 1.67) followed by concentration 0.250 kg/ha (1.67, 1.56 and 1.67) and least in concentration 0.375 kg/ha (1.22, 1.44 and 1.11).

Key Words: Tomato; *Lycopersicon esculentum*; Imazaquin; Imidazolinone herbicides.

Introduction

Tomato (*Lycopersicon esculentum*) belong to the family Solanaceae. It is one of the widely grown vegetables. The fruit is consumed fresh, sliced and used in the preparation of salads, milled and made into pastes and added to stews. It is grown today for its edible fruit (Kocchar, 1981).

There has been a longstanding interest in the commercial production of tomato into puree and associated products in Northern Nigeria (Jackson, 1971; Quinn, 1973). According to Jackson (1971) the practical problems of tomato production are primarily concerned with, among others, plant protection and crop density studies so as to suit the requirements and capabilities of the local growers.

Tomato growers have an array of management practices that can enable them to control unwanted vegetation in tomato fields. Good weed control is only achieved by a year-round programme which integrates various control techniques. Most herbicides used in tomatoes are effective only on germinating weed seeds. It is essential, therefore, to know what targets weeds are before planting the crop.

Imazaquin (Scepter) is a new selective herbicide for weed control in soybean, cowpeas, beans, peas, tobacco and coffee (Akobundu, 1987). It controls a broad spectrum of weeds and absorbed by both the foliage and roots and is translocated through the xylem to the other parts of the plant. Increase in soil acidity as well as dry soil conditions before and after soil application were reported to have increased soil adsorption of Imazaquin, thereby increasing its soil persistence (Loux and Reese, 1992). Imazaquin residue was found to have adverse effect on the height and weight of cabbage, lettuce, tomato, green pepper and onion planted during the following spring on a field previously sprayed with the herbicide (Arsenovic *et al*., 1992).

No information is available on the sensitivity of fruit vegetables like tomatoes to the residual effect of Imazaquin in Nigeria. The objective of this study is therefore (i) to investigate the residual effect of Imazaquin on germination, growth and fruit production of tomato (ii) to ascertain whether or not a particular plot on which the herbicide has been previously used could immediately be used to plant tomato, and (iii) to find out the persistence of Imazaquin in humid loamy soil using bioassay method.

Materials and Methods

This study was carried out between the months of May and August, 1999, at the Department of Biological Sciences, University of Ilorin, Ilorin. A set of 36 polybags (18 x 30 cm) were filled with well drained loamy soil. The soil-filled polybags were divided into 3 sets of 12 each and were watered thoroughly and allowed to stay overnight before spraying with Imazaquin (Scepter) to allow enough humid soil condition for herbicide activities.

Three concentrations of Imazaquin (0.125, 0.250 and 0.375 kg/ha) were sprayed on the soil in the polybags with each of the concentrations replicated three times in each of the three groups, while the control experiments received no herbicide spray. The sprayed experiments with the control were left for different time intervals (4, 6 and 8 weeks) before tomato seeds were planted and watered once daily. Seeds from local wrinkled type of tomato were used for this study. The following parameters were studied during the experimental period.

(i) *Germination Count*: This was done by direct counting of the number of seeds that germinated into seedlings out of twenty-five seeds sown into each polybag. The seedlings were later thinned down to 3 per pot four weeks after germination.

(ii) *Plant Height*: Average stem height of tomato plants were taken at 6 weeks after planting.

(iii) *Fruit Number*: Fruit number per plant was also taken and an average of 3 replicates was recorded 12 weeks after planting.

(iv) *Fruit Weight*: Fruit fresh weights were taken using an electric weighing balance.

(v) *Mean weights of tomato plants after fruit harvest*: Mean weights of both fresh and dry roots and shoots of tomato plants were taken 12 weeks after the fruit harvest.

Results

Seed Germination

There were no inhibitions of seed germination in all the three concentrations used in all the time intervals of 4, 6 and 8 weeks after herbicide application. There were no observable differences in the germination of tomato seeds between the control and treatment experiments as they all gave germination percentage ranging from 98 to 100 percent.

Seed Establishment

Seedlings of tomato were watched after seed germination for any possible phytotoxicity effect arising from Imazaquin residue. There were no death of the seedlings after germination, neither were there ny observed deformities in the shoot development of the tomato plants in all the concentrations and the time intervals.

Stem Height

Stem height at 6 weeks after planting was best in the plants treated with 0.25 kg/ha of Imazaquin in all the time intervals (Table 1). This was followed by the control experiments and least in the herbicide concentration of 0.375 kg/ha.

Table 1: Mean plant height of tomato 6 weeks after planting.

Time of planting after herbicide application	Concentration (kg/ha)	Mean Height
4 WAA	Control	30.33 ± 9.07
	0.125	29.67 ± 3.15
	0.250	31.33 ± 1.53
	0.375	22.33 ± 2.50
6 WAA	Control	26.00 ± 3.61
	0.125	20.33 ± 2.51
	0.250	29.67 ± 2.89
	0.375	21.50 ± 2.12
8 WAA	Control	25.11 ± 4.07
	0.125	24.11 ± 3.74
	0.250	27.33 ± 4.24
	0.375	20.05 ± 2.26

4 WAA – 4 Weeks after herbicide application; 6 WAA – 6 Weeks after herbicide application; 8 WAA – 8 Weeks after herbicide application;

Fruit number and fruit fresh weight

Fruit number was higher in the control than in the herbicide treatments in the tomato plants that were sown 4 and 6 weeks after herbicide application on the soil but the result was different in the tomato plants sown 8 weeks after herbicide application (Table 2) as the seed number in the control was only higher than the ones obtained in tomato plants treated with herbicide concentrations of 0.375 kg/ha, but not in 0.25 kg/ha.

Fruit fresh weights per plant were higher in tomato plants with herbicide concentration of 0.25 kg/ha in all time intervals than the control and other herbicide treatments (Table 2).

Mean weights of harvested tomato plants at 12 weeks after planting

Higher fresh and dry weights of both shoot and roots of tomato taken after fruit harvest (12 weeks after planting) were obtained in plants treated with herbicide concentration of 0.25 kg/ha in all the time intervals. This was followed by the control experiment and least in a higher concentration of 0.375 kg/ha (Table 3).

Table 2: Effect of herbicide concentrations on fruit number and fruit fresh weight.

Time of planting after herbicide application	Concentration (kg/ha)	Number of fruits per plant	Fresh weight of fruit per plant
4 WAA	Control	1.78	14.54
	0.125	1.44	8.67
	0.250	1.67	20.23
	0.375	1.22	4.08
6 WAA	Control	1.67	11.49
	0.125	1.56	8.18
	0.250	1.56	14.53
	0.375	1.44	3.36
8 WAA	Control	1.67	4.55
	0.125	1.33	3.81
	0.250	1.67	7.16
	0.375	1.11	1.81

Figures represent the mean values of 3 replicates.

4 WAA – 4 Weeks after herbicide application; 6 WAA – 6 Weeks after herbicide application; 8 WAA – 8 Weeks after herbicide application;

Discussion

The timing of a pre-sowing or pre-planting application depends upon the persistence of the chemical, the dose required for weed control and the tolerance of the crop towards the chemical. If the crop is not completely resistant to the herbicide dose needed for good weed control, the period between spraying and sowing must be long enough to allow some of the chemical to dissipate before the crop germinates since sensitive crop may be affected if the chemical remains for too long in the upper layer of the soil (Fryer and Makepeace, 1997).

The result of this study revealed that germination and seedling establishment were not adversely affected by Imazaquin residue in the soil. This may be as a result of either low residue of the chemical in the soil or tolerance of the tomato. This observation was different from the report of Broz-Kosiv and Macek (1988) on the reduction in the emergence of wheat and sugar beet from 85% in the untreated controls to 69 and 29 percent, as a result of the residues of atrazine and metolachlor in Slovenia after application of 4 and 9 litres/ha of primextra, respectively.

Stem height, shoot and root weights (fresh and dry) were better in a concentration of Imazaquin (0.25 kg/ha) than in both the control and the other herbicide treatments (Tables 1 – 3_. This observation agreed with the observations of Omokaro and Ajakaiye (1989) in which pendimenthalin and prometryne

significantly increased cowpea growth rate throughout the growth period, except at the flowering and pod filling phase. The observation is also at variance with the report of Arsenovic et al. (1992) on the adverse effect of Imazaquin residue on the height of cabbage, lettuce, tomato, green pepper and onion planted during the following spring on a soybean field previously sprayed with Imazaquin.

Table 3: Mean weights of tomato plants after harvest.

Time of planting after herbicide application	Concentration (kg/ha)	Shoot		Root	
		FW	DW	FW	DW
4 WAA	Control	37.73	6.90	4.90	1.96
	0.125	31.51	5.45	3.65	1.40
	0.250	43.51	7.96	5.76	1.61
	0.375	24.85	5.34	3.99	1.17
6 WAA	Control	33.61	4.71	6.10	1.34
	0.125	28.88	3.95	5.24	1.25
	0.250	34.43	5.32	7.75	1.69
	0.375	12.89	1.69	1.67	0.49
8 WAA	Control	28.17	4.31	3.83	0.72
	0.125	27.67	3.91	3.31	0.68
	0.250	31.71	4.77	5.57	0.89
	0.375	20.19	3.40	2.26	0.47

FW – Fresh weight; DW – Dry weight.

4 WAA – 4 Weeks after herbicide application; 6 WAA – 6 Weeks after herbicide application; 8 WAA – 8 Weeks after herbicide application;

Fruit number was higher in the control in all the time intervals except 8 weeks after herbicide application while the fruit fresh weight was consistently higher in the plants treated with herbicide concentration of 0.25 kg/ha than both the control and other treatments (Table 3). This is probably due to the herbicide enhancing accumulation of materials in the tomato fruits.

Since Imazaquin concentration of 0.25 kg/ha supported good growth performance and fruit yield in tomato and absence of obvious injury caused by the herbicide in all the time intervals, it can be suggested that tomato can be planted in a filed or plot previously sprayed with Imazaquin after 4 weeks of application.

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