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EVALUATION OF BIO EFFICACY AND PHYTO TOXICITY EVALUATION OF INDAZIFLAM 500 SC IN ACID LIME

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ABSTRACT

Field experiments were conducted to evaluate the bio efficacy and phyto toxicity of Indaziflam 500 SC in acid lime at Central Block, Horticultural College and Research Institute, Periyakulam during *kharif* and *rabi* seasons of the years 2017 and 2018. Experiments were carried out in Randomized Block Design with ten treatments and replicated thrice. Indaziflam 500 SC was sprayed as pre emergence as well as combination with post emergence herbicides in acid lime before the onset of South West Monsoon and North East Monsoon at *kharif* and *rabi* seasons respectively. Indaziflam 500 SC either alone or in combination with post emergence herbicide was completely dissolved while making stock solutions. There were no phyto toxicity symptoms on acid lime at higher doses of pre emergence application and combination with post emergence application of Indaziflam 500 SC. Pre emergence application of Indaziflam 500 SC @ 62.5 g a.i./ha recorded significantly lower no. of weed density on 30, 60, 90 and 120 DAA during both the seasons. Increased weed density was observed in untreated control at all stages of crop growth during both the seasons. Pre emergence application of Indaziflam 500 SC @ 62.5 g a.i./ha recorded significantly lower weed DMP at 90 DAA during both the seasons of the study followed by pre emergence application of Indaziflam 500 SC @ 50 g a.i./ha and resulted in higher weed control efficiency at all stages of observation. Significantly higher acid lime fruit yield of 12.45 and 13.85 t/ha was recorded with hand weeding during *kharif* and *rabi* respectively due to weed free condition maintained during entire growth stage of the crop and it was followed by pre emergence application of Indaziflam 500 SC @ 62.5 g a.i./ha.

Keywords: Acid lime, Weed density, Weed dry matter, Weed control efficiency, fruit yield

INTRODUCTION

Acid lime is the third important citrus crop in India next to mandarins and sweet oranges. Sweet orange, mandarins and grape fruit are sub-tropical, whereas lime and lemon are tropical in their climatic requirements. In India, acid lime is grown in a variety of agro - climates comprising of the northern plains and central highlands having hot semi arid eco region with black and red soils. Lemon fruits have high medicinal value and industrial use as it is a rich source of vitamin C with fair amounts of vitamin A, B and minerals such as calcium, phosphorus and iron (Khehra and Bal, 2014). Besides their consumption as fresh fruit, a large number of products and by-products like pickles, squash, jam, jelly, candies and marmalades are prepared and marketed at a premium price (Ahmed *et al.,* 2007).Weed control in citrus orchards is necessary, otherwise unchecked weed growth will compete with the trees for moisture and nutrients and interfere with orchard operations, thus reducing yields and increasing the cost of production.

Weeds are plants that interfere with human activity, or in some way intrude upon human welfare (Gare and Raundal, 2015). They posses traits or characteristics that make them ideal for proliferation. Traits such as the ability to reproduce at a faster rate, rapid growth from seedling to sexual phase, phenotypic plasticity, and high tolerance to environmental heterogeneity are associated with weedy plant species. Of the total annual loss of agricultural produce from various pests, weeds accounts for 45%, insects 30%, diseases 20% and other pests 5% (Behera and Singh, 1999). Weed interference can cause high yield reduction by competing for resources. Some weeds can also increase pest problem by serving as alternate host for insects, diseases, nematodes and also introduce of chemicals into the soil that can adversely affect the growth of susceptible plants (Ladaniya *et al.,* 2020).

Weed control is essential in citrus orchards. Control of weeds is essential in the basins of the trees, below the drip and also upto 1.5 to 3.0 metres on either side of the tree rows. The weeds besides competing with the trees, interfere with the plant protection measures, harvesting, pruning and other cultural operations. Further they aggravate the damage to surface roots by diseases and rodents. Orchards with weed infestation suffer from frost because of reduced radiation from the soil. Weed control both in the nursery and main field is important for healthy performance of citrus trees. Hence, an attempt was made to evaluate the bio efficacy and phyto toxicity of Indaziflam 500 SC in acid lime.

MATERIALS AND METHODS

Field experiments were conducted to evaluate the bio efficacy and phyto toxicity of Indaziflam 500 SC in acid lime during *kharif* and *Rabi* seasons of the years 2017 and 2018 at Central Block, Horticultural College and Research Institute, Periyakulam, Tamil Nadu located at 10.13^0 N, 77.59^0 E and at an altitude of 289 m above mean sea level with average rainfall 791.1 mm. The soil was sandy loam having pH 7.1, organic carbon (0.26%), medium in available nitrogen (298 kg/ha), low in available P_2O_5 (10.4 kg/ha) and medium in available potash (220 kg/ha). The field experiment was carried out in Randomized Block Design with three replications. The experiment consists of ten treatments *viz.,* Untreated control (T_1), Indaziflam 500 SC @ 37.5 g a.i./ha (T_2), Indaziflam 500 SC @ 50 g a.i./ha (T_3), Indaziflam 500 SC @ 62.5 g a.i./ha (T_4), Diuron 80% WP @ 4000 g a.i./ha (T_5), Hand weeding (T_6), Indaziflam 500 SC @ 62.5 g a.i./ha + Glyphosate 41% SL @ 1230 g a.i./ha (T_7), Indaziflam 500 SC @ 62.5 g a.i./ha + Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha (T_8), Glyphosate 41% SL @ 1230 g a.i./ha (T_9) and Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha (T_{10}). Acid lime variety PKM 1 was used for this study. Experimental trials were taken in already established acid lime fields after pruning. Pre emergence application of Indaziflam 500 SC at different concentration was sprayed at the onset of South West Monsoon and North East Monsoon periods. During the onset of monsoon, early emerged weeds were controlled by manual weeding and then the treatments were imposed as given in the protocol. Periodical hand weeding was done to maintain the weed free condition in the hand weeding treatment. Post emergence application Indaziflam 500 SC, treatments were imposed when the weeds at 4-6 leaf stages. Observations on weed density, weed dry matter production, physical compatibility and phyto toxicity rating were recorded. Weed Control Efficiency was calculated using the following formula,

$$WCE = \frac{\text{Weed DMP in control plot - Weed DMP in treated plots}}{\text{Weed DMP in control plot}} \times 100$$

All the observed data were subjected to statistical analysis and observed the significance of treatments. Square root transformation was also carried out for the weed characteristics and analysed following the analysis of variance for Randomized Block Design as suggested by Gomez and Gomez (1984).

Indaziflam 500 SC is an aliphatic group of herbicide. Spacing followed for acid lime was 6 m x 6 m. Fertlizer dose of 600:200:300 g/ tree of NPK was applied since the orchard was already established. Experimental trials were taken in already established acid lime fields after pruning. Plant protection chemicals such as Dichlorvos 76 WSC @ 1 ml/lit or Dimethoate 30 EC @ 2 ml/lit or Monocrotophos 36 WSC @ 1.5 ml/lit or Neem Seed Kernel Extract (NSKE) @ 50g/lit or 3 % neem cake extract or neem oil were applied as and when required. Carbofuran 3 G @ 75 g/tree to control citrus nematodes. Other regular package of practices were followed in acid lime as per TNAU Crop Production Guide.

RESULTS AND DISCUSSION

The weed flora observed in the experimental field during the course of study consisted of grasses, sedges and broad leaved weeds. *Cynodon dactylon*, *Chloris barbata* and *Dactyloctenium aegyptium* in grasses, *Cyperus rotundus* in sedges, *Boerhavia diffusa, Euphorbia hirta, Abutilon indicum, Cleome viscosa, Achyranthes aspera, Amaranthus viridis Convolvulus arvensis* and *Parthenium hysterophorus*in broad leaved weeds were observed in the experimental field. The predominant weeds were broad leaved weeds followed by sedges and grasses. *Achyranthes aspera Cyperus rotundus and Cynodon dactylon* were the dominant weed species respectively recorded under broad leaved weeds, sedges and grasses.

Weed density

At pre spray, almost all the treatments recorded same no.of weed density during the both the seasons of the study.

Application of Indaziflam 500 SC either alone as pre emergence herbicide or in combination with the post emergence application effectively controlled the weeds. Significantly lower no. of total weed population was observed in hand weeding treatment as the weed free condition was maintained by periodical hand weeding, this treatment recorded lower weed population.

Pre emergence application of Indaziflam 500 SC @ 62.5 g a.i./ha (T_4) recorded significantly lower no. of total weed population as 9.3, 19.3, 39.7 and 46.3 No.m^{-2} at 30 60, 90 and 120 DAA respectively. This was followed by Indaziflam 500 SC @ 50 g a.i./ha (T_3) and Indaziflam 500 SC @ 62.5 g a.i./ha + Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha. (T_8) (Table 1 and Table 1a)

Similarly, trend of observation on weed density was noticed during rabi season. Pre emergence application of Indaziflam 500 SC @ 62.5 g a.i./ha (T_4) recorded significantly lower no. of total weed population as 9.8, 20.6, 42.4 and 49.0 No.m^{-2} at 30 60, 90 and 120 DAA respectively during *rabi* season (Table 2 and Table 2a).

Increased weed density was observed in untreated control at all stages of crop growth during both the seasons of the study (Table 2, 3, 4, 5 and 6). This result is in accordance with Hargilas *et al*. (2015).

Table 1 : Effect of Indaziflam 500 SC on weed density (No.m^{-2}) in acid lime at 30 and 60 DAA during *Kharif* season.

Treatments	30 DAA				60 DAA			
	Weed density (No.m^{-2})				Weed density (No.m^{-2})			
	Grass	BLW	Sedges	Total	Grass	BLW	Sedges	Total
T_1 - Untreated control	4.76 (22.7)	7.93 (63.0.)	5.73 (32.9)	10.8 (118.6)	3.96 (15.7)	10.08 (101.7)	7.41 (55)	13.13 (172.4)
T_2 - Indaziflam 500 SC @ 37.5 g a.i./ha	2.32 (5.4)	3.87 (15.0)	2.98 (8.9)	5.41 (29.3)	2.68 (7.2)	4.94 (24.5)	4.06 (16.5)	6.94 (48.2)
T_3- Indaziflam 500 SC @ 50 g a.i./ha	2.32 (2.6)	2.44 (6.0)	2.40 (5.8)	3.79 (14.4)	2.34 (5.5)	3.19 (10.2)	3.22 (10.4)	5.10 (26.1)
T_4- Indaziflam 500 SC @ 62.5 g a.i./ha	1.41 (2.0)	2.44 (6.0)	1.14 (1.3)	3.04 (9.3)	1.94 (3.8)	2.66 (7.1)	2.89 (8.4)	4.39 (19.3)
T_5 - Diuron 80% WP @ 4000 g a.i./ha	1.97 (3.9)	3.3 (11.0)	3.83 (14.7)	5.44 (29.6)	2.94 (8.7)	4.77 (22.8)	3.88 (15.1)	6.82 (46.6)
T_6- Hand weeding	0.5 (0.3)	0.70 (0.5)	0.5 (0.3)	1.00 (1.0)	0.59 (0.4)	0.50 (0.3)	0.63 (0.4)	1.00 (1.0)
T_7- Indaziflam 500 SC @ 62.5 g a.i./ha + Glyphosate 41% SL @ 1230 g a.i./ha	1.73 (3.0)	4.00 (16.0)	2.88 (8.3)	5.22 (27.3)	2.66 (7.1)	4.48 (20.1)	4.12 (17)	6.64 (44.2)
T_8- Indaziflam 500 SC @ 62.5 g a.i./ha + Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	2.45 (6.0)	3.31 (11.0)	2.07 (4.3)	4.61 (21.3)	2.82 (8.0)	4.27 (18.3)	3.36 (11.3)	6.13 (37.6)
T_9 - Glyphosate 41% SL @ 1230 g a.i./ha	2.36 (5.6)	4.04 (16.4)	4.15 (17.2)	6.26 (39.2)	2.79 (7.8)	5.09 (26)	4.40 (19.4)	7.29 (53.2)
T_{10} - Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	2.38 (5.7)	4.12 (17.0)	3.60 (12.9)	5.96 (35.6)	3.06 (9.4)	4.23 (17.9)	4.87 (23.8)	7.14 (51.1)
SEd	0.029	0.043	0.331	0.066	0.033	0.086	0.467	0.090
CD (P=0.05)	0.062	0.091	0.682	0.139	0.070	0.182	0.945	0.189

Data in parenthesis are original values. Others are $\sqrt{(x + 0.5)}$ transformed values

Table 1a : Effect of Indaziflam 500 SC on weed density (No.m^{-2}) in acid lime at 90 and 120 DAA during *Kharif* season

Treatments	90 DAA				120 DAA			
	Weed density (No.m^{-2})				Weed density (No.m^{-2})			
	Grass	BLW	Sedges	Total	Grass	BLW	Sedges	Total
T_1 - Untreated control	5.70 (32.6)	11.47 (131.6)	7.00 (49.1)	14.60 (213.3)	5.24 (27.5)	12.23 (149.7)	9.06 (82.1)	16.10 (259.3)
T_2 - Indaziflam 500 SC @ 37.5 g a.i./ha	3.43 (11.8)	6.14 (37.7)	4.27 (18.3)	8.23 (67.8)	3.27 (10.7)	6.30 (39.7)	5.77 (33.3)	9.14 (83.7)
T_3- Indaziflam 500 SC @ 50 g a.i./ha	3.04 (9.3)	4.79 (23.0)	3.31 (11.0)	6.58 (43.3)	3.11 (9.7)	4.91 (24.2)	4.08 (16.7)	7.11 (50.6)
T_4- Indaziflam 500 SC @ 62.5 g a.i./ha	2.44 (6.0)	4.39 (19.3)	3.79 (14.4)	6.30 (39.7)	3.03 (9.2)	4.08 (16.7)	4.51 (20.4)	6.80 (46.3)
T_5 - Diuron 80% WP @ 4000 g a.i./ha	3.54 (12.6)	4.69 (22.0)	5.56 (31.0)	8.09 (65.6)	3.76 (14.2)	6.97 (48.7)	4.32 (18.7)	9.03 (81.6)
T_6- Hand weeding	0.70 (0.5)	0.5 (0.3)	0.5 (0.3)	1.00 (1.0)	2.16 (4.7)	2.34 (5.5)	2.12 (4.5)	3.83 (14.7)
T_7- Indaziflam 500 SC @ 62.5 g a.i./ha + Glyphosate 41% SL @ 1230 g a.i./ha	3.47 (12.1)	5.21 (27.2)	4.69 (22.0)	7.82 (61.3)	3.28 (10.8)	6.32 (40.0)	4.63 (21.5)	8.50 (72.3)
T_8- Indaziflam 500 SC @ 62.5 g a.i./ha + Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	3.50 (12.3)	5.38 (29.0)	3.46 (12.0)	7.30 (53.3)	3.30 (10.9)	4.82 (23.3)	5.21 (27.2)	7.83 (61.4)
T_9 - Glyphosate 41% SL @ 1230 g a.i./ha	3.44 (11.9)	7.04 (49.6)	5.02 (25.3)	9.31 (86.8)	3.13 (9.8)	7.38 (54.6)	5.77 (33.4)	9.88 (97.8)
T_{10} - Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	3.31 (11.0)	6.71 (45.1)	5.22 (27.3)	9.13 (83.4)	3.20 (10.3)	6.55 (43.0)	6.48 (42.0)	9.76 (95.3)
SEd	0.026	0.099	0.334	0.102	0.045	0.075	0.122	0.097
CD (P=0.05)	0.055	0.208	0.699	0.214	0.095	0.157	0.265	0.205

Data in parenthesis are original values. Others are $\sqrt{(x + 0.5)}$ transformed values

Table 2 : Effect of Indaziflam 500 SC on weed density (No.m^{-2}) in acid lime at 30 and 60 DAA during *Rabi* season

Treatments	30 DAA				60 DAA			
	Weed density (No.m^{-2})				Weed density (No.m^{-2})			
	Grass	BLW	Sedges	Total	Grass	BLW	Sedges	Total
T_1 - Untreated control	4.88 (23.9)	7.40 (54.9)	6.92 (48.0)	11.26 (126.8)	6.36 (40.5)	7.97 (63.6)	8.96 (80.3)	13.57 (184.4)
T_2 - Indaziflam 500 SC @ 37.5 g a.i./ha	2.32 (5.4)	4.22 (17.8)	2.84 (8.1)	5.59 (31.3)	2.93 (8.6)	4.87 (23.8)	4.31 (18.6)	7.14 (51.0)
T_3- Indaziflam 500 SC @ 50 g a.i./ha	1.55 (2.4)	2.34 (5.5)	2.73 (7.5)	3.92 (15.4)	2.40 (5.8)	3.98 (15.9)	2.38 (5.7)	5.23 (27.4)
T_4- Indaziflam 500 SC @ 62.5 g a.i./ha	1.41 (2.0)	2.40 (5.8)	1.41 (2.0)	3.13 (9.8)	1.87 (3.5)	2.94 (8.7)	2.89 (8.4)	4.53 (20.6)
T_5 - Diuron 80% WP @ 4000 g a.i./ha	1.94 (3.8)	3.93 (15.5)	3.43 (11.8)	5.57 (31.1)	2.89 (8.4)	5.14 (26.5)	3.78 (14.3)	7.02 (49.3)
T_6- Hand weeding	0.54 (0.3)	0.707 (0.5)	0.5 (0.25)	1.00 (1.0)	0.70 (0.5)	0.50 (0.3)	0.50 (0.3)	1.00 (1.0)
T_7- Indaziflam 500 SC @ 62.5 g a.i./ha + Glyphosate 41% SL @ 1230 g a.i./ha	1.67 (2.8)	3.87 (15.0)	3.36 (11.3)	5.39 (29.1)	2.79 (7.8)	4.54 (20.7)	4.26 (18.2)	6.83 (46.7)
T_8- Indaziflam 500 SC @ 62.5 g a.i./ha + Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	2.45 (6.0)	2.95 (8.7)	2.82 (8.0)	4.76 (22.7)	3.06 (9.4)	4.27 (18.3)	3.52 (12.4)	6.34 (40.2)
T_9 - Glyphosate 41% SL @ 1230 g a.i./ha	2.36 (5.6)	4.75 (22.5)	3.67 (13.5)	6.45 (41.6)	3.01 (9.1)	5.23 (27.4)	4.51 (20.4)	7.54 (56.8)
T_{10} - Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	2.38 (5.7)	4.75 (22.5)	3.08 (9.5)	6.14 (37.7)	3.08 (9.5)	4.77 (22.8)	4.72 (22.3)	7.38 (54.6)
SEd	0.026	0.051	0.036	0.042	0.033	0.082	0.065	0.075
CD (P=0.05)	0.055	0.107	0.076	0.089	0.068	0.173	0.133	0.157

Data in parenthesis are original values. Others are √ (x + 0.5) transformed values

Table 2a : Effect of Indaziflam 500 SC on weed density (No.m^{-2}) in acid lime at 90 and 120 DAA during *rabi* season

Treatments	90 DAA				120 DAA			
	Weed density (No.m^{-2})				Weed density (No.m^{-2})			
	Grass	BLW	Sedges	Total	Grass	BLW	Sedges	Total
T_1 - Untreated control	6.65 (44.3)	11.17 (124.8)	7.62 (58.1)	15.07 (227.2)	6.97 (48.6)	12.94 (167.6)	7.79 (60.7)	16.64 (276.9)
T_2 - Indaziflam 500 SC @ 37.5 g a.i./ha	3.27 (10.7)	6.57 (43.2)	4.25 (18.1)	8.48 (72.0)	3.49 (12.2)	3.70 (13.7)	7.97 (63.6)	9.46 (89.5)
T_3- Indaziflam 500 SC @ 50 g a.i./ha	2.75 (7.6)	4.60 (21.2)	4.18 (17.5)	6.80 (46.3)	2.88 (8.3)	5.17 (26.8)	4.30 (18.5)	7.32 (53.6)
T_4- Indaziflam 500 SC @ 62.5 g a.i./ha	2.40 (5.8)	4.56 (20.8)	3.97 (15.8)	6.51 (42.4)	2.75 (7.6)	5.0 (25.1)	4.02 (16.2)	7.0 (49.0)
T_5 - Diuron 80% WP @ 4000 g a.i./ha	3.16 (10.0)	5.74 (33.0)	5.20 (27.1)	8.37 (70.1)	3.39 (11.5)	4.97 (24.8)	7.10 (50.5)	9.31 (86.7)
T_6- Hand weeding	0.54 (0.3)	0.50 (0.25)	0.70 (0.5)	1.00 (1.0)	0.77 (0.6)	2.91 (8.5)	3.41 (12.2)	4.60 (21.2)
T_7- Indaziflam 500 SC @ 62.5 g a.i./ha + Glyphosate 41% SL @ 1230 g a.i./ha	3.25 (10.6)	5.23 (27.4)	5.25 (27.6)	8.09 (65.5)	3.49 (12.2)	6.46 (41.8)	4.77 (22.8)	8.76 (76.8)
T_8- Indaziflam 500 SC @ 62.5 g a.i./ha + Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	3.20 (10.3)	4.35 (19.0)	5.21 (27.2)	7.51 (56.5)	3.52 (12.4)	4.96 (24.7)	5.29 (28.0)	8.06 (65.1)
T_9 - Glyphosate 41% SL @ 1230 g a.i./ha	3.16 (10.0)	4.73 (22.4)	7.77 (60.4)	9.63 (92.8)	3.64 (13.3)	5.48 (30.10	7.71 (60.7)	10.20 (104.1)
T_{10} - Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	3.03 (9.2)	6.32 (40.0)	6.28 (39.5)	9.41 (88.7)	3.60 (13.0)	4.27 (18.3)	8.37 (70.1)	10.06 (101.4)
SEd	0.051	0.080	0.201	0.109	0.051	0.105	0.236	0.083
CD (P=0.05)	0.108	0.169	0.451	0.229	0.106	0.222	0.503	0.173

Data in parenthesis are original values. Others are √ (x + 0.5) transformed values

Weed Dry Matter production

Significantly lower weed DMP was observed in hand weeding treatment due to maintenance of weed free condition during the entire growth stages of crop. Pre emergence application of Indaziflam 500 SC @ 62.5 g a.i./ha (T_4) recorded significantly lower weed DMP 34.5 and 36.0 g.m^{-2} at 90 DAA during *kharif* and *rabi* season respectively followed by pre emergence application of Indaziflam 500 SC

@ 50 g a.i./ha. (T_3) due to lower weed density. This was followed by Indaziflam 500 SC @ 50 g a.i./ha and ndaziflam 500 SC @ 62.5 g a.i./ha + Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha. (T_8) (Table 3). Weed DMP recorded more with untreated control (T_1) during both the seasons of study due to increased weed population (Table 3). This result is in concordance with Malik and Yadav, 2014.

Weed control efficiency

Higher weed control efficiency was registered with hand weeding treatment during both the years of observation due to periodical hand weeding and lesser dry matter production of weeds. (Table 4)

Pre emergence application of Indaziflam 500 SC @ 62.5 g a.i./ha recorded higher weed control efficiency at all stages of observation. This treatment recorded 99.23, 90.80, 87.86, 86.84, 82.05, 80.15 and 82.33 % respectively during 15, 30, 45, 60, 75, 90 and 120 DAA of first season. Similarly, this treatment recorded 99.28, 90.84, 87.89, 86.86, 82.07, 80.18 and 82.35 % respectively during 15, 30, 45 , 60, 75, 90 and 120 DAA of second season (Table 4). Lower no. of weed density and lower weed DMP resulted in higher weed control efficiency (Patel, 2004).

Table 3 : Effect of Indaziflam 500 SC on weed drymatter production (g m^{-2}) in Citrus on 90 DAA.

Treatments	*Kharif*	*Rabi*
T_1 - Untreated control	13.20 (174.2)	14.29 (204.1)
T_2 - Indaziflam 500 SC @ 37.5 g a.i./ha	7.61 (57.9)	9.53 (90.9)
T_3- Indaziflam 500 SC @ 50 g a.i./ha	6.19 (38.9)	6.60 (43.5)
T_4- Indaziflam 500 SC @ 62.5 g a.i./ha	5.88 (34.5)	6.00 (36.0)
T_5 - Diuron 80% WP @ 4000 g a.i./ha	8.38 (70.3)	9.19 (84.5)
T_6- Hand weeding	0.71 (0.5)	3.38 (11.4)
T_7- Indaziflam 500 SC @ 62.5 g a.i./ha + Glyphosate 41% SL @ 1230 g a.i./ha	8.45 (71.4)	8.70 (75.7)
T_8- Indaziflam 500 SC @ 62.5 g a.i./ha + Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	6.60 (43.5)	7.22 (52.1)
T_9 - Glyphosate 41% SL @ 1230 g a.i./ha	9.76 (95.3)	10.28 (105.7)
T_{10} - Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	9.28 (86.2)	9.74 (94.9)
SEd	0.101	0.101
CD (P=0.05)	0.213	0.212

Data in parenthesis are original values. Others are $\sqrt{(x + 0.5)}$ transformed values

Table 4 : Effect of Indaziflam 500 SC on Weed Control Efficiency (%) in Acidlime

Treatments	I Season							II Season						
	15 DAA	30 DAA	45 DAA	60 DAA	75 DAA	90 DAA	120 DAA	15 DAA	30 DAA	45 DAA	60 DAA	75 DAA	90 DAA	120 DAA
T_1 - Untreated control	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_2 - Indaziflam 500 SC @ 37.5 g a.i./ha	99.23	78.76	71.52	61.84	65.92	66.76	55.45	99.28	78.79	71.55	61.85	65.94	66.78	55.46
T_3- Indaziflam 500 SC @ 50 g a.i./ha	99.23	87.69	84.88	84.11	86.01	77.94	78.66	99.28	87.72	84.91	84.13	86.04	77.96	78.68
T_4- Indaziflam 500 SC @ 62.5 g a.i./ha	99.23	90.80	87.86	86.84	82.05	80.15	82.33	99.28	90.84	87.89	86.86	82.07	80.18	82.35
T_5 - Diuron 80% WP @ 4000 g a.i./ha	99.23	77.27	68.10	64.57	59.00	59.64	58.59	99.28	77.30	68.13	64.59	59.02	59.66	58.61
T_6- Hand weeding	91.06	99.32	100	99.59	95.08	99.68	94.38	91.11	99.37	100	99.61	95.11	99.71	94.41
T_7- Indaziflam 500 SC @ 62.5 g a.i./ha + Glyphosate 41% SL @ 1230 g a.i./ha	99.23	79.84	70.31	71.27	62.96	58.96	62.89	99.28	79.87	70.33	71.29	62.98	58.98	62.90
T_8- Indaziflam 500 SC @ 62.5 g a.i./ha + Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	99.23	82.27	73.51	75.91	77.81	74.99	74.47	99.28	82.31	73.54	75.93	77.84	75.02	74.49
T_9 - Glyphosate 41% SL @ 1230 g a.i./ha	99.23	66.71	65.45	54.64	49.39	45.27	48.21	99.28	66.74	65.48	54.65	49.41	45.28	48.23
T_{10} - Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	99.23	69.15	67.99	56.79	53.02	50.49	53.51	99.28	69.18	68.02	56.80	53.04	50.50	53.52

Fruit yield

Significantly higher acid lime fruit yield of 12.45 and 13.85 t/ha was recorded in hand weeding treatment (T_6) due to weed free condition maintained during entire growth stage of the crop. Pre emergence application of Indaziflam 500 SC @ 62.5 g a.i./ha (T_4) recorded significantly higher acid lime fruit yield to the tune of 11.18 and 12.40 t/ha. This treatment recorded 14 % and 13.5 % increased yield over the standard Diuron 80% WP @ 4000 g a.i./ha. (T_5). The increased yield was due to better control of weeds through higher weed control efficiency. Unweeded control recorded lowest yield than the rest of the treatments during both the seasons of the study (Table 5). This result is in correlation with Shweta Sharma and Patel, 2011.

Table 5 : Effect of Indaziflam 500 SC on Acid lime yield (t/ha)

Treatments	*Kharif*	*Rabi*
T_1 - Untreated control	4.07	4.52
T_2 - Indaziflam 500 SC @ 37.5 g a.i./ha	9.34	10.40
T_3- Indaziflam 500 SC @ 50 g a.i./ha	10.95	12.20
T_4- Indaziflam 500 SC @ 62.5 g a.i./ha	11.18	12.40
T_5 - Diuron 80% WP @ 4000 g a.i./ha	9.81	10.89
T_6- Hand weeding	12.45	13.85
T_7- Indaziflam 500 SC @ 62.5 g a.i./ha + Glyphosate 41% SL @ 1230 g a.i./ha	10.26	11.39
T_8- Indaziflam 500 SC @ 62.5 g a.i./ha + Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	9.86	10.95
T_9 - Glyphosate 41% SL @ 1230 g a.i./ha	8.29	9.32
T_{10} - Glufosinate Ammonium 13.5 % SL @ 500 g a.i./ha	8.71	9.68
SEd	0.186	0.239
CD (P=0.05)	0.392	0.504

CONCLUSION

Pre emergence application of Indaziflam 500 SC @ 62.5 g a.i./ha recorded significantly lower weed density, weed dry matter production, higher weed control efficiency and higher acid lime fruit yield to the tune of 11.18 and 12.40 t/ha. This treatment recorded 14 % and 13.5 % increased yield over Diuron 80% WP @ 4000 g a.i./ha in acid lime during both the years of study.

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