



Phytotoxicity of herbicides on *Cynodon dactylon*

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Abstract: Field experiment was conducted to manage the sedge and broad leaf weeds in lawn during November to December 2013 to February to March 2014. Experimental plot was red sandy loam soil with pH 6.50. The experimental plot consisted of bermuda grass *Cynodon dactylon* which was established through turfing. The experimental plot was laid out in a randomized complete block design (RCBD) having 17 treatments with three replications. Herbicide treatments include 2, 4-D sodium salt 80 WP at (2, 3 and 4g/lit of water), 2, 4-D dimethyl amine salt 58% EC at (5, 7.5 and 10 ml/lit of water), carfentrozone ethyl 40 DF at (0.25, 0.5 and 1 g/lit of water), fluroxypyr meptyl 48% EC at (1.5, 3 and 6 ml/lit of water) and chlorimuron methyl + metasulfuron methyl at (0.3, 0.4 and 0.5 g/lit of water). Hand weeding was done at every 20 days interval at 20 days after application of herbicides and also maintained one unweeded control in during November to December and February to March. The phytotoxic symptoms were observed only fluroxypyr meptyl 48% EC applied at 6 ml/lit of water at 3, 7, 10, 15 and 25 days after application of herbicides (DAAH) but it recovered at later stages. However, the other herbicides did not cause any phytotoxic effect on *C. dactylon*.

Keywords: *Cynodon dactylon*, Herbicides, Phytotoxicity, Turfing, Weeds

INTRODUCTION

Bermudagrass (*Cynodon dactylon*) is a plant that is grown as a turfgrass is hardy, perennial grass, belonging to family Poaceae, very variable, with long rapid growing, creeping runner or stolons, rooting at nodes, forming a dense tuft on the surface of the soil (Cudney, 2007). Bermudagrass is a plant that is grown as a turfgrass or as forage for livestock, but it also can be an invasive weed. It is native to north and east Africa, Asia and Australia and southern Europe (Singh *et al.*, 2009). The management of a lawn as an outdoor green surface has become an important aspect of the landscape. Lawns provide open space for recreational activities and relaxation as well as a means to ameliorate heat and dust (Turgeon, 1999). Their importance is especially appreciated on university campuses, where the management of lawn has become an integral part of the overall development and enhancement. The multiple benefits of the lawn are also appreciated by the private and commercial estate developers as well as by governmental estates. The use of herbicides holds a good promise for timely, effective and efficient weed control where, labour is scarce and expensive. As most weeds emerge either before or along with the crop, the use of pre-sowing incorporation and pre-emergence

herbicides is a better management practice. The use of dinitroaniline herbicides, such as prodiamine and pendimethalin, may cause abnormal swelling of turfgrass root tips, stunting of lateral root growth and/or severely pruned roots when healthy tissue comes into contact with the chemical barrier created in the upper soil profile (Mitra and Bhowmik, 2005). Other researchers (Fishel and Coats, 1994) have observed noticeable reductions in growth and abnormal root development in Bermuda grass plants treated with pendimethalin, prodiamine and dithiopyr. The choice of herbicide for a particular situation will depend upon the climate, soil type, prevalent weed species, crop cultivar and method of propagation and management. Therefore, the current research was aimed to determine the phytotoxicity of herbicides on *C. dactylon*.

MATERIALS AND METHODS

The field experiments were carried out at College of Agriculture, Gandhi Krishi Vigyan Kendra, Bengaluru during the period from November to December 2013 and February to March 2014. The experimental plot consists of bermuda grass which was established during 2009-10 through turfing. Experimental plot was located at 12°58' latitude and 77°35' east longitude

with an altitude of about 930 m above mean sea level (MSL). The experimental plot irrigated through sprinkler at every two days interval based on water requirement for lawn and mowed at every 20 days interval and care should be taken that never mowed shorter than two inches (5 cm). The soil type at College of Agriculture, Gandhi Krishi Vigyan Kendra, Bengaluru is red sandy loam soil with pH of 6.50. Herbicide treatments were single application of 2, 4-D sodium salt 80 WP at (2, 3 and 4g/lit of water), 2, 4-D dimethyl amine salt 58% EC at (5, 7.5 and 10 ml/lit of water), carfentozone ethyl 40 DF at (0.25, 0.5 and 1 g/lit of water), fluroxypyr meptyl 48% EC at (1.5, 3 and 6 ml/lit of water) and chlorimuron methyl + metasulfuron methyl at (0.3, 0.4 and 0.5 g/lit of water) were sprayed using a hand operated knapsack sprayer fitted with flood jet nozzle on *C. dactylon* a spray volume of 500 lit/ha. The herbicides were sprayed uniformly covering all areas of the plots. Hand weeding was done at every 20 days interval and also maintained one unweeded control in during November to December 2013 and February to March 2014. The plots were 2.0 m × 2.0 m with each treatment replicated three times. Treatments were arranged in a randomized complete block design. Visual rating was recorded at 3, 7, 10, 15 and 25 days after application of herbicides to know the extent of toxicity caused by different herbicides on *C. dactylon* were ranked in the scale of 0 to 10 (Rao, 1986). The phytotoxicity ratings using 0 to 10 scale are shown in Table 1.

RESULTS AND DISCUSSION

Visual observations of herbicide toxicity on lawn grass were recorded at 3, 7, 10, 15 and 25 days after application of herbicides. Among herbicide treatments, fluroxypyr meptyl 48% EC at 6 ml/lit of water caused slight toxicity on *C. dactylon* during the period November to December, February to March. Whereas, other herbicides treatments did not cause any toxic effect on *C. dactylon* (Table 2). At 3 DAAH, fluroxypyr meptyl 48% EC at 6 ml/lit of water caused slight toxicity (2.0) on lawn during the period November to December and February to March. At 5 DAAH, the phytotoxicity rating increased to (3.0) and at 7

DAAH, it further increased to (4.0) in the treatment fluroxypyr meptyl 48% EC at 6 ml/lit of water. Treatment fluroxypyr meptyl 48 EC at 6 ml/lit of water caused phytotoxicity rating (3.0) during the period November to December, February to March and pooled analysis at 10, 15 and 25 DAAH but it recovered at later stages (Fig. 1) at 35 days after application of herbicides.

The toxicity rating recorded in lawn at 3, 7, 10, 15 and 25 DAAH of herbicides during the period November to December 2013, February to March and pooled analysis (Table 2) indicated that carfentozone ethyl at (0.25, 0.5 and 1.0 g/lit of water), chlorimuron methyl + metasulfuron methyl at (0.3, 0.4 and 0.5 g/lit of water), 2, 4-D sodium salt at (2, 3 and 4 g/lit water), 2, 4-D dimethyl amine salt 58% EC at (5, 7.5 and 10 ml/lit of water), fluroxypyr meptyl 48% EC (1.5 and 3 ml/lit of water) were selective to *C. dactylon* without any phytotoxic symptoms (Table 2) and 2, 4-D sodium salt, 2, 4-D dimethyl amine salt 58% EC, fluroxypyr meptyl 48% EC, chlorimuron methyl + metasulfuron methyl and carfentozone ethyl manage the annual grass and broad leaf weeds (Turgeon, 2011). Whereas, fluroxypyr meptyl 48% EC at 6 ml/lit of water caused slight yellowing of *C. dactylon* up to 25 DAAH but it recovered at later stages (Fig. 1).

Conclusion

It was concluded that the phytotoxic symptoms appeared in *Cynodon dactylon* at 3, 7, 10, 15 and 25 DAAH in fluroxypyr meptyl 48 EC at 6 ml/lit of water. However, the other herbicides carfentozone ethyl at (0.25, 0.5 and 1.0 g/lit of water), chlorimuron methyl + metasulfuron methyl at (0.3, 0.4 and 0.5 g/lit of water), 2, 4-D sodium salt at (2, 3 and 4 g/lit water), 2, 4-D dimethyl amine salt 58% EC at (5, 7.5 and 10 ml/lit of water), fluroxypyr meptyl 48% EC (1.5 and 3 ml/lit of water) did not cause any phytotoxic effect on *C. dactylon*.

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Table 1. Crop phytotoxicity rating using 0 to 10 point scale.

Effect	Score	Phytotoxicity symptoms
None	0	No injury, normal
	1	Slight stunting injury or discoloration
Slight	2	Some stand loss, stunting or discoloration
	3	Injury more pronounced but not persistent
	4	Moderate injury, recovery possible
Moderate	5	Injury more persistent, recovery possible
	6	Near severe injury, no recovery possible
	7	Sever injury, stand loss
Severe	8	Almost destroyed, a few plants surviving
	9	Very few plants alive
Complete	10	Complete destruction

(Source: Rao, 1986)

Table 2. Phytotoxicity rating (0-10) scale at different stages as influenced by weed management practices in lawn.

Treatments	3 DAAH			5 DAAH			7 DAAH		
	Nov-Dec	Feb-Mar	Pooled	Nov-Dec	Feb-Mar	Pooled	Nov-Dec	Feb-Mar	Pooled
T ₁ -2,4-D sodium salt 80 WP at 2 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₂ -2,4-D sodium salt 80 WP at 3 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₃ -2,4-D sodium salt 80 WP at 4 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₄ -2,4-D dimethyl amine salt 58% EC at 5 ml/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₅ -2,4-D dimethyl amine salt 58% EC at 7.5 ml/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₆ -2,4-D dimethyl amine salt 58% EC at 10 ml/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₇ -Carfentozone ethyl 40 DF at 0.25 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₈ -Carfentozone ethyl 40 DF at 0.5 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₉ -Carfentozone ethyl 40 DF at 1 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₀ -Fluroxypyr meptyl 48% EC at 1.5 ml/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₁ -Fluroxypyr meptyl 48% EC at 3 ml/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₂ -Fluroxypyr meptyl 48% EC at 6 ml/lit. of water	2.0	2.0	2.0	3.0	3.0	3.0	4.0	4.0	4.0
T ₁₃ -Chlorimuron methyl + metasulfuron methyl at 0.3 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₄ -Chlorimuron methyl + metasulfuron methyl at 0.4 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₅ -Chlorimuron methyl + metasulfuron methyl at 0.5 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₆ -Hand weeding at every 20 days interval	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₇ -Unweeded control	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 2: Contd...

Treatments	10 DAAH			15 DAAH			25 DAAH		
	Nov-Dec	Feb-Mar	Pooled	Nov-Dec	Feb-Mar	Pooled	Nov-Dec	Feb-Mar	Pooled
T ₁ -2,4-D sodium salt 80 WP at 2 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₂ -2,4-D sodium salt 80 WP at 3 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₃ -2,4-D sodium salt 80 WP at 4 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₄ -2,4-D dimethyl amine salt 58% EC at 5 ml/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₅ -2,4-D dimethyl amine salt 58% EC at 7.5 ml/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₆ -2,4-D dimethyl amine salt 58% EC at 10 ml/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₇ -Carfentozone ethyl 40 DF at 0.25 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₈ -Carfentozone ethyl 40 DF at 0.5 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₉ -Carfentozone ethyl 40 DF at 1 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₀ -Fluroxypyr meptyl 48% EC at 1.5 ml/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₁ -Fluroxypyr meptyl 48% EC at 3 ml/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₂ -Fluroxypyr meptyl 48% EC at 6 ml/lit. of water	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
T ₁₃ -Chlorimuron methyl + metasulfuron methyl at 0.3 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₄ -Chlorimuron methyl + metasulfuron methyl at 0.4 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₅ -Chlorimuron methyl + metasulfuron methyl at 0.5 g/lit. of water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₆ -Hand weeding at every 20 days interval	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
T ₁₇ -Unweeded control	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAAH = Days after application of herbicides, Nov-Dec=November to December 2013, Feb-Mar=February to March 2014, Pooled=Pooled analysis

(A) *C. dactylon*-Before herbicide application.(B) *C. dactylon*-3 Days after herbicide application.(C) *C. dactylon*-5 Days after herbicide application.(D) *C. dactylon*-7 Days after herbicide application.(E) *C. dactylon*-10, 15 and 25 Days after herbicide application.(F) 35 *C. dactylon*-Days after herbicide application.**Fig. 1.** Fluroxypyr meptyl 48% EC at 6 ml/lit of water caused phytotoxicity on *C. dactylon*.

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