

## Effect of Dalapon on the Enzyme Activities in *Cynodon dactylon* Pers.\*

By

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### ABSTRACT

Except for an initial rise in catalase activity, there was a general decrease at subsequent stages. Higher concentrations of the herbicide reduced the peroxidase activity in the foliage. The proteolytic activity was generally increased in relation to the concentration of dalapon used in this study. With an initial inhibition in nitrate reductase activity, an increasing trend was exhibited in the samples gathered at later stages.

### INTRODUCTION

Besides the formative effects on foliage and roots, the involvement of herbicide in respiration and enzyme systems is an interesting line of study. Dalapon, 2, 2 - dichloropropionic acid ( $\text{CH}_3\text{C}(\text{Cl})_2\text{COOH}$ ) is translocated through foliage as well as by roots, and its rapid distribution in plant system has been an advantage over other systemic herbicides.

Auerbach et al. (quoted by Audus, 1964) felt that amitrole inhibited the synthesis of the enzyme rather than inhibiting the activity. Belyaeva (1967) found no particular change in catalase activity in *C. dactylon* treated with dalapon. Peroxidase activity was not very much altered both in the dormant and treated tubers of *Cyperus rotundus*, as reported by Palmer and Porter (1959), who used amitrole in the study. Tweedy and Ries (1967) recorded that simazine increased the nitrogen content

of plant and this increase was associated with nitrate reductase activity. Freiberg (1952) showed that 2, 4-D decreased the proteinase activity in the leaf, but in stem and shoots an increasing trend was noticed. Ashton et al. (1968) reported an increase in proteolytic activity during germination in squash seedlings after herbicidal treatments.

### MATERIALS AND METHODS

The experimental work involved the treatment of species with different concentrations of the herbicide (74 per cent acid equivalent) used as a post-emergence foliar spray. The enzymic activities viz., the catalase activity (Decock et al., 1960), peroxidase activity (Perur, 1962), proteinase activity (Lee and Takahashi, 1966) and nitrate reductase activity (Eckerson, 1931) were measured in the foliage of the weed species at four stages after application.

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## RESULTS AND DISCUSSION

Although no uniform trend was noticed in the catalase activity (Table 1) it was observed that the activity was altered by the dalapon concentration. A maximum catalase activity of 2.10 was recorded at the first stage. There was no particular change in this respiratory enzyme even though dalapon reduced the catalase activity after an initial increase. Belyaeva (1967) is of the opinion that no particular change could be established after dalapon application in *C. dactylon*. Regarding peroxidase activity (Table 1), an initial rise was seen in the second and third stages at the lowest concentration, followed by reduction in the higher concentration. In general peroxidase activity was inhibited. The same trend was observed by Nagarajan (1968) in *C. dactylon* with amitrole.

Taking into account the important protein hydrolysing enzyme proteinase, a striking effect was seen on the proteolytic activity (Table 1). The proteolytic activity increased in proportion to the concentrations of the herbicide. In the first stage, the proteolytic activity increased upto  $T_3$  and a slight decrease was recorded thereafter at the highest concentration. In the second stage, the rise in activity of this enzyme was directly proportional to the concentrations of the herbicide. At the third stage a maximum activity was recorded in the last two concentrations. The proteolytic activities recorded in  $T_3$  and  $T_4$  were 154.35 and 176.36 per cent in control. Freiberg (1952) recorded a similar observation in the stem and shoots of soybean. In general, a close

relationship was observed between the protein breakdown and the proteolytic activity in respect of dalapon application.

Dalapon concentration also interfered with nitrate reductase activity in the foliage (Table 1). The nitrate reductase activity was inhibited in the first stage and the enzyme activity was not much altered. In the second stage an initial rise in the first two treatments was observed. Then a sudden inhibition in the enzyme activity could be noticed in  $T_3$  and a slight increase in  $T_4$ . In the third stage the nitrate reductase activity was much increased in the lowest concentration ( $T_1$ ) and it was the highest in  $T_4$  namely 4,333. per cent on the control. In  $T_2$  and  $T_3$  also the activity increased as compared to the control. At the final stage of sampling, enhancement in the activity was seen in the first two concentrations. In the last two concentrations an increase in activity was however noticed, but the rate of activity was low as compared to the lowest concentration. From the data, it was seen that nitrate reductase activity was influenced by the herbicide.

In general, dalapon had a marked effect on protein hydrolyzing enzyme. Wort (1950) suggested that "reaction between herbicide and enzyme protein is thus a possibility" and similarly Leasure (1963) stated "that the effect of dalapon as a protein precipitant which would inactivate the enzyme complex generally". These two views were confirmed in the present study.



TABLE 1. Effect of Dalapon on the different enzyme activities in the foliage of *Cynodon dactylon* at four stages  
(activity/g fresh weight of tissue)

Treatment (dalapon as kg/ha)	catalase activity				peroxidase activity				proteolytic activity				nitrate reductase**			
	1*	2*	3*	4*	1*	2*	3*	4*	1*	2*	3*	4*	1*	2*	3*	4*
C - Control	1.33	1.18	1.01	1.11	0.20	0.21	0.20	0.20	0.20	0.20	0.22	0.20	0.015	0.05	0.003	0.078
T <sub>1</sub> —5	0.82	0.91	0.97	1.42	0.11	0.26	0.25	0.22	0.20	0.21	0.23	0.20	0.015	0.18	0.030	0.080
T <sub>2</sub> —10	1.15	1.03	0.61	1.42	0.05	0.14	0.12	0.25	0.21	0.24	0.27	0.21	0.008	0.15	0.013	0.490
T <sub>3</sub> —15	2.10	0.75	1.00	0.59	0.09	0.16	0.18	0.16	0.27	0.25	0.34	0.21	0.015	0.03	0.015	0.078
T <sub>4</sub> —20	1.57	0.81	1.34	0.64	0.02	0.21	0.10	0.12	0.24	0.26	0.39	0.23	0.013	0.05	0.130	0.200

\* Stages include (1) 4 days, (2) 8 days, (3) 12 days and (4) 16 days

\*\* Nitrate reductase activity measured as nitrite nitrogen released / 100 g fresh weight of tissue



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