

The Effects of Ametryne, Prometryne and Fluometuron on Germination and Amylase Activity of *Triticum aestivum* L.

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The pretreatment effect of herbicides on germination and amylase activity of wheat (*Triticum aestivum* L.) seeds was studied. Lethal concentration (1000 ppm) of fluometuron and ametryne significantly inhibited germination. Amylase activity of seeds, in general, markedly increased from 20 to 60 hours of germination. At sublethal dose (1 ppm) all herbicides promoted the amylase activity. But at lethal dose this activity was remarkably suppressed by fluometuron and prometryne. Most of the changes in amylase activity induced by the herbicides, however, were not correlated with percentage germination.

Numerous reports indicate that triazines do not influence seed germination,¹⁻³ whereas Wakonig and Arnason⁴ found complete suppression of seed germination of barley by 200 ppm simazine. Similarly Grover⁵ demonstrated the inhibitory effects of triazines on germination of some conifer seeds.

The biochemical changes during germination are likely to be modified by factors which affect the rate and percentage of germination.^{6, 7} As a first step in this direction the effect of herbicides on amylase activity is studied owing to the fact that this biochemical process plays an important role in germination by way of sugar mobilization.

MATERIALS AND METHODS

Lots of 20 seeds of wheat (*Triticum aestivum* L. var. Pak. 70) were placed on Whatman No. 1 filter paper in sterilized

petri plates which contained 5 ml of aqueous solution or suspension of ametryne (6-methylmercapto - 2 - isopropylamino - 4-ethylamino-s-triazine), prometryne (6-methylmercapto-2-4 bis (isopropylamino-s-triazine) and fluometuron (3-m-trifluoromethyl-phenyle-1,1 dimethyl urea) at 1 and 1000 ppm concentrations. In controls 5 ml of distilled water was substituted for the herbicide. Each treatment or control was replicated thrice. The dishes were placed in a growth chamber maintained at $20 \pm 1^\circ\text{C}$ and 65% relative humidity. Light intensity at the top of dishes was 4000 Lux. Germination counts were made at 20, 40 and 60 hour following the criterion of Taylor.⁸

Amylase activity of the seeds was measured at 20, 40 and 60 hours with an agar gel diffusion method described by Briggs⁹ with minor modifications. The agar gel contained 1% agar and 0.1% soluble starch. The amylase extracts were prepared by macerating 20 seeds (from indivi-

dual dishes) at 20, 40 and 60 hour in 25 ml ice-cold buffer (ph 5.3) incorporated with 5 ppm chloramphenicol.¹⁰ Drops of 0.01ml of the extract were placed on substrate agar with the aid of a micrometer syringe. After 3 days of incubation the agar plates were flooded with I₂-KI solution and the clear zone diameters measured.

RESULTS AND DISCUSSIONS

The results of seed germination are presented in Table 1. The seeds did not germinate at 20 hour but subsequently germination percentage, in general, increas-

ed rapidly. Prometryne at either concentrations did not alter the percentage of germination. Although, ametryne at 1 ppm did not influence germination substantially, a significant inhibition of germination occurred at 1000 ppm. Likewise fluometuron had no effect on germination at 1 ppm but significantly reduced the germination percentage at 1000 ppm.

The effects of herbicides on amylase activity are shown in Fig. 1. At 1 ppm ametryne and prometryne significantly stimulated the amylase activity at 20, 40 and 60 hour, but fluometuron promoted this activity only at 60 hour of inhibition.

TABLE 1

Effect of ametryne, prometryne and fluometuron on germination of *Triticum aestivum* L.

Treatment	Germination after different periods (hours)*		
	20	40	60
Control	0	78.75 ± 4.01	91.20 ± 4.27
Ametryne (1 ppm)	0	76.60 ± 2.30	88.30 ± 1.65
Ametryne (1000 ppm)	0	21.60 ± 6.60	43.30 ± 4.50
Prometryne (1 ppm)	0	70.00 ± 3.33	86.60 ± 5.00
Prometryne (1000 ppm)	0	81.66 ± 7.10	88.30 ± 1.65
Fluometuron (1 ppm)	0	71.66 ± 5.32	86.60 ± 1.67
Fluometuron (1000 ppm)	0	38.30 ± 3.60	46.60 ± 6.10

*Mean percentage germination of three replicates.

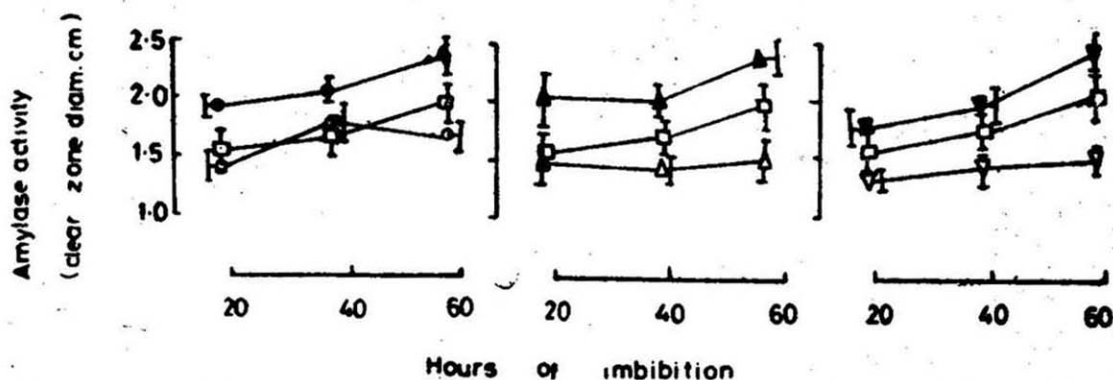


Fig. 1. Effect of ametryne, prometryne and fluometuron on amylase activity of germinating *Triticum aestivum* seeds

Control	○—○	Prometryne 1 ppm	▲—▲
Ametryne 1 ppm	●—●	Prometryne 1000 ppm	△—△
Ametryne 1000 ppm	○—○	Fluometuron 1 ppm	▼—▼
		Fluometuron 1000 ppm	□—□

Ametryne at 1000 ppm did not alter the starch hydrolysing activity at any of the time periods examined. However, prometryne at this concentration induced suppression of amylase activity only at 60 hour. On the other hand 1000 ppm fluometuron drastically retarded this activity at all the time periods of analysis.

Lorenzoni¹¹ demonstrated that low doses of triazines (viz. 1 ppm) stimulate the rate and percentage of germination. Contrary to this no such stimulation was obtained at 1 ppm either by ametryne or prometryne. Yet the same concentration substantially stimulated the amylase activity, indicating that the overall metabolic system of the germinating seeds was not stimulated in comparison to the controls, and perhaps some other metabolic processes were slightly impeded. Such a hypothesis is substantiated by the fact that both ametryne and prometryne are known to inhibit respiration and the associated oxidative phosphorylation.^{12, 13}

The marked reduction of germination induced by ametryne at 1000 ppm was probably due to its high water solubility whereby substantial amount of herbicide was absorbed and affected one or more enzyme systems.^{14, 15} However, the reduction in germination was not correlated with amylase activity, since this activity remained unaffected by 1000 ppm prometryne brought about a reduction in the amylase activity at 60 hour there was no significant inhibition of germination.

Although 1 ppm fluometuron slightly promoted the amylase activity at 60 hour yet there was no increase in the germination percentage over the controls. On the other hand the suppression of germination by 1000 ppm fluometuron was probably the result of drastic inhibition of amylase activity.

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