

The Effect of Atrazine on the Growth and Dry Weight of *Lolium multiflorum* Under Different Temperature Regimes.

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ABSTRACT

An experiment was carried out at the Department of Plant Husbandry, Swedish University of Agricultural Sciences, Uppsala in 1985 to evaluate the effect of a soil-applied herbicide (atrazine) on rye grass (*Lolium multiflorum*) under different temperature regimes, i.e., 5-15, 10-20, 15-25, 20-30 and 25-30°C. Atrazine was applied to the soil in 0.5 litre plastic pots at rates of 0 (control), 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 mg/kg soil. The pots were placed in growth cabinets at the required temperatures and a suitable light intensity of 6000 lux. Pots were watered frequently to keep the adequate moisture level.

The number of days for highest emergence increased with a decrease in temperature but the herbicide doses showed only a slight effect on the time of plant emergence. The percentage of survived plants decreased with an increase in the herbicide dose but an increase in temperature decreased the survival percentage. Increase in the herbicide dose decreased the dry weight of rye grass plants but the dry weight of rye grass decreased with an increase in temperature levels. The dry weight of rye grass as a percentage

of the dry weight in the control decreased with an increase in herbicide dose, whereas the dry weight percentage increased with a temperature decrease.

INTRODUCTION

Atrazine (2-Chloro-4 ethylamino-6 isopropylamino-5-triazine) belongs to a group of herbicides which could be called substituted s-triazines. It affects photosynthesis in the plants following uptake. Residues persist in the soil for considerable periods. Atrazine shows striking selectivity in maize where it is used for pre-emergence soil treatment.

The influence of various environmental factors on the phytotoxic effect and persistence of herbicides has been discussed in literature. Bylterud (1958, 1965) obtained results from a series of field trials and a pot experiment indicating a good effect of TCA against couch when the substance is present in the soil in a period of early shoot development in combination with low temperature (with frost involved). Hakansson (1970) observed a decrease in the phytotoxic effect of TCA with an increase of daily mean temperature above 7-10°C to levels around 20°C higher. Little work seems to have been done to study the influence of temperature on the phytotoxic effect of soil-applied atrazine. The present experiment was

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carried out to study the temperature influence on the effect of soil-applied atrazine.

MATERIALS AND METHODS

An experiment was conducted at the Department of Plant Husbandry, Swedish University of Agricultural Sciences, Uppsala, in 1985 to study the effect of soil-applied herbicide (atrazine) on rye grass (*Lolium multiflorum*) under different temperature regimes. Rye grass was sown at a depth of 1.5cm in 0.5 litre plastic pots with a square cross section, in a mixture of sandy loam and low-humified organic soil. Atrazine was applied to the soil surface with water at the rate of 0.4, 0.8, 1.6, 3.2, 6.4 and 12.8 mg/ kg soil. Four pots sown with rye grass were supplied with the same quantity of pure water, as a control treatment. All herbicide treatments were replicated twice in each of five temperatures: 5-15, 10-20, 15-25, 20-30 and 25-35°C. Growth cabinets having the required temperatures and with suitable light intensity (6000 lux) were used for this experiment. Water was

applied to the pots frequently to keep the moisture content at about 70% of the maximum water holding capacity of the soil.

Observations of percentage emergence were taken when all seeds had germinated in most of the pots. The number of plants was counted in each pot on every alternative day to see the effect of the herbicide on the plants. The pots were harvested when nearly all the plants in the control treatment pots had two leaves, at each temperature. The harvest time varied between temperatures as the grass reached the two-leaf stage earlier at higher than at lower temperatures. After harvest, the aerial shoots were dried at 105°C and weighed to get their dry weight.

RESULTS AND DISCUSSION

The number of days required for maximum emergence increased with decrease in temperature (table 1). Fairly high differences were observed between the highest and the lowest temperature.

Herbicide doses showed only

Table 1. Number of days after sowing for maximum emergence of rye grass.

Herbicide dose mg/ litre	Temperature					Mean
	25-35°C	20-30°C	15-25°C	10-20°C	5-15°C	
0.0	7	10	9	11	19	11.2
0.4	7	7	7	9	19	9.8
0.8	7	7	9	9	23	11.0
1.6	7	9	9	9	19	10.6
3.2	7	9	9	11	21	11.4
6.4	7	9	9	11	17	10.6
12.8	7	7	9	11	19	10.6
Mean	7	8.3	8.7	10.1	19.5	

slight effects on the time required for emergence of rye grass. However, 0.4 mg/litre might have favoured rapid emergence as compared to other doses.

The mean percentage emergence of rye grass was lower at 25-35°C than at the other temperatures (Table 2). The herbicide showed no influence. However, the control treatment and the 0.4 mg/litre herbicide dose showed higher percentage emergence than all the other treatments.

Table 3 shows that the percentage

of survived plants decreased with an increase in the herbicide dose. The decrease in survived plants was quite visible beyond 0.8 mg/litre herbicide dose. At the highest concentration (12.8 mg/litre) of herbicide, only 4.7% of the plants survived.

Temperature also exhibited a pronounced effect on the percentage of survived plants. There was a gradual increase with decrease in temperature. The highest temperature (25-35°C) showed the lowest percentage (20.4) of survived plants where as

Table 2. Percentage emergence of rye grass seeds.

Herbicide dose mg/litre	Temperature					Mean
	25-35°C	20-30°C	15-25°C	10-20°C	5-15°C	
0.0	74	82	96	88	85	85.0
0.4	82	80	88	88	88	85.2
0.8	64	84	80	76	80	76.0
1.6	70	90	78	80	90	82.6
3.2	80	70	84	72	86	77.6
6.4	64	78	82	72	86	75.6
12.8	76	70	98	76	86	81.2
Mean	72.8	79.1	86.5	78.2	85.8	

Table 3. Number of survived plants at harvest as a percentage of the number of emerged plants.

Herbicide dose mg/litre	Temperature					Mean
	25-35°C	20-30°C	15-25°C	10-20°C	5-15°C	
0.0	89.4	100	100	100	100	97.8
0.4	23.8	95.0	100	100	97.0	83.1
0.8	18.7	71.4	95.4	89.4	92.5	73.5
1.6	5.5	21.7	30.0	65.4	68.8	38.2
3.2	5.2	16.6	19.0	44.4	53.4	27.7
6.4	0	0	0	27.7	36.6	12.8
12.8	0	0	0	5.2	18.6	4.7
Mean	20.4	43.5	49.2	61.7	66.6	

Table 4. Mean dry weight of aerial shoots of rye grass per pot(g).

Herbicide dose mg/ litre	Temperature					Mean
	25-35°C	20-30°C	15-25°C	10-20°C	5-15°C	
0.0	0.0281	0.0844	0.0745	0.1583	0.2464	0.1183
0.4	0.0044	0.0352	0.0389	0.0456	0.0518	0.0351
0.8	0.0021	0.0183	0.0188	0.0244	0.0267	0.0180
1.6	0.0011	0.0051	0.0092	0.0171	0.0199	0.0104
3.2	0.0004	0.0043	0.0061	0.0155	0.0167	0.0086
6.4	0	0	0.0016	0.0080	0.0112	0.0041
12.8	0	0	0	0.0006	0.0052	0.0011
Mean	0.0051	0.0210	0.0213	0.0385	0.0539	

the highest percentage (66.6) of survived plants was observed at the lowest (5-15°C) temperature.

The results indicate that higher temperature and higher concentration of herbicide (beyond 0.8 mg/ litre) have adverse effect on the survival of rye grass plants.

Data presented in Table 4 reveal that increase in the dose of herbicide gradually decreased the dry weight of rye grass. The effect was very much pronounced even with the lowest herbicide dose (0.4 mg/ kg) which produced a reduction of about 70% in the dry weight of rye grass (Table 5). The dry weight decreased to 2.3% and 0.5% at 6.4 and 12.8 mg/ kg herbicide doses, respectively. Even the lowest concentration of atrazine had a highly adverse affect on the dry weight of rye grass.

A decrease in temperature level increased the dry weight of rye grass at all temperature regimes (Table 4). A fairly great difference (90%) in dry weight of rye grass was observed between the lowest and highest tempera-

tures. However the difference between 20-30 and 15-25°C temperatures was not well marked. This may be due to little variation in the percentage of survived plants in the two temperature regimes, as visible from Table 3.

The dry weight of rye grass as a percentage of the dry weight in the control decreased with an increase in the herbicide dose (Table 5). The weight was reduced in the lowest herbicide dose (0.4 mg/ kg soil) and a further decrease was observed at each successive dose of herbicide. At 6.4 and 12.8 mg/ litre, the dry weight was reduced to 2.3 and 0.5% respectively.

The dry weight as a percentage of the dry weight in the control increased with temperature increase from 25-35°C (18.3%) to 15-25°C (28.5%), but there after a decrease in the percentage dry weight was recorded at 10-20°C (24.3%) and 5-15°C (21.9%).

A similar trend was observed in dry weight of rye grass plants per pot. The results indicate that the effect of atrazine was more pronounced at the

Table 5. Dry weight of rye grass plants as a percentage of the dry weight in the control treatment.

Herbicide dose mg/litre	Temperature					Mean
	25-35°C	20-30°C	15-25°C	10-20°C	5-15°C	
0.0	100	100	100	100	100	100
0.4	15.6	41.7	52.2	28.8	21.0	31.8
0.8	7.5	21.7	25.2	15.4	10.8	16.1
1.6	3.9	6.6	12.3	10.8	8.1	8.2
3.2	1.4	5.9	8.2	9.8	6.7	6.4
6.4	0	0	2.1	5.07	4.5	2.3
12.8	0	0	0	0.4	2.3	0.5
Mean	18.34	25.04	28.57	24.31	21.91	

highest (25-35°C) and lowest (5-15°C) temperatures as compared to the medium temperature regimes.

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