TEMPERATURE INFLUENCES ON SUMMER GRASS GERMINATION

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Introduction

Prairie cupgrass (Eriochloa contratus) has been increasing in alfalfa fields in the lower Colorado desert for the last ten years.

Barnyardgrass (Echinochlea crusgalli), which has been the most troublesome weed in alfalfa, is commonly controlled with preemergence treatments of EPTC. These treatments are applied with irrigation water as "water-run" applications. In many fields where EPTC has been applied, there seems to be an increase in the population of prairie cupgrass. Prairie cupgrass is a member of the genus Eriochloa.

The genus Eriochloa is a small group of plants of the subfamily Panaceae. There are 12 species in this genus, two of which occur as weeds in southern California. The Eriochloas are known as cupgrasses due to a swollen area at the base of each spikelet. The swollen area is thought to be due to vesigual glumes which have been reduced to form a "cup" at the base of the spikelet. Eriochloa species have been shown to have a C4 photosynthetic pathway. This type of photosynthesis is common in many of the most competitive warm-season weeds. C4 plants have shown the ability to fix carbon and grow under high light and high temperature. Barnyardgrass is also a member of the Panaceae subfamily and has the C4 pathway.

Two species, prairie cupgrass and southerwestern cupgrass, have been shown to occur as weeds in southern California. Of these, prairie cupgrass is the most common in the Imperial Valley.

In its seedling and early growth stages, it is often mistaken for barnyardgrass; however, at flowering it is easily distinguished from barnyardgrass by its inflorescence.

Growers and fieldmen have been concerned about the increase in prairie cupgrass and the lack of control with EPTC. Possible reasons for this increase in prairie cupgrass under EPTC treatments include:

1. Prairie cupgrass is less susceptible to EPTC and thus increases as barnyardgrass decreases.

2. Prairie cupgrass germinates earlier in the year than barnyardgrass and becomes established before EPTC application. EPTC does not have significant postemergence activity beyond the early seedling stages.

3. A combination of 1 and 2.

Methods

Greenhouse and laboratory tests were initiated in the summer and fall of 1983 in an effort to compare the herbicide and growth responses of prairie cupgrass and barnyardgrass. A temperature bar was set up at the University of California at Riverside to measure the germination responses of prairie cupgrass and barnyardgrass at varying temperatures.

The temperature bar consisted of a one-inch thick aluminum bar, 16 inches wide and 30 inches long. Holes were drilled laterally through each end of the bar. Hot water circulated through one end of the bar and cold water through the other end. This allowed for a temperature gradient down the bar. Temperatures were varied from 16 to 32°C. Petri dishes containing prairie cupgrass and barnyardgrass were placed on the bar. Grass seed of both barnyardgrass and prairie cupgrass were collected from alfalfa fields in the Imperial Valley for use in the trial. Eight temperatures were studied and four replications were made of each temperature treatment for each grass species.

A greenhouse study was initiated utilizing four-inch square pots, each of which contained seedlines of barnyardgrass and prairie cupgrass. Immediately after planting, the pots were

treated with four concentrations of EPTC (4, 2, 1, and .5 lb A.I./A) and three concentrations of CIPC (2, 1, .5 lb A.I./A). A check was included and the treatments were replicated four times. Cupgrass germination was excellent; however, barnyardgrass germination was poor. Tetrazolium tests for seed viability showed that the seeds were viable but dormant. Leaching the seed in running water for 12 hours prior to germination helped to increase seed germination sufficiently to conduct the temperature tests.

Results

In Figure 1 cupgrass showed a dramatic increase in germination at 18°C, with maximum germination occurring at 20°C. Barnyardgrass also showed a dramatic increase in germination at 18°C, although it did not attain a high germination level due to dormancy of the seeds. The germination pattern for both species was similar, with germination beginning between 16 and 18°C, and achieving maximum germination shortly thereafter. The colioptile was also measured for both species as a function of temperature at the end of one week (Figure 2). Both species showed near maximum growth at between 22 and 24°C.

Table 1 compares the control ratings for the chemical treatments of EPTC and CIPC after two weeks. A comparison of the control of barnyardgrass and prairie cupgrass reveals that both are controlled at the highest rates of application of EPTC and CIPC; however, prairie cupgrass shows a faster decline in control as the rate of EPTC application is reduced, with poorest control at .5 lb of EPTC.

Discussion

The temperature data indicated that there was no difference in the temperature at which germination was initiated for both species. The seed samples of barnyardgrass which were obtained showed relatively poor germination rates due to seed dormancy. The growth of the colioptiles with temperature was also similar for most species, although the maximum rate of growth reached with barnyardgrass was lower than for prairie cupgrass. These data seem to indicate that the threshold for germination and growth for both species is quite similar and, therefore, could not be used to explain the differences in control obtained from pre-emergence EPTC treatments.

Best control was obtained when applying either CIPC or EPTC at the highest rates. Control of prairie cupgrass declined faster as rates of EPTC were reduced than did barnyardgrass. This indicates that perhaps prairie cupgrass control could be improved by increasing the rate of EPTC application in areas where this weed is a problem. Field tests should be conducted to evaluate higher rates of EPTC for prairie cupgrass control. CIPC is registered at high rates, however, 2 lb A.I./A gave adequate control in the greenhouse study. CIPC should also be included in an evaluation program.

Figure 1. Prairie Cupgrass-Barnyardgrass Germination/Temperature Graph

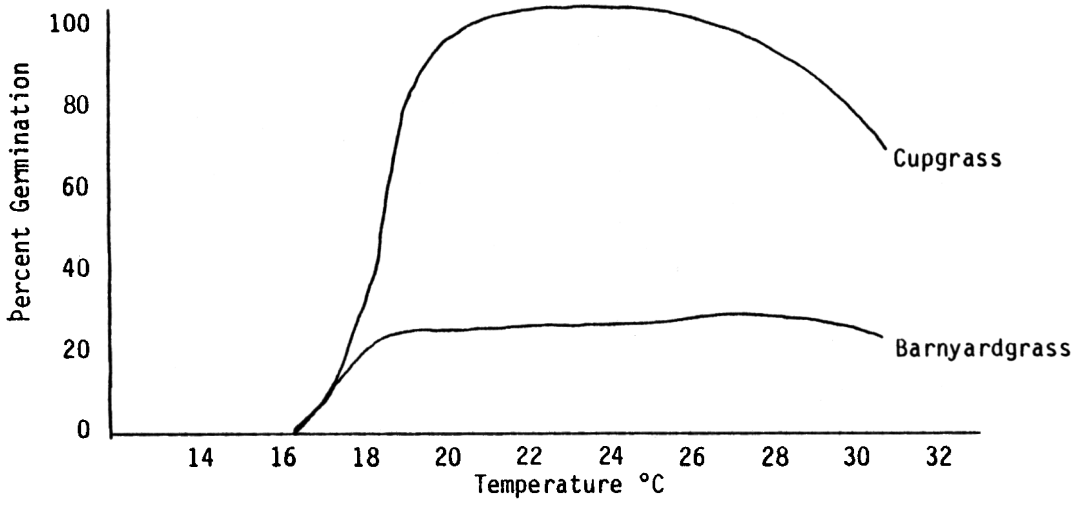

Figure 2. Prairie cupgrass-barnyardgrass coleoptile length/temperature in one week

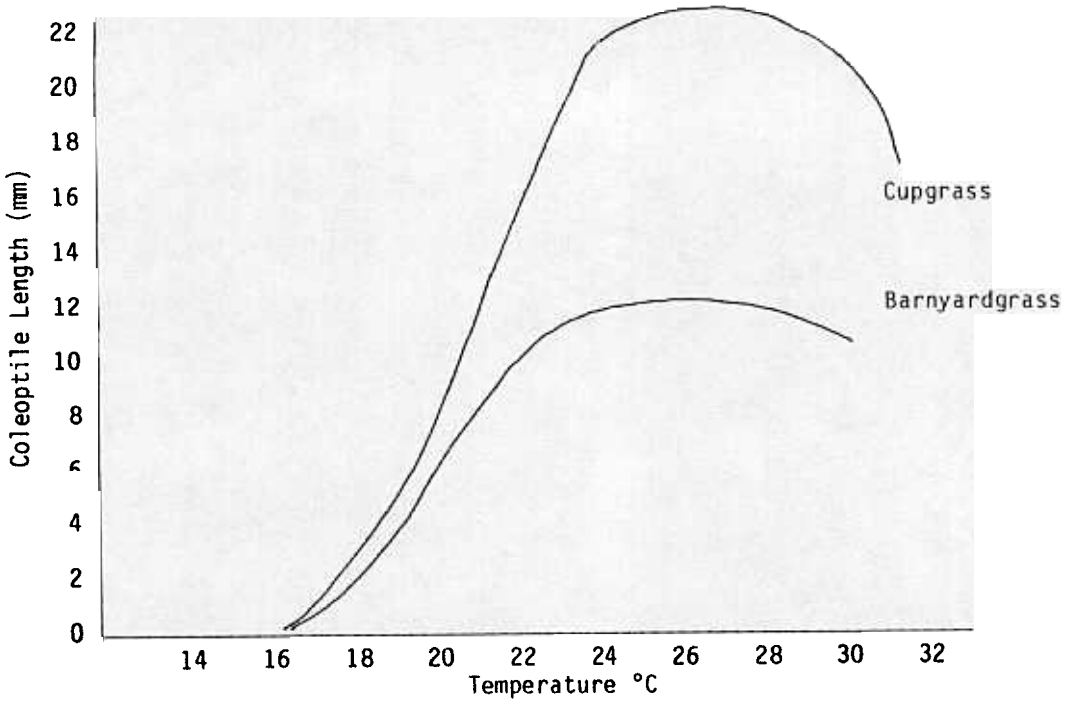

Table 1. Prairie Cupgrass and Barnyardgrass Phytotoxicity Trials, two weeks

Treatments	Rate a.i./A	Control*	
		Barnyardgrass	Prairie Cupgrass
1. EPTC	4.0	9.75	9.25
2. EPTC	2.0	9.25	7.25
3. EPTC	1.0	7.75	4.50
4. EPTC	.5	6.75	3.50
5. CIPC	2.0	9.75	9.00
6. CIPC	1.0	8.75	7.75
7. CIPC	.5	4.75	3.25
8. Check		1.00	1.00
LSD (1%)		1.4531	

*1 = no control, 10 = all plants dead.