

PEG Induced Stress on Alfalfa Seedlings

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INTRODUCTION

Alfalfa, (*Medicago sativa* L.) is the most important forage crop in Arizona. It has a higher water requirement compared to other crops, especially since it is grown all year. A laboratory study was conducted to determine the response of 2-week-old alfalfa seedlings to low levels of water stress induced by Polyethylene Glycol (PEG). The PEG was used to determine the level of stress at which significant reduction in root and shoot weight would first occur.

MATERIALS AND METHODS

Polyethylene Glycol (PEG) is an inert, high molecular weight compound that has no biological effect on the seed. It lowers the water potential of the germination media, simulating drought conditions, but does not penetrate plant tissue or directly inhibit the physiological processes involved in plant growth.

The seedlings were grown hydroponically in 7 ounce styrofoam containers filled with 70 grams of plastic beads (used for rock polishing). Thirty seeds of the alfalfa cultivar CUF-101 were placed on top of the beads, which float in the nutrient solution. Five replications of eight treatments (control, -2, -4, -6, -8, -1.0, -1.2, and -1.4 MPa) were used.

The containers were placed randomly on trays and put in an illuminated growth chamber set at 28° C. Hydroponic solution was added when needed to keep the plants growing. After a week and a half, the plants were thinned to 10 per cup and the worst replication was discarded. The remaining solution was then suctioned out of the cup. Care was taken in doing this since any solution left would dilute the concentration of the PEG.

The PEG solutions were pipetted into the cups and they were placed into the growth chamber. Three days later the plants were harvested and separated into root and shoot parts for determining dry weights.

RESULTS

Shoot dry weight showed a significant decline as PEG concentrations increased. (Figure 1). The greatest drop in above ground weight occurred between 0 and -0.8 MPa while weights were not significantly different at water potentials lower than that. PEG appeared to increase root dry weight in this study. A possible reason for the difference is that the PEG was not completely washed off the roots as it is an extremely adhesive compound.

CONCLUSIONS

This study showed that seedling growth after germination and emergence is highly sensitive to water stress, and that the greatest decline in shoot weight occurs at a water potential of greater than -0.8 MPa. Another possible explanation for the increase in root weight is that the stressed plants put more energy into their root system compared to the nonstressed plants. The PEG method was successful in determining the effect of water stress on alfalfa seedlings.

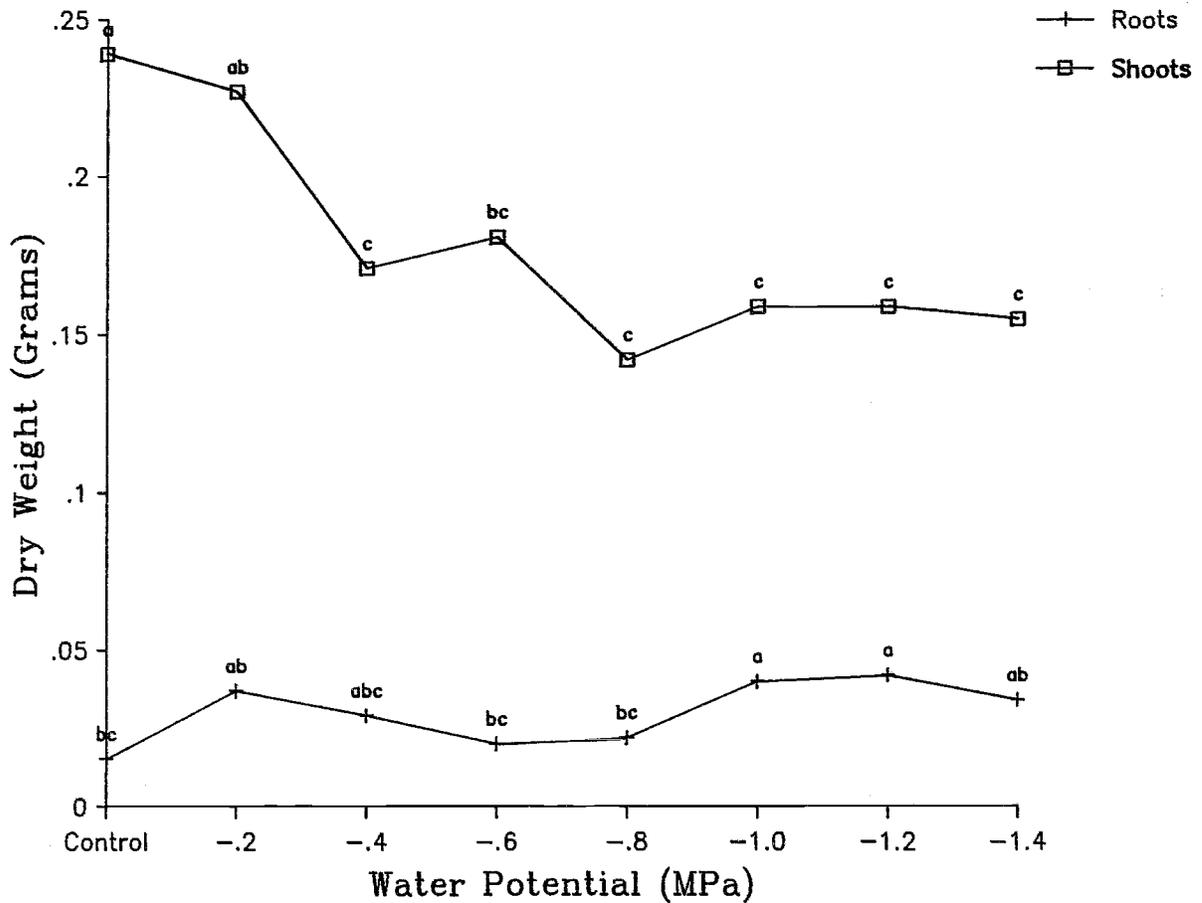


Fig. 1 The effect of eight water potentials on root and shoot weights in alfalfa. Each point represents the average of forty seedlings. Values followed by the same letter are not significantly different at the .05 level using Student-Newman-Keuls test.