

Example SURE Proposal: Biology

Proposal

In 1979 a naturally occurring class of steroidal hormones, the brassinosteroids (BS), was found to be synthesized by plants. Since the discovery of BS in plants there have been over 50 structurally different BS reported (Adam and Zullo, 2002). Although there has been much research done on BS throughout the world, the majority of the work has focused on the chemical synthesis within plants and the physiological properties of these steroids (Khripach N, Zhabinskii and Khripach V, 2003). Research is lacking in the areas of applied agriculture and horticulture especially in the United States. There has, however, been some research done on use of BS in bedding plants and crop plants in Europe and Asia. Use of these chemicals in commercial settings has been approved by the respective governments. Commercial use has not been approved within the US. Research is needed to determine the effects of application of the steroid on both the seed and developing plant under US cultural conditions. Based on research in Europe and Asia, there is evidence that application of BS is beneficial to a range of agricultural and horticultural plants. Reported benefits of treatment include decreased germination time, decreased time to maturity, and increased resistance to stresses such as drought and heat. However, specifics such as dosage, application time, application method and specific species affected have yet to be fully studied or reported.

My proposed research includes looking at the effects of one specific brassinosteroid, 24-epibrassinolide, on both the germination rate and time to maturity in common agricultural and horticultural plants. Seeds of several species including marigolds, petunias, impatiens, soybean, corn and wheat will be soaked in a range of concentrations of 24-epibrassinolide. Not only will we test the effects of exposing the seeds to the concentration recommended by previous research but also the effects of both higher and lower concentrations. Time of the emergence of the first root will be recorded as germination time, and will be compared with germination in water-treated controls. This data will be used to determine if, in fact, the germination time of the plants was decreased.

This steroid is also reported to affect the time the plant takes to mature which is a second area that we will test again in our chosen species. This will be done by application of the chemical (as a spray), again at several concentrations, directly to the growing plant. The rates of maturation will be compared to plants sprayed with water. Maturation will be monitored by several different factors: measuring leaf emergence, plant height, chlorophyll concentration, time to flowering and expansion of pods or fruits.

Following the completion of the studies above we hope to examine the ability of plants treated with 24-epibrassinolide to withstand several different increased stresses. This would include areas such as heat resistance and drought resistance. This will be tested by looking not only at application pre-germination but also to the developing plant. Exposing the growing plants not only to the chemical but also to different measurable stresses will allow us to determine if treatment with the chemical helps the plant not only to survive but remain healthy. Analysis of the increased resistance will again be done through a variety of methods including chlorophyll content, protein content, starch content, plant height, and dry weight of plant parts at harvest time.

This area of research is very interesting to me and although it will take much time and dedication I am very excited about this new area of research. I wish to enter the crop

sciences field at the time of my graduation from USD to go into graduate school in this area. The implications of commercial application of this chemical in agriculture could have enormous effects on many areas of agriculture and being part of that would be an amazing experience.

References

Adam G, Zullo M (2002), Brassino Steroid phytohormones – structure, bioactivity and applications. *Braz J Plant Physiol* 14(3):143-181

Khripach N, Zhabinskii and Khripach V (2003), New Practical Aspects of Brassinosteroids and Results of their Ten Year Agricultural Use in Russia and Belarus. S.Hayat and A Ahmad (eds.), *Brassinosteroids*, 189-230