

<<Project Title precisely describes the work with no more than 3 lines and 15 words maximum.
All numbers, chemical elements and compounds should be spelled out.>>

Student Researcher(s): Chase Krug

Chapter: Linn-Mar FFA

State: Iowa

Category:

Division:



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Abstract

<<Abstract is brief and concisely describes the purpose, methods, results and conclusions.

Abstract does not include cited references. Abstract is no longer than one page. Arrangement makes the purpose, procedure, results and conclusions clear. The abstract is worth 5 points.>>



Introduction

According to S. Basu et al. (2016), “Drought stress is the most prevalent environmental factor limiting crop productivity, and global climate change is increasing the frequency of severe drought conditions”. Plant development phases such as germination and reproduction can be severely affected by drought stress which causes a decrease in cell division and cell elongation, which contributes to a reduction in yield. Drought severely affects poor subsistence farmers who are unable to irrigate their crops during long periods of time without adequate precipitation for crop production. Innovative ideas are needed to help limit the effects of drought on crops. The use of acetic acid could help crop plants cope with drought.

Literature Review

<<The literature review details what information currently exists concerning the research project. The information includes materials used in the research and material cited such as articles about similar studies, similar research methods, history of the research area and other items that support the current knowledge base for the topic and how the project might complement existing information. The literature review is worth 10 points.>>

Materials and Methods

Hypothesis/Research Question:

Drought is the main limiting factor of crop productivity. Acetic acid

Materials:

- *Gycline max*
- Potting Soil
- 6-pack Inserts
- 30% Vinegar

1) Glycine max Seeds



- a) Dampen two sheets of paper towel.
- b) Place 100 seeds in between the moist paper towels.
- c) Place moisten paper towels with seeds into plastic bags.
- d) Place plastic bags in place at room temperature.
- e) Wait 3-4 days for germination.
- f) Repeat steps A-D for remaining seeds.

2) Planting Glycine max into Potting Soil

- a) Fill 10 of the six-pack inserts with potting soil.
- b) Place the 10 six-pack inserts into a greenhouse flat tray.
- c) Remove germinated seeds from the paper towels in plastic bags.
- d) Plant seeds at a $\frac{1}{2}$ depth into the 12 six-pack inserts.
- e) Water with distilled water.
- f) Repeat steps A-E with the remaining trays.
- g) Allow the plants to grow for two weeks, watering when soil is dry.

3) Acetic Acid Solution

- a) Measure 1L of 30% vinegar.



- b) Dilute 30% vinegar to create 1L of 20% vinegar.
- c) Dilute 30% vinegar to create 1L of 10% vinegar.
- d) Label a pair of greenhouse flats with 0%, 10%, 20% or 30% vinegar concentration.
- e) Water each flat with the designated concentration of vinegar.
- f) Allow the potting soil to absorb the solution for 20-30 minutes.
- g) Place paper towel under the six packs of each flat to absorb excess solution.
- h) Place greenhouse flats back into the indoor plastic greenhouse.
- i) Do not water the plants for 2-3 weeks.

4) Drought Test

- a) After 2-3 weeks with no water, record observations of the plants.
- b) Water plants with distilled water.
- c) After 2-3 days, record how many plants in each flat has survived.

The materials and methods section is clearly written to enable others to replicate the study and results. Section is written in third person, encompasses all materials required, states the hypothesis/research questions and explains the study design. If used, the statistical procedures are included. The materials and methods section is worth 15 points.>>



Results

<<Written results of the project are summarized. Trends and relationships are clearly addressed. No conclusions are made in this section. Data that can stand alone in the form of tables and/or figures are included. The results are worth 20 points.>>

Discussion and Conclusions

<<Brief recap of the results is included and shows how they were the foundation of the study. Sound reasoning is shown that conclusions are based on results, incorporates previous literature and relates directly to the hypothesis. Discussion refers/references to facts and figures in results section and provides recommendations for practice, future research and the impact on the agriculture industry. The discussion and conclusions are worth 20 points.>>

Acknowledgements

<<Detailed list or paragraph is included acknowledging anyone who assisted with any aspect of the project and how they helped. The acknowledgements are worth 5 points.>>



References

Kim JM and To KT et al. (2017) *Acetate-mediated novel survival strategy against drought in plants*. Retrieved from Nature Plants.

The authors of the article researched how the addition of acetate when applied to *Arabidopsis* plants increased the plant's drought resistance by triggering an epigenetic switch. The epigenetic switch influences the metabolic flux conversion and hormone signaling by which plants adapt to drought. This article is important to my research to understand how this epigenetic switch influences the pathways which regulate a plant's drought resistance. We can use this pathway to provide drought tolerance to plants in areas which experience low precipitation or frequent drought. If this epigenetic pathway can be triggered efficiently in many crop plants it could provide a radically new method to prevent widespread crop loss.

M. Farooq, M. Hussain, Abdul Wahid and K. H. M. Siddique (2012, October 12) *Chapter 1 Drought Stress in Plants: An Overview*. Retrieved from Plant Responses to Drought Stress From Morphological to Molecular Features

The authors describe the morphological effects of drought on crops and how drought is a major constraint in crop production. According to the article, agricultural drought is defined as the lack of ample moisture required for normal plant growth and development to complete the life cycle. Drought affects the plant's ability to regulate turgor in its cells. When a plant experiences drought, cell division and elongation are reduced contributing to lower yield. This article is important to my research, to understand the plant mechanisms which take place when exposed to drought. These mechanisms could be targeted to improve a plant's resistance to drought.

S. Basu, V. Ramegowda, A. Kumar and A. Pereira (2016, June 30) *Plant adaptation to drought stress*. Retrieved from National Center for Biotechnology Information

The authors of the article describe the variety of drought adaptation techniques used by plants and plant breeders to limit the effects of drought. According to the article drought escape is the ability of a plant species to complete its life cycle before the onset of drought. The plants do not experience the environmental stress which limits yield. Drought avoidance is defined as the plants ability to maintain a high tissue water content while there is a reduced water content in the soil. The plant can maintain a high tissue water content through the traits such as increased rooting. Drought tolerance is defined as the ability of plants to endure a low water tissue content. This article is important to my research to understand how various plant traits increase a plant's ability to maintain its water content.

A. Lenssen (2012, June 22) *Soybean Response to Drought*. Retrieved from Iowa State University Extension and Outreach Integrated Pest Management

The author of the article describes when a soybean is the vulnerable to drought stress. The germination and reproductive phases are the most vulnerable development stages to drought stress. Without proper soil moisture soybean seeds fail to absorb enough water to begin germination which results in poor germination rates. During the reproduction development phase drought stress increases flower abortion rates, reduced pod number, reduced seeds per pod and



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small seed size. This article is important for my research because it explains how drought stress can cause reductions in yield by affecting important developmental phases in soybeans. References contain significant, published and relevant sources.

The references section is worth 5 points.

