The Effects of Water Stress on Early Germination in Winter Wheat

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Introduction:

- Drought is a major issue in wheat production globally and in Nebraska.
- Drought can have a dramatic effect on wheat, particularly during germination.
- Rapid emergence of winter wheat is important for satisfactory stands of wheat crops (Lindstrom et al., 1976).
- Later establishment of the crop in the fall due to late germination may lead to a lower yield.
- Few studies (Wuest and Lutcher, 2012) have evaluated the potential genetic differences of wheat cultivars under water stress conditions in terms of germination.

Purpose:

- To compare germination of ten Nebraska wheat cultivars under water stress conditions.

Methods:

- Wheat cultivars were selected: Anton, NuPlains, Pronghorn, Trego, Wesley, Goodstreak, NE05448, Overland, Robidoux, and Settler CL with differing WUE (water use efficiency).
- Soil water release curve was created to choose water treatments (-1.9 MPa (megapascal), -1.8 MPa, -1.7 MPa).
- Twenty seeds of each variety were placed in each petri dish filled with soil and measured water treatments (8 ml (milliliter), 9.1 ml, 10 ml).
- Filter paper was set on top of the soil, and seeds were placed on top of the filter paper in order to see the development (Wuest and Lutcher, 2012).
- Petri dishes were placed lid side down in the incubator (21°C) for the radical to grow towards the lid and easier to see (Wuest and Lutcher, 2012).
- Germination was scored on the fifth day and twelfth day after watering, and germination scoring ended on the twenty-fifth day.
- When a 5-millimeter radicle sprouted from the seed, it was considered as germinated (Wuest and Lutcher, 2012).
- Results were statistically analyzed by analysis of variance.

Results:

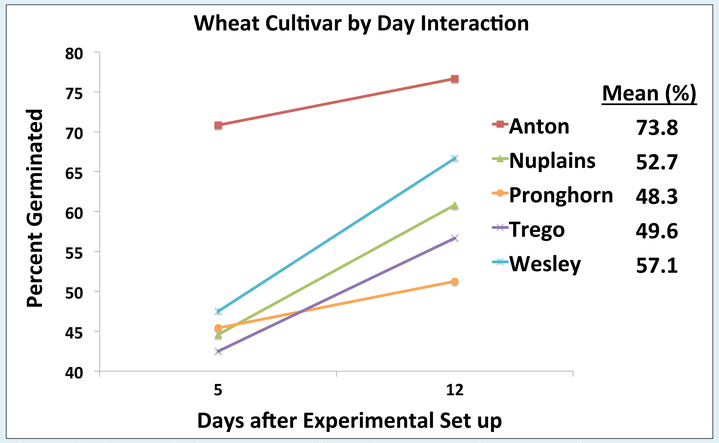

Figure 1. The graph depicts a significant interaction between wheat cultivar and days after the experiment was set up ($p<0.0001$).

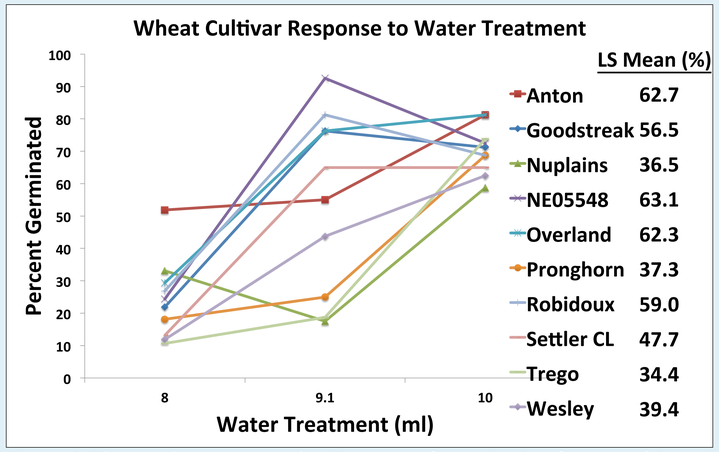

Figure 2. The graph represents the LS means of germination for ten cultivars in response to water treatment.

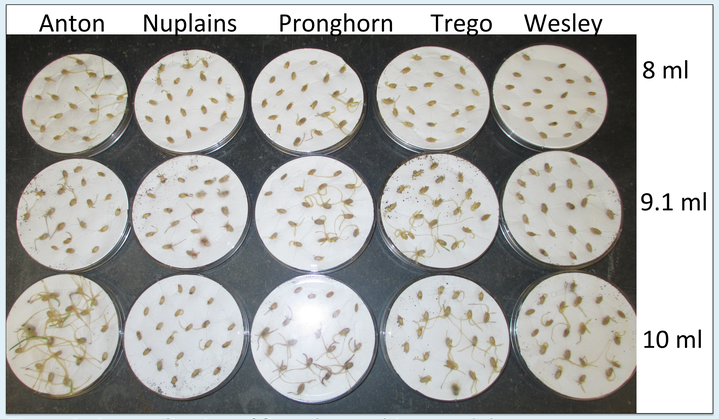

Figure 3. One replication of five wheat cultivars and three water treatments in petri dishes representing a 2x2 factorial design on the fifth day.

Discussion:

- Anton showed significantly higher germination ($p<0.05$) which is supported by previous work that found Anton to have low tolerance to pre harvest sprouting in humid areas (Graybosch, R., et al., 2013).
- Wesley had nearly as high germination as Anton which is inconsistent with previous work that found Wesley to be the most tolerant to pre harvest sprouting (Graybosch, R., et al., 2013).
- Pronghorn was least responsive to water treatments which is inconsistent with previous work that found Pronghorn to have lower tolerance to pre harvest sprouting (Graybosch, R., et al., 2013).
- Wheat cultivars were significantly different as well as water treatment ($p<0.05$, $p<0.0001$).
- 8 ml significantly differed from 9.1 ml and 10 ml ($p<0.05$) but 9.1 ml and 10 ml did not differ ($p>0.05$).
- Day 12 showed significantly higher germination than day 5 ($p<0.05$).
- Although the variety by treatment interaction was not significant ($p>0.05$), it appeared that Anton, Goodstreak, Overland, NE05448, and Robidoux were more responsive to water treatments than the others ($p<0.05$).

Conclusion:

- Germination was different across wheat cultivars and water treatments.
- Anton reached the highest percent germination at all water levels.
- For further research, testing other cultivars with these procedures can help to evaluate germination and WUE under water stress conditions.
- Measuring the coleoptile length instead of the radicle in seeds is an efficient way to evaluate the germination rate (Erayman M., et al., 2006).

Literature Cited.

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