



The Influence of the Environment on Soybean Seed Nutritional Composition

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Introduction

Soybean yield, oil, and protein are influenced by the genotype, and the environment. Other soy-nutritional compounds may also be sensitive.

Alpha-tocopherol: Vitamin E, stabilizes membranes by scavenging free oxygen radicals, preventing heart diseases and cancers and enhancing the immune system.

Lutein: absorbs high energy blue radiation (447nm) and protects the macular of the eye reducing the risks of cataracts, macular degeneration, and other eye diseases.

GABA (γ -aminobutyric acid): a neurotransmitter inhibitor in the brain -- proposed as a anti-hypertension compound.

Objective: Determine the climate parameters that influence changes in the concentration of nutritional seed compounds in short-season soybean cultivars.

Materials & methods

Short-season soybean cultivars were grown in a replicated yield trial at Ottawa, Canada from 2001 to 2013.

Yield, oil and protein concentration were determined each year and a seed sample preserved in cold storage for lutein, α -tocopherol, and GABA determination.

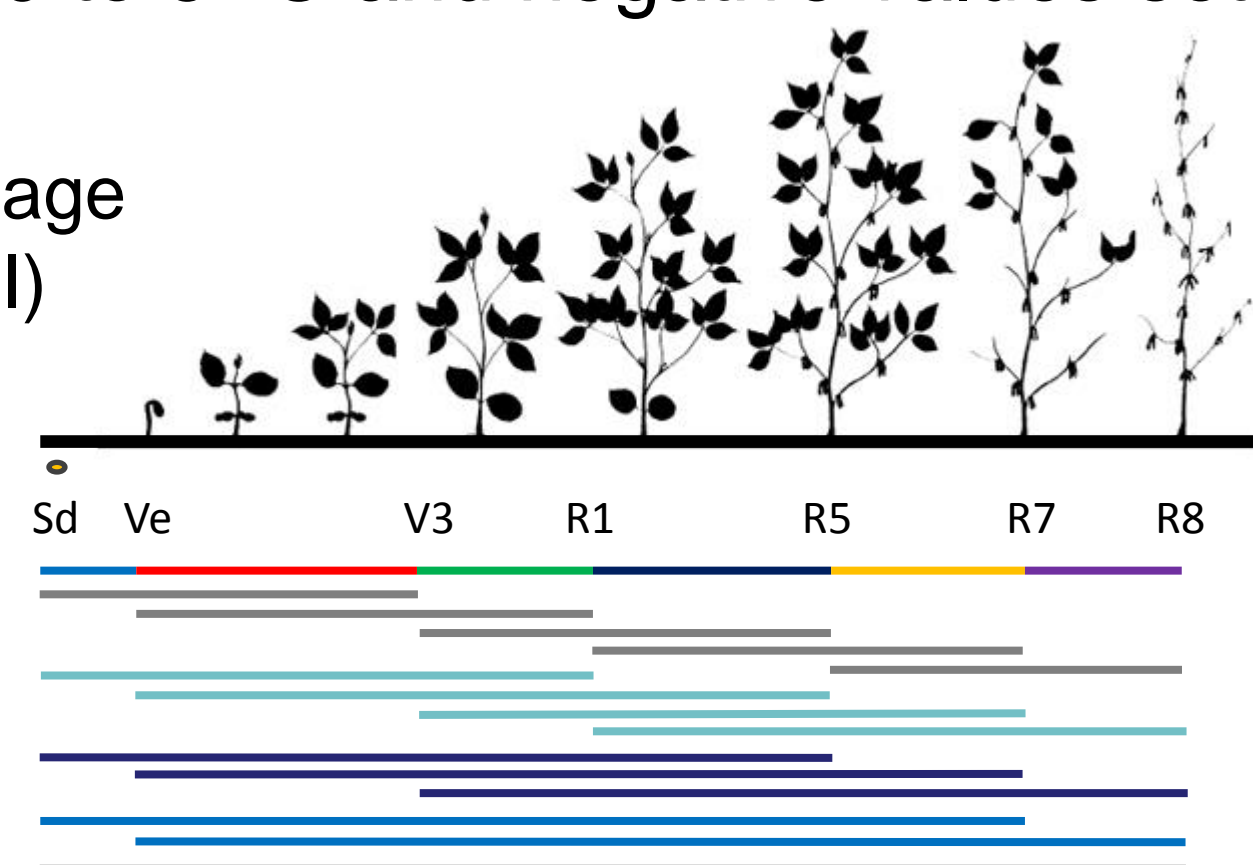
Phenology and climate data bases were established each year. Seven growth stages were noted -- when combined these produced 21 different growth stage intervals (GSI).

Climate parameters determined for each GSI per year, were correlated with the seed component and the most significant presented.

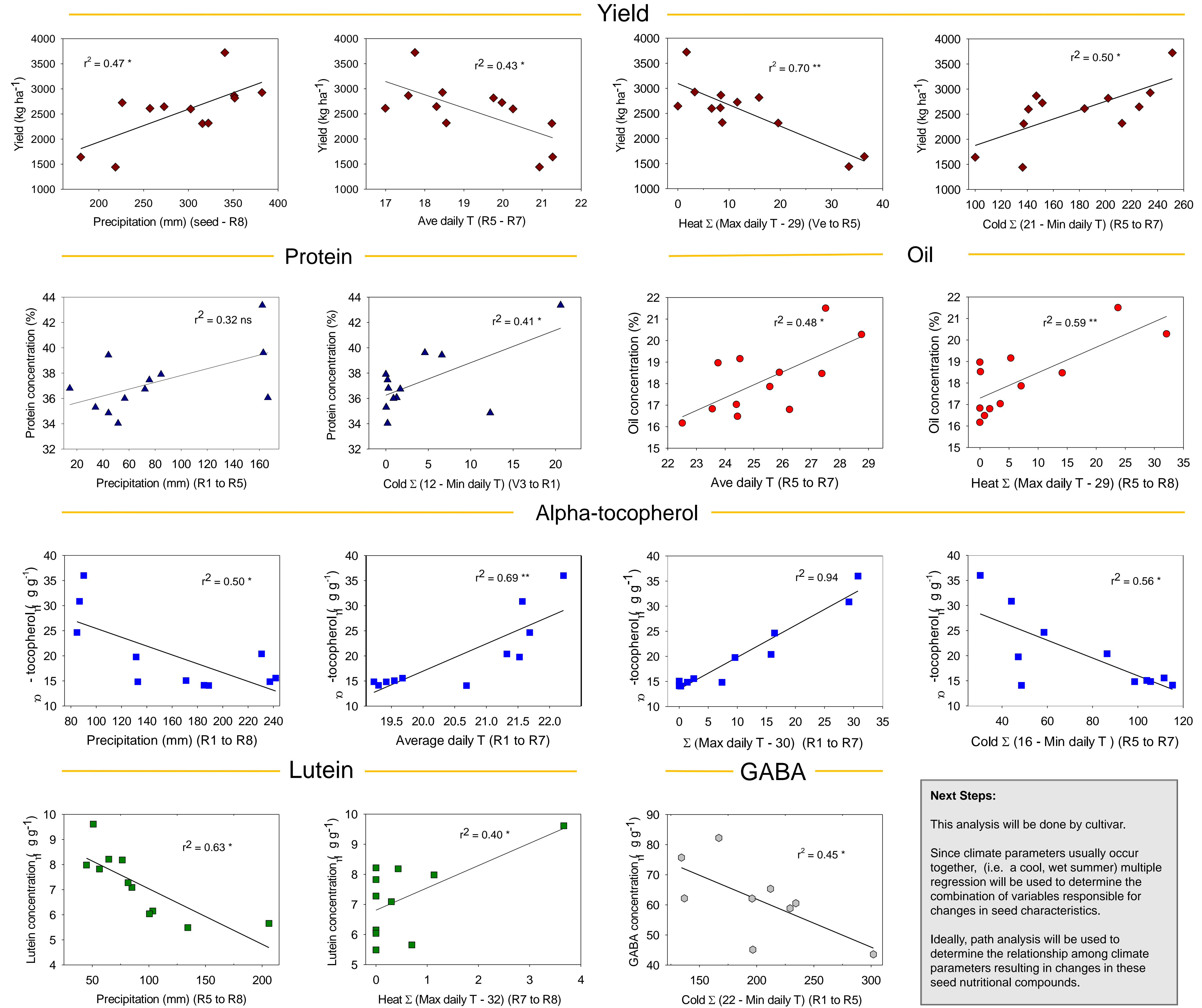
Climate Parameters calculated per GSI

- Sum Precipitation (mm),
- Average daily T, Average daily Max T, Average daily Min T
- Cumulative heat = Σ (daily Max T – base T_H) where T_H varied from 20 to 36 °C and negative values set to 0.
- Cumulative cold = Σ (base T_C – daily Min T) where T_C varied from 20 to 5 °C and negative values set to 0

21 Growth Stage Intervals (GSI)



Results



Next Steps:

This analysis will be done by cultivar.

Since climate parameters usually occur together, (i.e. a cool, wet summer) multiple regression will be used to determine the combination of variables responsible for changes in seed characteristics.

Ideally, path analysis will be used to determine the relationship among climate parameters resulting in changes in these seed nutritional compounds.

Conclusions

- High yield was associated with increased precipitation during the growing season and cool ave daily T resulting from lower Min daily T during seed development. Yield decreased as ave daily T increased and max daily T exceeded 29 during seed initiation.
- Cool T during late vegetative development and increased precipitation resulted in increased protein.
- High average T during seed development resulting from Max daily T exceeding 29 resulted in high oil concentration.
- Alpha-tocopherol concentration decreased as precipitation during flowering to seed development and Min daily T during seed development increased. High average daily T resulting from Max T in excess of 30 resulted in increased alpha-tocopherol.
- Lutein concentration was higher under dry and hot conditions during seed development and ripening.
- GABA concentration decreased with low min daily T during flowering.