

Implications of nitrogen enhancement as an Integrative Pest Management (IPM) strategy

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Research Questions

- How will N fertilizer (urea) alter the macronutrient ratios of wheatgrass and other cereal crops?
- How will plants with elevated N levels affect herbivory levels? How about locust preference and performance?

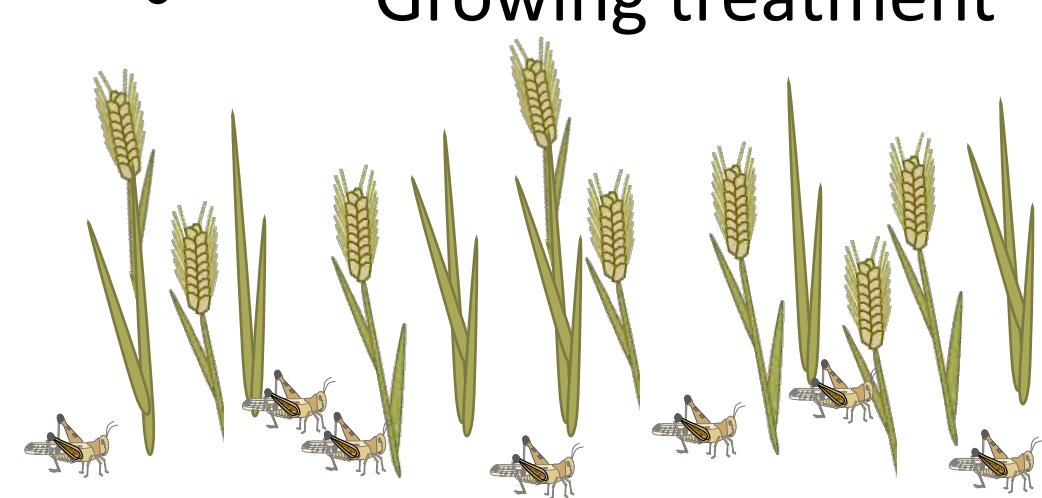
Background

Integrative Pest Management (IPM)

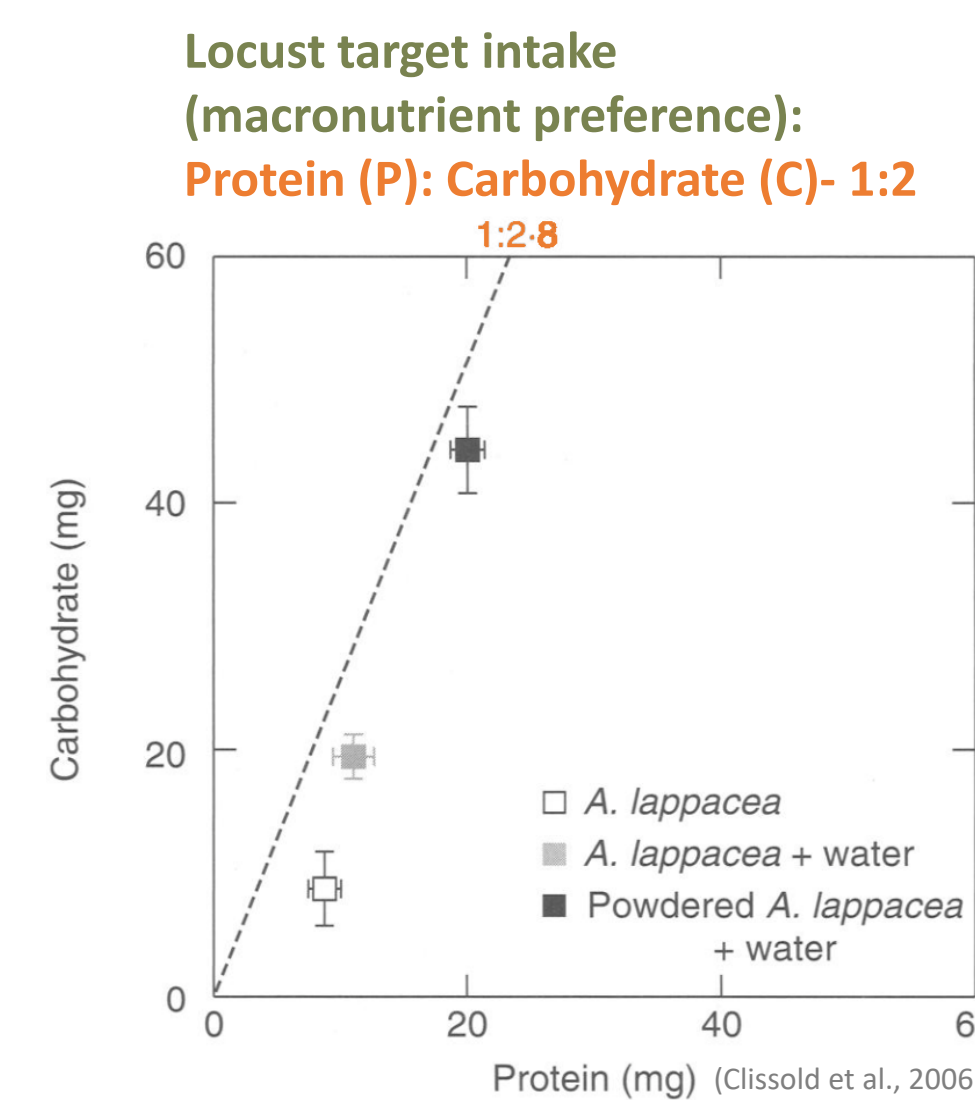
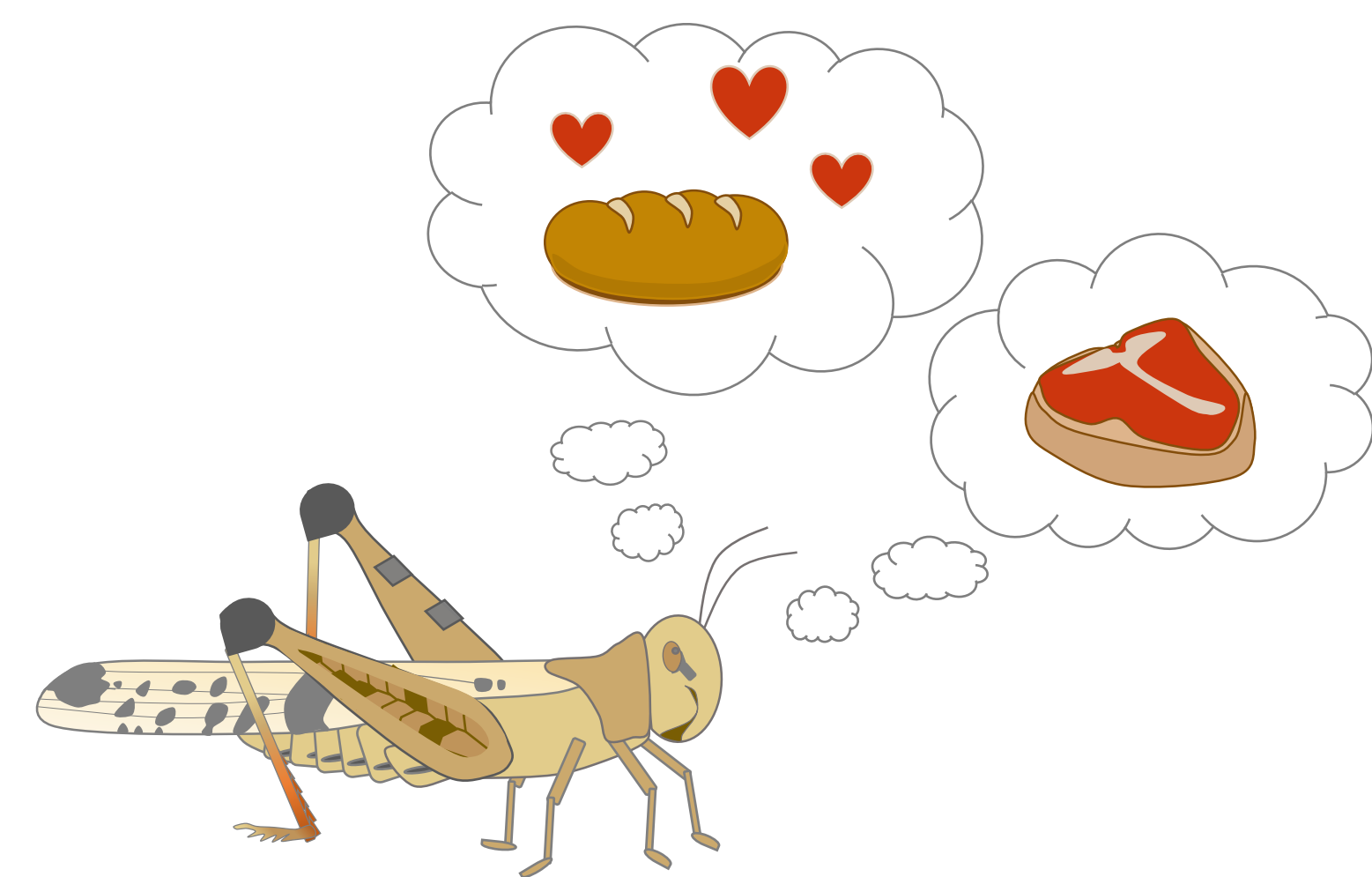
Preventative pest control strategy(s) that are economical while minimizing externalities for producers, society and the environment (Kogan, 1998)

- E.G. Altering:**
- Nutrient content
 - Soil Quality
 - Growing treatment

To reduce locust abundance and increase yield

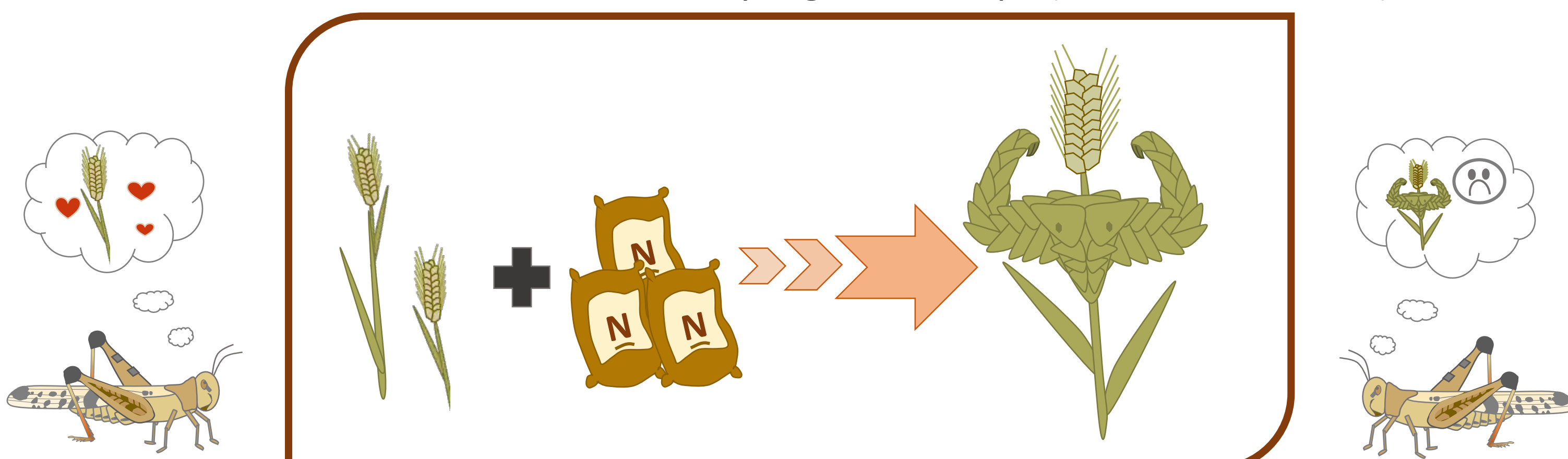


IPM techniques could be used to prevent locust herbivory of Australian cereal crops including corn, barley, wheat, and sorghum.



Many locust species have shown to be carbohydrate limited, so growing protein-rich crops would make it more difficult for locusts to meet their macronutrient needs therefore hindering their reproduction and survival (Clissold et al., 2006).

Additionally, locust prefer low N concentrations in crops suggesting that locust outbreaks could be inhibited by high N in crops (Cease et. al, 2012)

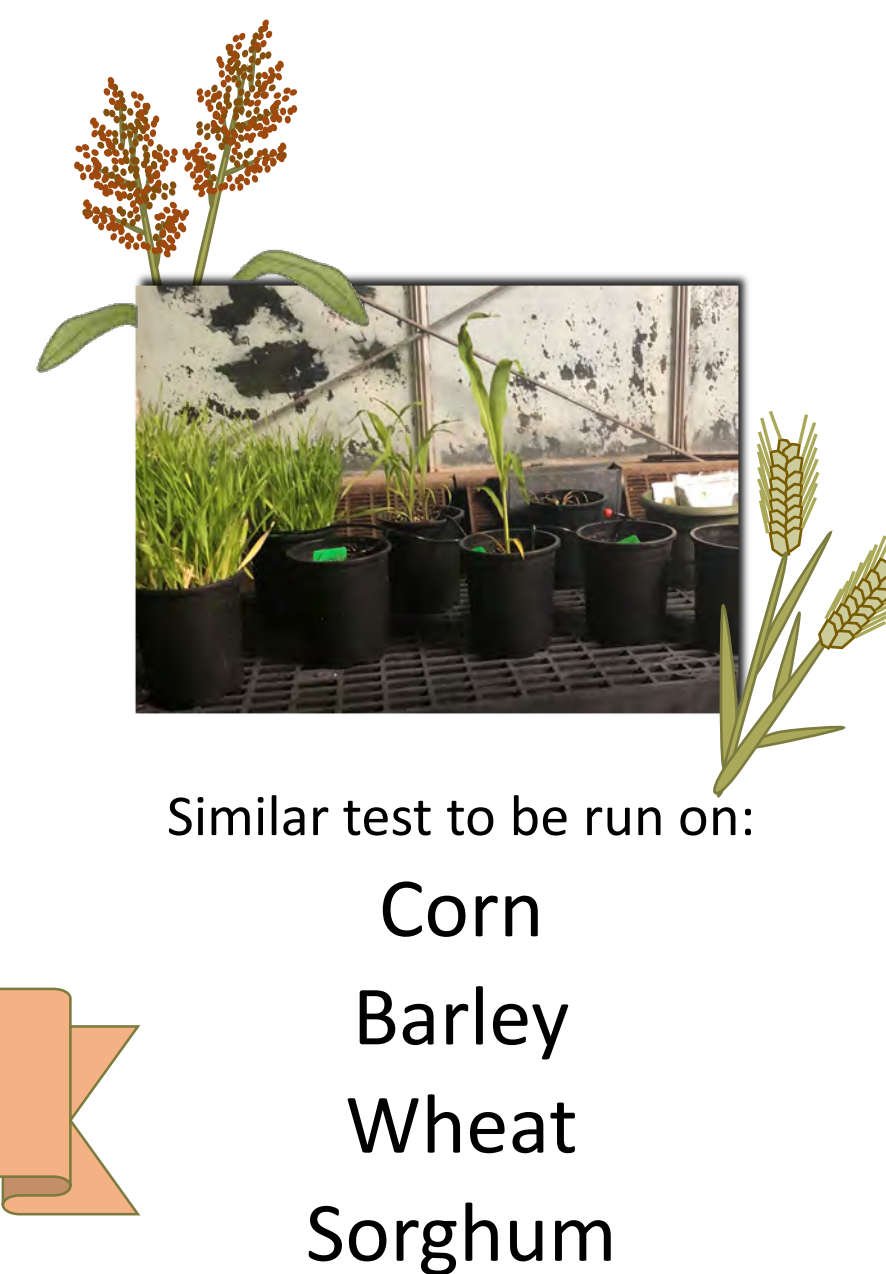
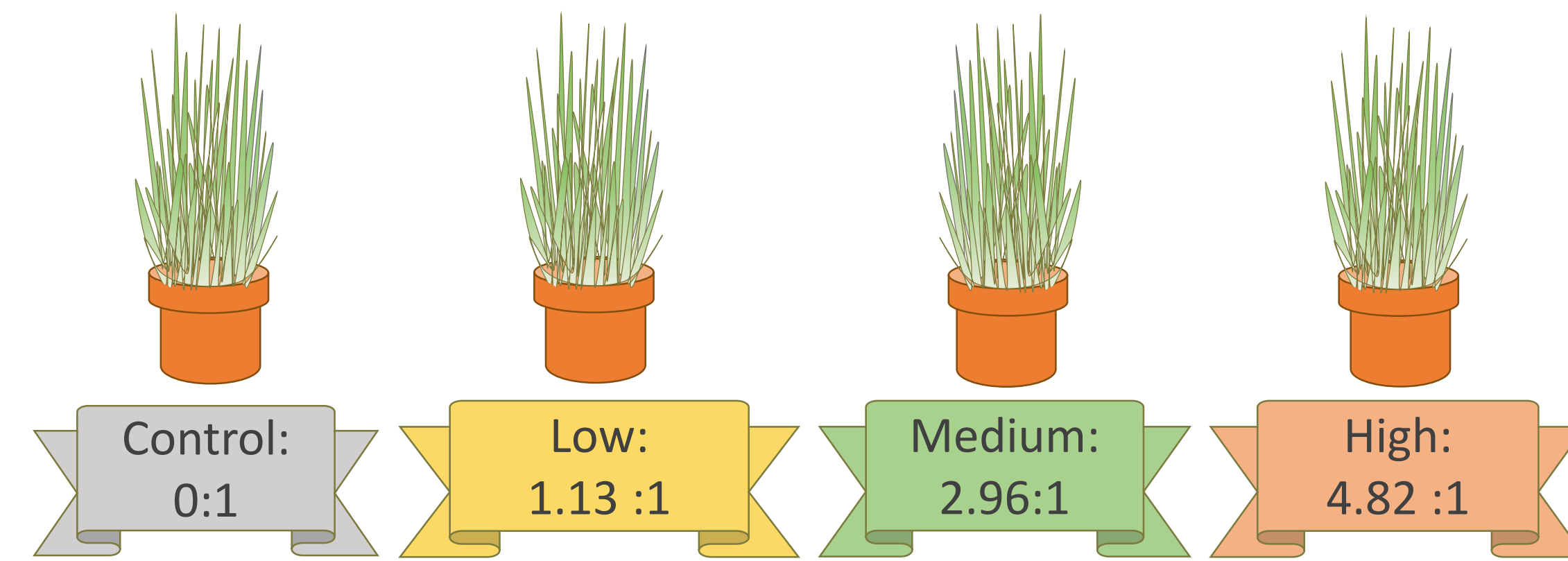


Nitrogen (N) is critical to protein synthesis in plants, so N high content of soil implies protein-rich forge. Knowing this, the experiment examines how N treatment alters the protein and carbohydrate ratios of various cereal crops to create nutritionally undesirable food for locusts.

Methods

Growing Cereal Crops

Wheatgrass treated with varying amounts urea (N) fertilizer (grams) : cups of water



Analyze macronutrients of each treatment group:

Nitrogen : Protein : Carbohydrate

Data analysis using T tests and Analysis of Variance (ANOVA)

Different disciplines use distinct nutritional measurements. The implications of this IPM strategy are valuable in the fields of agronomy and nutritional ecology, so tests were run using common metrics in each field.

Nutritional Ecology

Chemical Carbohydrate Assay (non-structural carbohydrates)

Bradford Protein Assay

CHN Assessment

Determines:

- Total Carbon, Hydrogen and Nitrogen in a sample
- Can use this N to calculate crude protein of the sample

Agronomy Metrics: Forge Quality

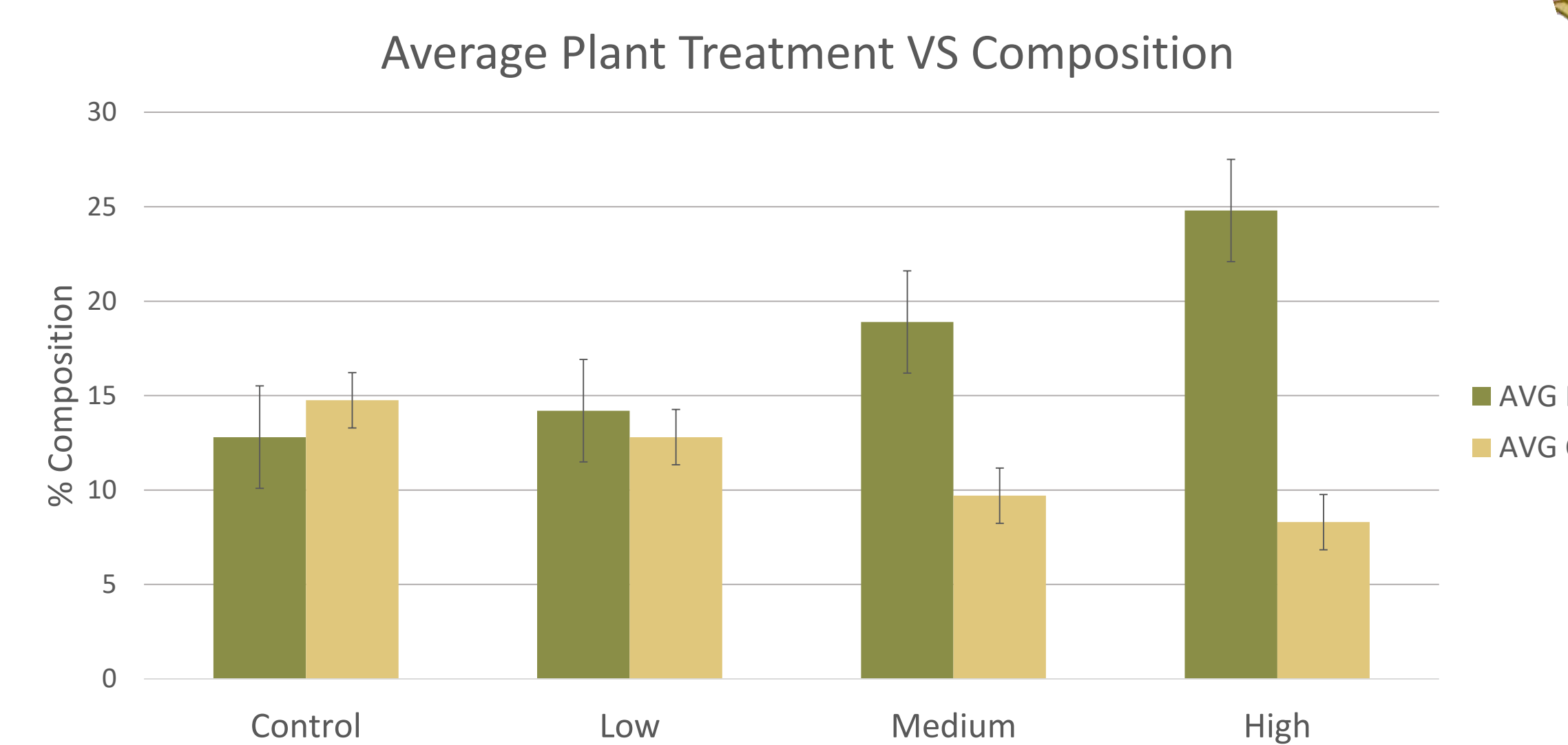
Near-infrared Reflectance Spectroscopy (NIRS)

Determines:

- Crude protein (CP)
- Neutral Detergent Fiber (NDF)- Total fiber of the forge measured. Sample boiled in acid solution measuring: Cellulose, hemicellulose, lignin & ash
- Acid Detergent Fiber (ADF)- Least digestible components measured. Sample boiled in acid solution measuring: Cellulose, lignin & ash

Expected Results

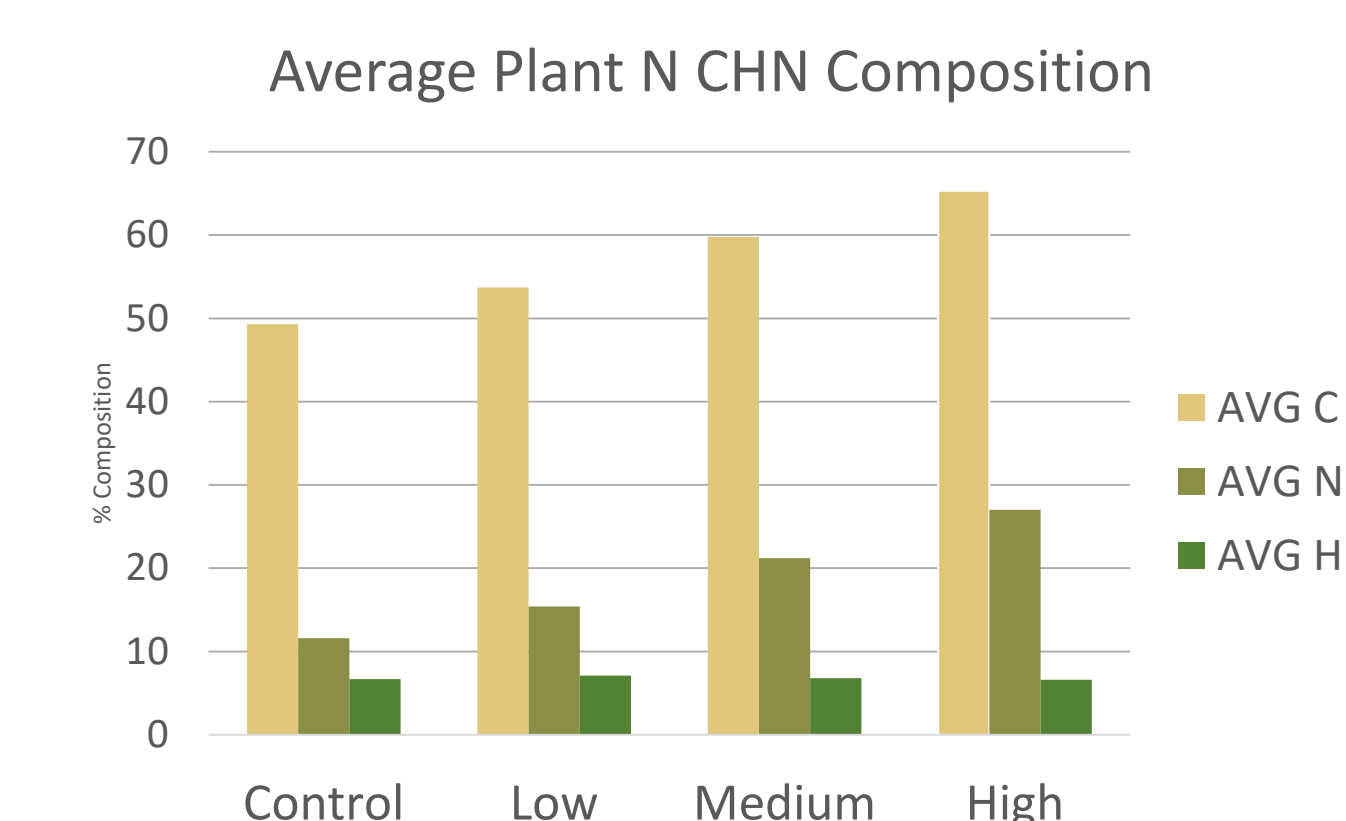
Expected Bradford and Carbohydrate Results



Because N is stored in plants as protein, it is expected that the increase in N will subsequently increase the protein content of each of the cereal crops while reducing the carbohydrate content.

Nutritional Ecology

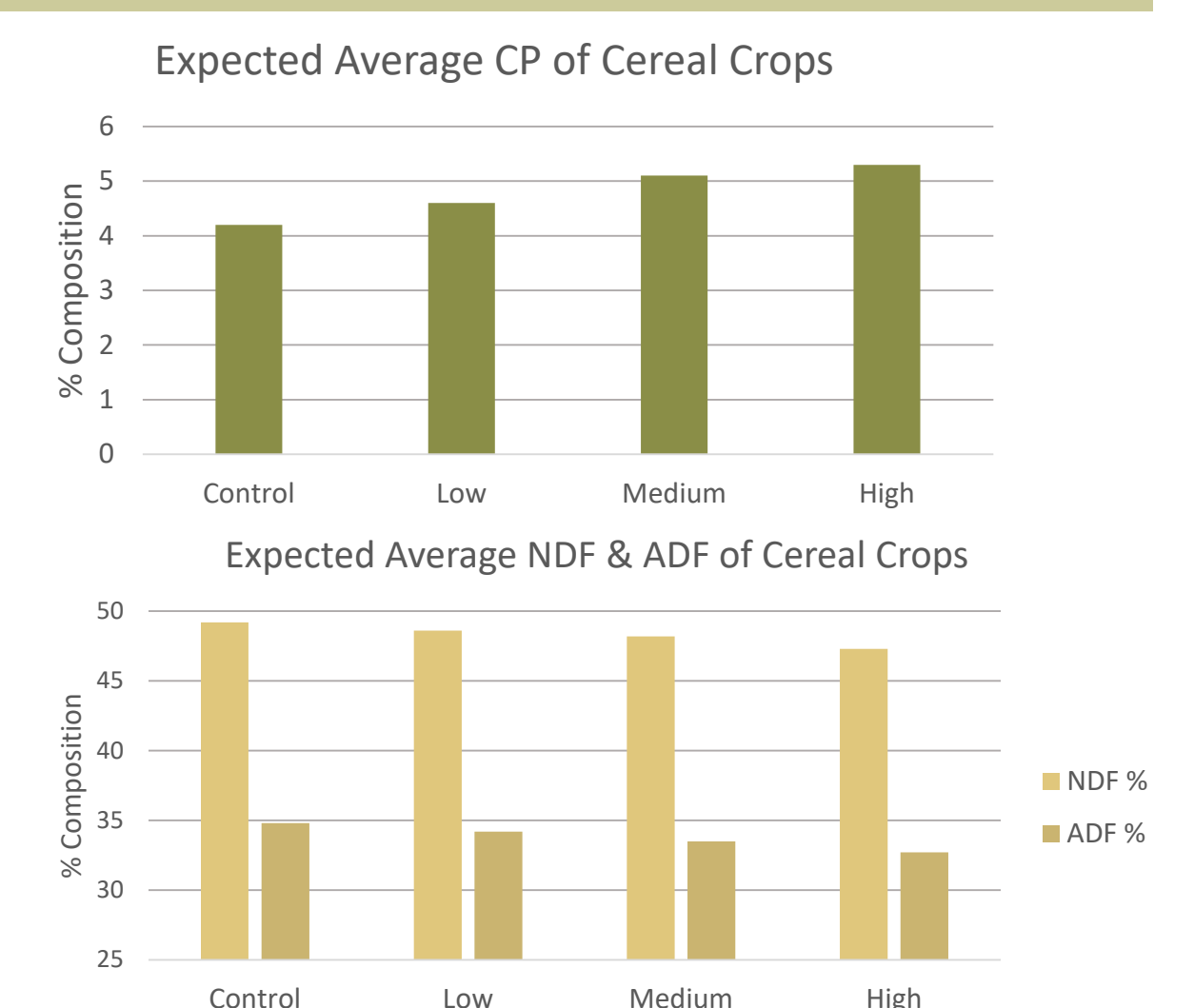
Expected CHN Results



Up to a certain point, N increases plant growth and facilitates higher protein in plant tissue. Therefore, it is expected that carbon (C) and N content will be positively correlated. It is further expected that N content will be positively correlated with CP content, and negatively correlated with NDF and ADF.

Agronomy: Forge Quality

Expected NIRS Results



Workplan

- Complete macronutrient tests on urea treated wheatgrass samples.
- Grow samples of corn, barley, wheat, and sorghum in controlled greenhouse using different N treatments.
- Complete macronutrient analysis on each of the cereal crop samples.

Acknowledgements & References

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