AMINO ACIDS AND BIOSYNTHESIS BYPRODUCTS AS NITROGEN SOURCES FOR CORN PRODUCTION

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INTRODUCTION

Byproducts resulting from the industrial synthesis of amino acids for feed-use may provide a significant and considerable supply of nutrients for crop production, particularly nitrogen (N). Iowa has a strong amino acid biosynthesis industry, resulting in a continuous supply of byproducts. Byproduct utilization as a N source for crop production may enhance revenues for amino acid producers and Iowa farmers. Little information is available on the use of amino acid byproducts as a source of nutrients in crop production.

OBJECTIVES

Evaluate corn response to tryptophan (TRP) and lysine (LYS) biosynthesis byproducts as N sources in isonitrogenous N fertilization treatments:

- Different levels of dry TRP when replacing ammonium nitrate.
- Combinations of liquid TRP byproduct with different levels of LYS byproduct.

MATERIALS & METHODS

- A field experiment was conducted in 2013 near Ames, IA on a Clarion Series soil (fine-loamy, mixed, superactive, mesic Typic Hapludolls). The study site was cropped with soybeans the previous year.
- The experimental design was a randomized complete block with four replicates. Corn was planted at 79,000 seeds ha^{-1} with a full-season hybrid (Pioneer 33W84). Dry and liquid treatments were applied pre-plant and immediately after planting, respectively. Ammonium nitrate and ammonium sulfate were applied with a Gandy spreader, while both the dry and liquids TRP and LYS byproducts were broadcast. All treatments were adjusted to 196 kg N ha^{-1} (Table 1).
- The growth, developmental and yield parameters studied in this study are shown in table 2.

Figure 1. Field after dry treatments applications.

Table 1. Percentage nitrogen by source in eight iso-nitrogenous treatments.

Treatment	Formulation	TRP Product	TRP Byproduct	LYS Byproduct	Ammonium Nitrate	Ammonium Sulfate
		----------%----------				
1	Dry	0	0	0	100	0
2	Dry	7	0	0	93	0
3	Dry	15	0	0	85	0
4	Dry	30	0	0	70	0
5	Liquid	0	100	0	0	0
6	Liquid	0	50	50	0	0
7	Liquid	0	25	75	0	0
8	Dry	0	0	0	0	100

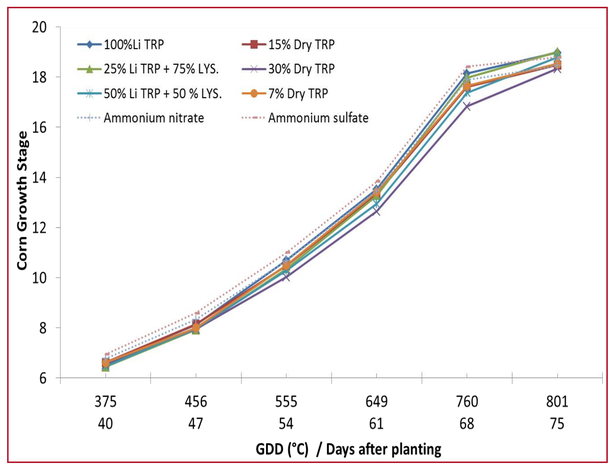
Table 2. Parameters measured during the study

Parameter	Stage for Measurements	Equipment / Method Utilized
Phenological Development	V8 – R5	Collar Method
Chlorophyll readings (SPAD)	V8 – R5	SPAD-502 Meter (Konica Minolta, Osaka, Japan)
Leaf Area Index (LAI)	V8 – R5	Decagon AccuPAR (Decagon Devices Inc., Pullman, WA)
Normalized Difference Vegetative Index (NDVI)	V8 – R5	Crop Circle ACS-210 Active Canopy Sensor (Holland Scientific, Lincoln, NE)
Corn Biomass and Yield Components	R6	Dobermann, 2005
Corn Grain Yield	2 weeks after R6	Dobermann, 2005
Grain Quality	2 weeks after R6	NIRS

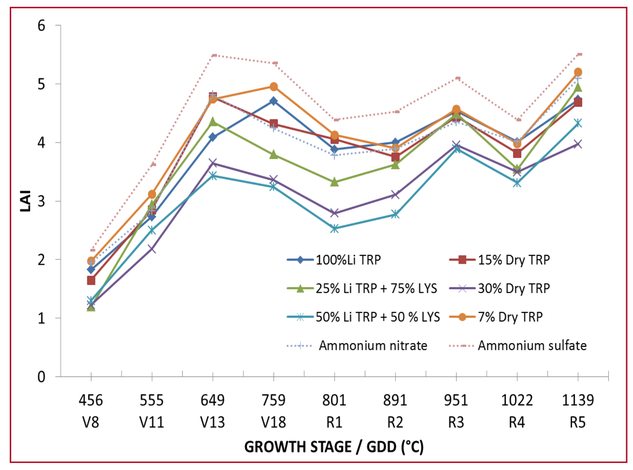
Figures 2 & 3. Field data collection SPAD readings and hand harvesting at R6.

RESULTS

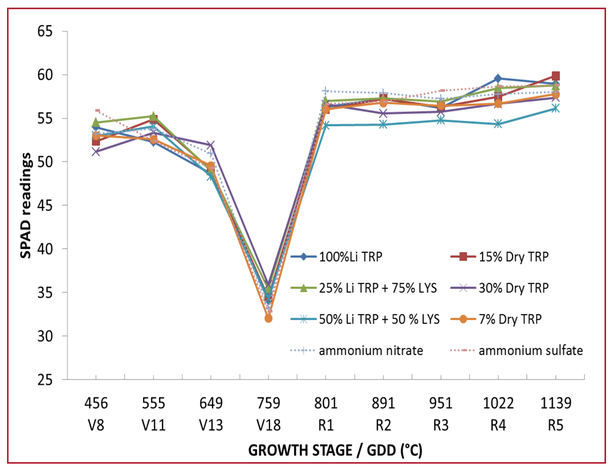
Corn Development



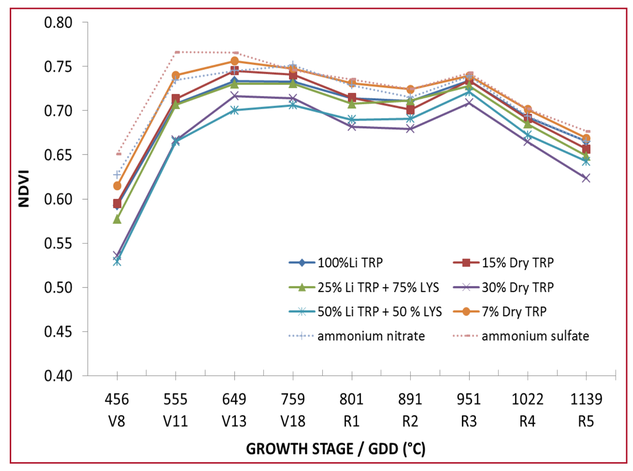
LAI



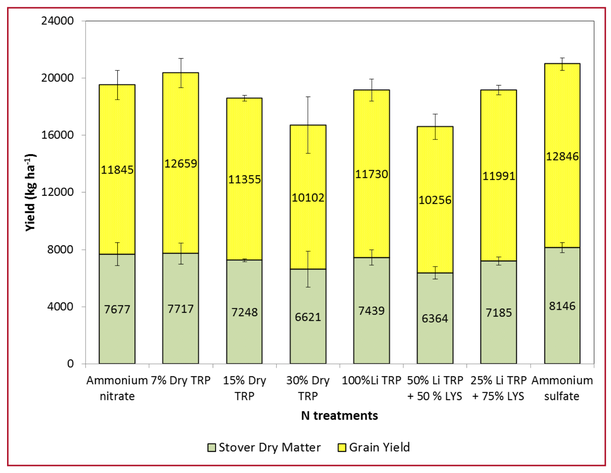
SPAD Readings



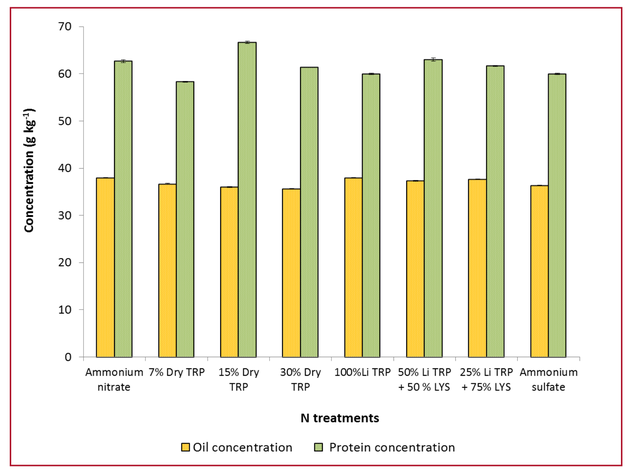
NDVI

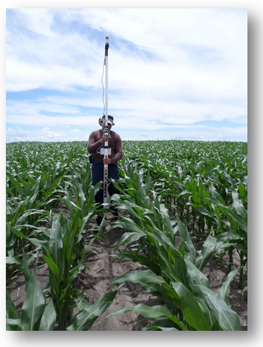


Corn Grain and Stover Yield



Grain Oil and Protein





CONCLUSIONS & FUTURE WORK

- First year results document that replacement of ammonium nitrate and ammonium sulfate with TRP, LYS or their biosynthesis byproducts did not influence corn growth and development, grain or stover yield.
- Our experiment is being repeated in 2014.

ACKNOWLEDGMENTS

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