

Predicting yield loss using early season leaf area indices

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Problem Statement

- ❖ Weeds in cropping systems negatively impact productivity in several ways including yield loss.
- ❖ Typical yield loss models that rely on density fail to account for the relative size of weeds through the season.
- ❖ Having the ability to accurately and quickly predict yield loss will allow growers to better plan for future years and make necessary management adjustments.
- ❖ Models, such as Kropff & Spitters (1991) that use relative leaf area of weeds may lead to a more accurate yield loss estimation

Objective

- ❖ To test the effectiveness of the Kropff & Spitters model on yield loss predictions in corn, soybean, & cotton.

Materials & Methods

- ❖ Field Location: Upper Coastal Plain Research Station in Rocky Mount, NC (35.89, -77.68).
- ❖ An existing dataset was used with yield and leaf area Index (LAI) of Corn, Soybean, and Cotton planted in two densities and in weedy/weed free conditions.
- ❖ The Kropff & Spitters model was applied to the weedy plots and compared to the average yields from the weed free plots to determine % loss.

$$YL = \frac{qL_w}{1+(q-1)L_w}$$

q = Competition Coefficient
 L_w = Relative leaf area of weeds

$$L_w = \frac{LAI_w}{LAI_c + LAI_w}$$

LAI_c = Crop LAI
 LAI_w = Weed LAI

Results

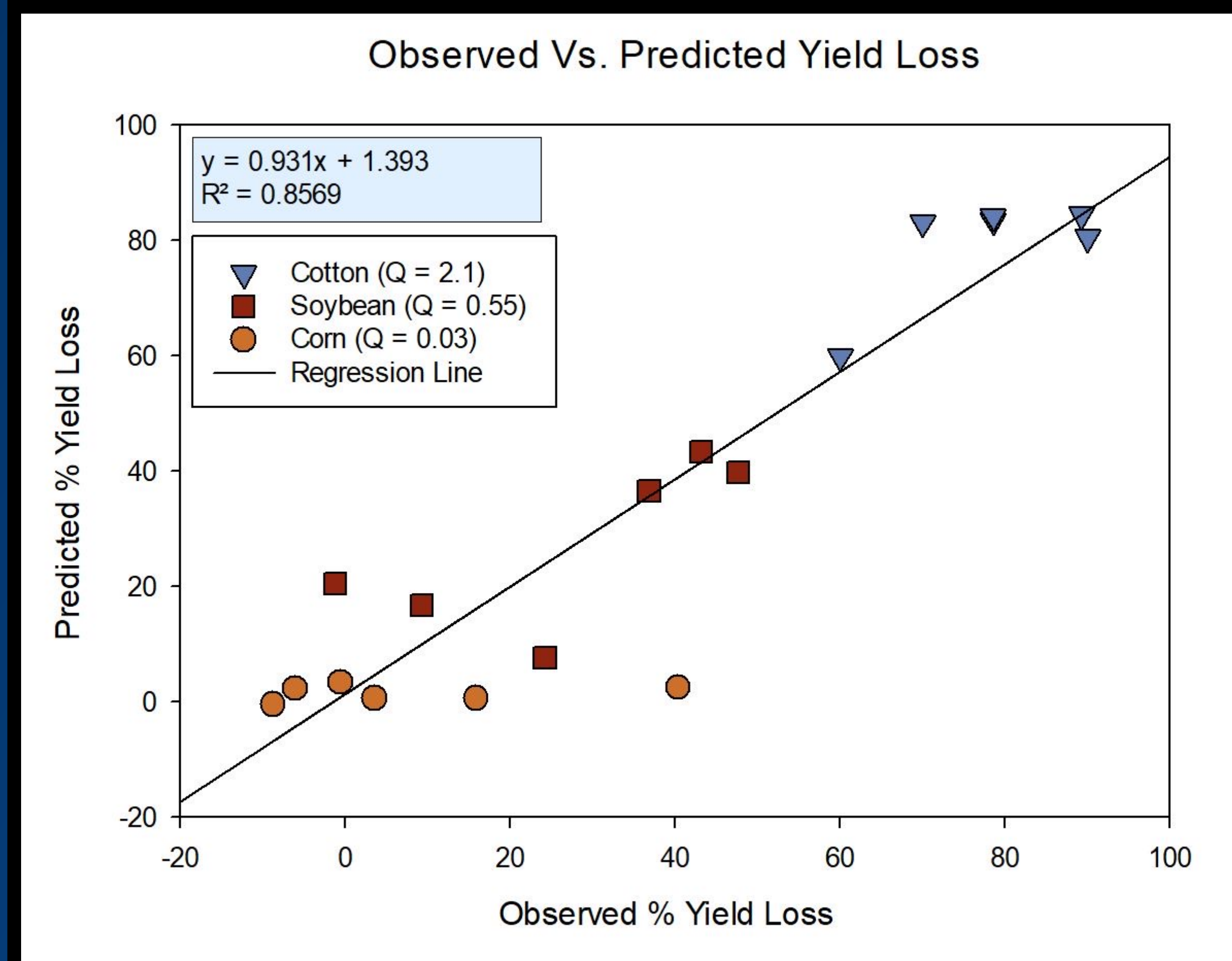


Figure 1: Observed vs Predicted yield loss in Corn, Soybean, & Cotton. The observed yield from the weedy plot was compared to the average weed free yield of the same species/planting density.

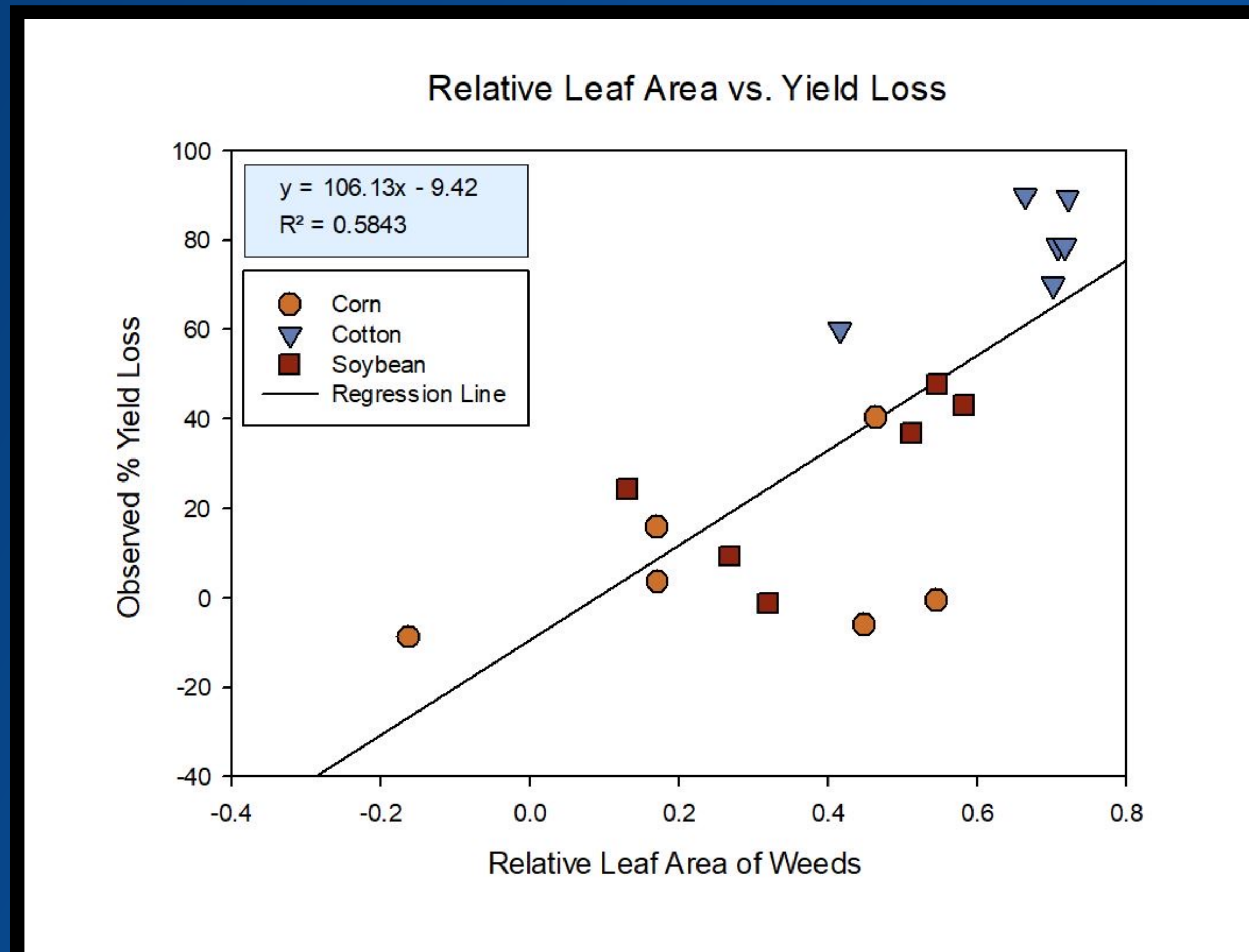


Figure 2: Weed relative leaf area vs Observed yield loss. Leaf area was determined just before canopy closure at 83 days after planting for all species.

Table 1: Plant density (plants per acre) for each species at single (D1) & Double densities (D2)

Crop	D1 Plants Per Acre	D2 Plants Per Acre
Corn	21,781	43,562
Soybean	58,097	116,194
Cotton	29,069	58,138

Table 2: Average yield across treatments

Crop	D1 Weedy Yield lbs/Acre (Weed Free)	D2 Weedy Yield lbs/Acre (Weed Free)
Corn	15,847 (16,345)	15,049 (17,043)
Soybean	6,977 (9,469)	6,177 (8,572)
Cotton	996 (5,580)	1,593 (5,979)



Figure 3: Aerial view of corn densities

Conclusion/Relevancy

- ❖ Kropff & Spitters accurately predicts yield loss across crop species.
- ❖ Weed relative leaf area is somewhat related to yield loss.
- ❖ Time and labor efficiency can be greatly improved through aerial imaging systems.

Kropff, M. J., & Spitters, C. J. T. (1991). A simple model of crop loss by weed competition from early observations on relative leaf area of the weeds. *Weed Research*, 31(2), 97–105.
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