Silage Corn Hybrid Response to Row Spacing and Plant Density in the Intermountain West

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Introduction

- Silage corn is an important feed for dairy cattle in the Intermountain west because it is a forage that produces high yields and energy (Roth, 1995).
- Increase of nearly 200,000 dairy cows from 2004 to 2014.
- Utah and Idaho have nearly doubled total corn hectares harvested over a 10 year period (+44,000 ha).
- Optimum plant population and row spacing for silage corn in the Intermountain West have yet to be determined.
- Previous study on corn row spacing showed a 4.2% yield increase with narrower row widths (Cox, 1998).

Figure 1. Irrigated corn plots in Jerome, ID with row widths 51-cm (left) and 76-cm (right). Should growers consider planting corn in narrow rows?

Objectives

- Determine the row spacing and plant density to optimize silage corn yield and quality in Utah and Idaho.

Materials & Methods

Research Sites

- North Logan, UT (2015 and 2016) study was conducted at the USU Greenville farm. The soil is a Millville Silt Loam. Previous crop was fallow (2015), and safflower (2016).
- Jerome, ID (2015 and 2016) Study was located on a commercial corn field. Soil is a Rad Silt Loam. The previous crop was corn both years.

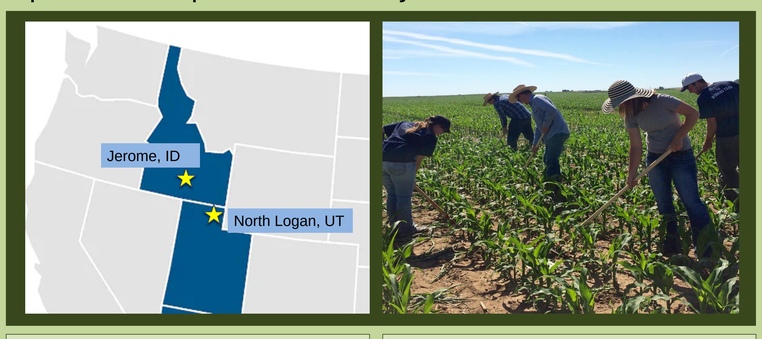


Figure 2. Sites are located approximately 320 kilometers apart. Both sites were sprinkler irrigated.

Figure 3. Plots were planted at 135,900 plants ha^{-1}. And hand thinned at 5th leaf collar stage to exact plant density.

Materials & Methods Continued

Study Design: Randomized complete block split-split plot (Replicated 4x)

- Hybrid (Whole plot):
  - Dekalb 49-29 (99-RM)
  - Dekalb 56-54 (106-RM)
  - Dekalb 61-88 (111-RM)
- Row spacing (Sub plot):
  - Row spacing: 76 or 51-cm
- Plant density (Sub-sub plot):
  - Plant Densities: 61776, 74132, 86487, 98842, 111197, 123553 plants ha^{-1}
- Plot size: 4 (0.76-m) or 5 (0.51-m) rows wide by 9.1 m
- Statistics: Means were compared using t-tests (P≥0.05)

Data Collection and Analysis:

- At Silking Stage (AccuPAR LP-80)
  - IPAR (Intercepted Photosynthetically Active Radiation)
  - LAI (Leaf Area Index)
- Stalk Diameter:
  - 10 plants per plot (internode)
- Yield:
  - Center rows used for yield weight, and sample

Figure 4. Aerial view of Plot layout, hybrid differences, and row spacing at North Logan, Utah

Results

DEPENDENT VARIABLE	HYBRID (H)	ROW WIDTH (R)	PLANT DENSITY (P)	H X R	H X P	R X P	H X R X P
STALK DIAMETER	<.0001	<.0001	<.0001	0.2123	0.0475	0.4996	0.9279
IPAR	<.0001	0.0039	<.0001	0.1454	0.3079	0.7251	0.8924
LAI	<.0001	0.0008	<.0001	0.0878	0.3134	0.3494	0.5111
DM YIELD	<.0001	0.0026	<.0001	0.0011	0.1910	0.3576	0.6837

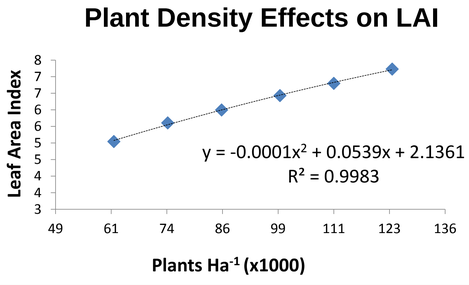
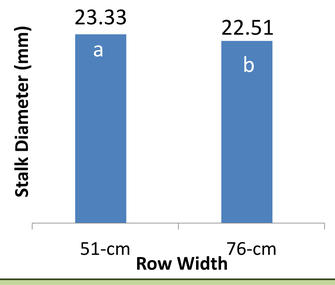


Figure 4. LAI measurements were taken at ground level when the 111-RM reached silking stage. Leaf area Index increased as plant density increases as predicted.

Row Spacing Effects on Stalk Diameter

Figure 5. Stalk diameter measurements were taken when the 111-RM hybrid reached silking stage. Measurements were taken from ten consecutive plants in the center of the plot.



Results cont.

Row Spacing and Hybrid Effects on Yield

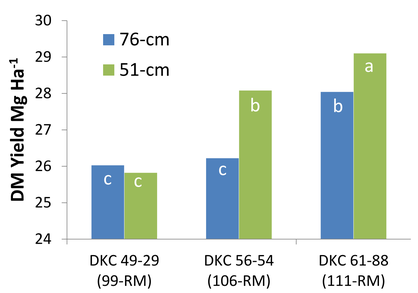
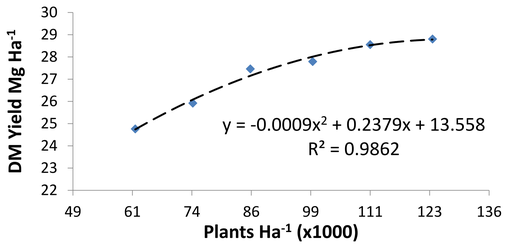


Figure 5. Row spacing can effect total DM yield. Means with same small letters are not statistically different. Row widths effect on yield are hybrid dependent. DKC 49-29 showed no difference. DKC 56-54, and DKC 61-88 responded positively to narrower row widths.

Plant Population Effects on Yield

Figure 6. As plant density increases DM yield increases all the way to 123,500 plants ha^{-1}. Both locations showed similar results.



Conclusions

1.Yield increases of 4-7% were achieved by narrowing to 51-cm row spacing. Doesn't hold true for every hybrid.

2. DM yield increased through 123,553 plants Ha^{-1}, although optimal plant densities are likely around 86,486-98,841 plants Ha^{-1} when considering economics of seed, fertilizer, and irrigation.

Figure 5. One harvest pass was taken for 76-cm row widths and three harvest passes were taken for 51-cm row widths. Corn plots are blown into weigh bin then dumped, and a 1000g sample is taken for analysis and moisture.

References

Cox,W.J., D.R. Cherney and J.J. Hanchar. 1998. Row spacing, hybrid, and plant density effects on corn silage yield and quality. Journal of Production Agriculture 11:128-134

Roth, G.,D. Undersander, M. Allen, S. Ford, J. Harrison, C. Hunt et al. 1995. Corn Silage Production, Management, and feeding. ASA, Madison, WI. NCR574

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