Effects of Plant Spacing Variability and Non-Uniform Emergence on Corn Yields

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Abstract

Plant spacing variability and non-uniform emergence in corn (*Zea mays L.)* is not uncommon in Louisiana corn fields. Variation in planting depth, non-uniform surface crop residue distribution in no-tillage systems, microsite variation in the seed bed condition, and seed vigor are major factors responsible for uneven emergence. Also, planters with low precision in seed placement and careless planting operations can cause uneven spacing. Six plant spacing treatments or variability scenarios at 34,000 plants per acre were evaluated which included: perfect spacing, seed skip, double seeded, seed misplace by 1/4, seed misplaced by 1/2, and seed misplaced by 3/4.The non-ideal planting outcomes compared to the perfect spacing did not always result in lower grain yield. The skip planting outcome was the only one that yielded less. Also, the double planted outcome produced more yield than the other five planting outcomes. There were no differences in yield for perfect spacing, seed misplaced by 1/4, seed misplaced by 1/2, and seed misplaced by 3/4 outcomes. A second study consisted of a zero, two, and four leaf delay in corn emergence. Both the two and four leaf delay treatments reduced yields by 10 and 23%, respectively. The objective of these studies was to quantify the effects of plant spacing variability and non-uniform emergence on grain yield of corn.

Introduction

In corn production, uniformity of plant distribution within the row, along with plant density and row spacing, has been a subject that has received much attention in the past (Liu et al., 2004). Agronomists and corn producers have assumed that evenly spaced stands of corn have greater yield potential than unevenly spaced stands. Duncan (1984) proposed a theoretical basis for plant competition effects on corn grain yield. The yield of a single corn plant is reduced by the presence of competing neighbors, and the amount of yield reduction for a given environment depends on how near and how numerous the neighboring plants are. Improved uniformity of within row plant spacing is expected to decrease plant-to-plant competition and increase grain yield through more efficient use of available light, water and nutrients by the plants (Shubeck and Young, 1970). Nafziger et al. (1991) reported that delayed emergence of part of the stand reduced grain yield from 6 to 22%. The reduction in yield increased as the percent of the stand that was delayed increased, and with a longer delay. Reported research results, however, are mixed regarding corn response to variation to within-row plant spacing. Also, potential yield benefits from improving within-row plant spacing variability in corn production are often questioned by growers in Louisiana.

Objectives

1. To quantify the effects and of plant spacing variability on grain yield of corn.
2. To quantify the effects of plant emergence variability in gran yield of corn.

Materials/Methods

Two studies were conducted at the Dean Lee Research and Extension Center located near Alexandria, Louisiana. The first study consisted of six plant spacing treatments or variability scenarios at 34,000 plants per acre were evaluated which included: perfect spacing, seed skip, double seeded, seed misplace by 1/4, seed misplaced by 1/2, and seed misplaced by 3/4. Plots were initially planted at 90,000 plants per acre and hand-thinned to achieve the desired plant spacing treatment. Experimental design was a randomized complete block with six replications. Each plot contained eight subplots of either 2, 3, or 4 plant groupings. Plot sizes were four rows by 45 feet in length and on 38-inch centers. Subplots were located on rows two and three. Previous crop was soybeans. The date of planting was on March 17, 2017. Soil type was a Coushatta silt loam. Hybrid was DeKalb DKC67-72. Plots were hand harvested on August 15, 2017. Hand harvested ears were mechanically shelled and total weight in grams and percent moisture were recorded. Analysis of variance was performed on grain yield using ARM 2017 (Gylling Data Management).

A second study consisted of a zero, two, and four leaf delay in corn emergence. Experimental design was a randomized complete block with six replications. Plot sizes were four rows by 45 feet in length and on 38-inch centers. Rows 1, 2, and 4 were planted with a John Deere planter and row three was hand planted. Each plot contained ten subplots of either the 0, 2, or 4 leaf delay emergence grouping which consisted of three plants. In each subplot, the second or middle plant was planted late to obtain either the two or four leaf delay. The date of planting was on March 17, 24, and 31, 2017, respectively for the 0, 2, and 4 leaf delay emergence treatments. Previous crop was soybeans. Soil type was a Coushatta silt loam. Hybrid was DeKalb DKC67-72. Plots were hand harvested on August 15, 2017. Hand harvested ears were mechanically shelled and total weight in grams and percent moisture were recorded. Analysis of variance was performed on grain yield using ARM 2017 (Gylling Data Management).

Table 1. Corn grain yields resulting from various plant spacings.

Planting outcome	Plant Spacing	Yield[1]	Loss/Gain in Grain Weight[2]	Grain yield[3]
		Grams	LBS of Grain	% of yield @ Prefect Spacing
Perfect Spacing	X X X	3332 b	0	100
Skip	X X	2558 c	-0.24	76
Double	X X X X	3991 a	0.11	111
Seed misplaced by ¼	X X X	3283 b	0	100
Seed misplaced by ½	X X X	3537 b	0	100
Seed misplaced by 3/4	X X X	3455 b	0	100

[1]Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.05; LSD).
[2]The gain or loss of yield of the 2,3, or 4 plant groupings compared to 3 plants at perfect spacing.
[3]The yield of the 2,3, or 4 plant groupings as a % of 3 plants at perfect spacing.

Table 2. Corn grain yields from plant emergence variability.

Emergence Outcome	Leaf Delay			Yield [1]	Loss/Gain in Grain Weight[2]	% Yield at Uniform Emergence[3]
	Plant No.					
	P	P	P	Grams	Lbs. of Grain	
Uniform	0	0	0	473 a	0	100
2 Leaf Delay	0	2	0	426 b	-0.10	90
4 Leaf Delay	0	4	0	366 c	-0.23	77

[1]Means in a column followed by the same letter are not significantly different by ANOVA (P=0.05, LSD).
[2]The loss of yield from delayed leaf emergence.
[3]The yield of the 2 and 4 leaf delay as a percent of the uniform emergence treatment.

Results

The non-ideal planting outcomes compared to the perfect spacing did not always result in lower grain yield. The skip planting outcome was the only one that yielded less. Also, the double planted outcome produced more yield than the other five planting outcomes. There were no differences in yield for perfect spacing, seed misplaced by 1/4, seed misplaced by 1/2, and seed misplaced by 3/4 (Table 1).

Both the two and four leaf delay treatments reduced yields by 10 and 23%, respectively (Table 2).

Acknowledgements

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References

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