Developing Seed Placement System on Precision Planters to Increase Seed Singulation of Sunflower to Achieve Appropriate Plant Stand

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Introduction

• Precision planters are developed to improve plant stand and plant population.
• Uneven plant stand and spacing causes plants compete for sunlight, water, nutrients, and space, which causes yield reduction.
• In addition uniform plant stand would prevent from seeding more than needs.
Plant Stand in Sunflower

- Plant stand has been the top yield-limiting factor.
- Uniformity of plant emergence, flowering period, and maturation is related to plant stand and plant population.
Related Factors to Plant Stand

- Poor seeding conditions
- Failure to adjust the planter
- Driving too fast
- Poor germination
- Disease
- Insect damage
- Other factors
Probable Causes and Solution

- Start at the source: Planter
- Existing solution: calibrating the equipment properly; which mainly improve the performance of seed metering system
- Question: Is it a comprehensive solution?
- Answer: No. It cannot control planting depth, seed-to-soil contact, and also seed behavior after it drops.
What Should We Do?

• Using controlled drop instead of free fall drop for seed delivery/placement

• Benefits:
  – Uniform plant spacing
  – Uniform plant depth
  – Better seed-to-soil contact
  – Higher planting speed
  – Reduce skips and doubles
Current Controlled Seed Delivery Systems

- Speed Tube (Precision Planting)
- Brush Belt (John Deere)

- Weakness:
  - Sunflower seed size and shape
  - Assured uniform plant depth
  - Seed-to-soil contact

Good for seed like corn but Not suitable for sunflower

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New Seed Delivery System

• This study is focused on designing a new seed delivery/placement system which is able to:
  – Adjust seed orientation while coming down; which cause avoid size and shape issues even with ultra-large confection varieties.
  – Place seed in the furrow in the desired depth uniformly spaced.
  – Plant in higher speed.
How Does It Work?

• It grab seed with two rubber belts and carry it down to the trench.
• Seed would have equal horizontal velocity with planter in the opposite direction, so that it would have relatively zero velocity while touching the soil. (avoid seed rolling or bouncing)
• Seed firmer would pass over the seed immediately after it touch the soil to assure plant spacing, depth, and good seed-to-soil contact.
Seed Falls from Metering System

Planter Moving Direction

Seed Firmer
Deliverables

• By solving plant stand problem about $90 per acre ($90,000 in a 1000-acre field) can be saved. (Calculated based on 2013 NSA crop survey report)
• Planting with higher speed would save lots of time and probably energy.
• Obtaining higher yield
• Making planter calibration more effective by avoiding field uneven surface condition
• Costs less than $200 per unit ($2000 for 10 row planter)
Questions?