

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.



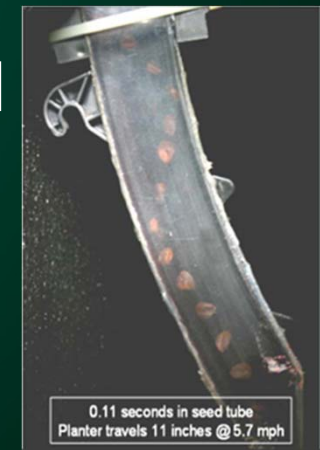
Related Factors to Plant Stand

- 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



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.

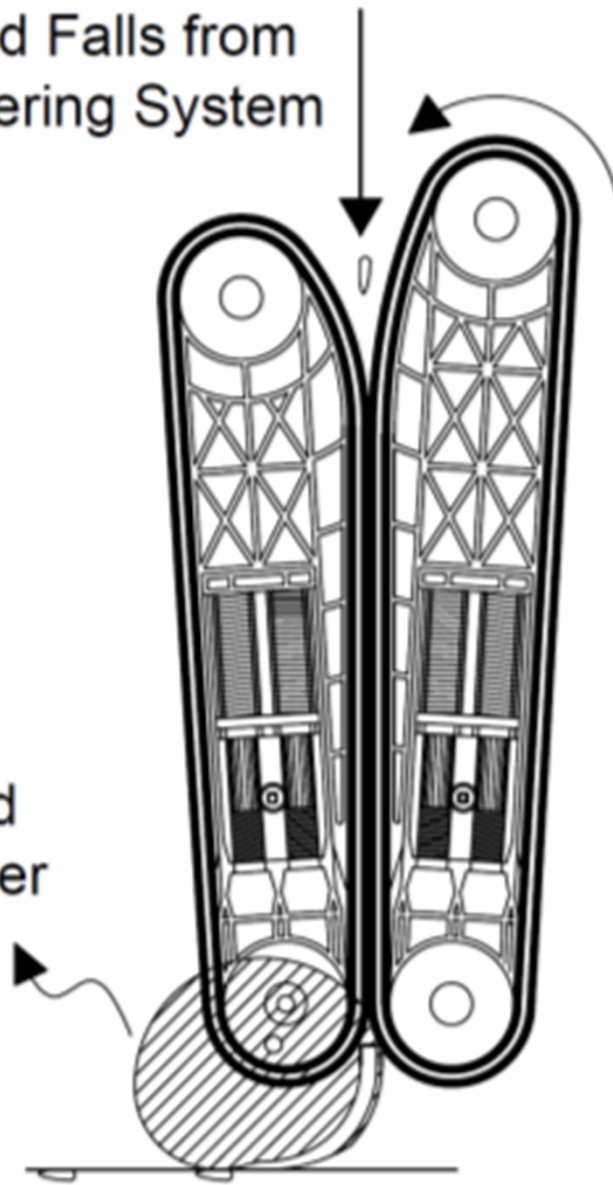
How Does It Work?

- 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

Seed
Firmer

Planter Moving
Direction



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?