

Mojtaba Ahmadi, Ganesh C. Bora, John F. Nowatzki

Department of Agricultural and Biosystems Engineering, North Dakota State University, Fargo, ND 58108

## BACKGROUND:

Sunflower has been a challenge to plant for farmers and it has become more challenging by moving the industry to longer and larger seeds. The farmers have observed that there is lack of consistency in plant stand. Though there are some precision planters available in the market, most of them are built for multiple crops, mainly small grains. It is important for sunflower farmers to have a precision planting device capable of singulating the seed placement with proper depth for good plant stand, avoiding the doubles and skips to maintain proper plant population. Although there are diverse factors which affect plant stand and spacing of sunflower, changes and modifications can be started from planters as the source of planting operation. In this regard, calibration and modification of the metering system would be the first step to avoid irregular plant depth and spacing. However, even after calibrating the system; some other issues are still affecting seed placement like, seed speed and path between seed meter and soil, seed movement, placing on desired depth, and having a suitable contact with soil.

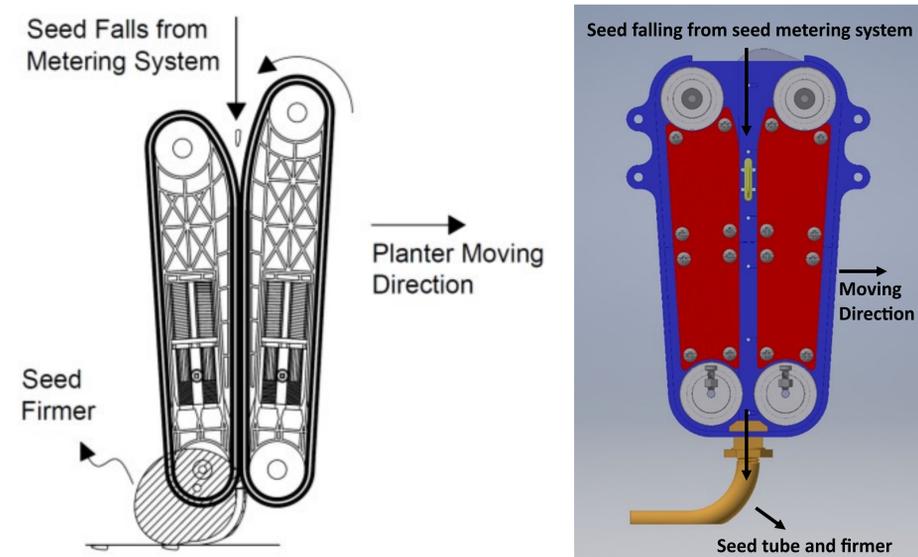


To improve the performance of the planter, it is necessary to use controlled seed delivery systems instead of seed tubes. Unfortunately current controlled seed delivery systems, which are new to the market, are not very much capable of working with sunflower. Hence a proper seed delivery systems should be customized for sunflower considering its physical shape and physiological development.



## MATERIALS AND METHODS:

In this system, there are two rubber belts that their tangential velocity is equal to the planter travel speed. These two belts grab the seed after falling down from seed meter and carry it down to the lower discharge point where there is a small tube to change the seed direction from vertical to horizontal. At the discharge point, seed would have equal horizontal velocity with planter but in the opposite direction, so that it would have relatively low or zero relative velocity while touching the soil which prevent from seed rolling or bouncing. To assure plant spacing, depth, and good seed-to-soil contact, seed tube has an extension that works as a seed firmer and would pass over the seed immediately after it touches the soil.



Since the main parts of this device is the belts, they have been ordered as custom belts with specific material (Linatex) for the baking to assure that it would be able to hold the seeds without damaging them. Besides the belts and standard parts which have been purchased from local markets, the main frame and other parts of this prototype has been 3D printed with PLA material. At this stage most parts of this prototype have been prepared and working well. Currently, we are looking for the suitable stepper motor and controller to drive the prototype and test it on the Precision Planting Test Stand.

After all lab and field tests accomplished, as further study on this project to improve the efficiency of this system, it is necessary to modify this design for testing this prototype with different type of belts and probably frame structure. These test would lead of to develop this prototype for commercial level, so that it would be more feasible for farmers to use this delivery system on their planter.

## OBJECTIVE:

This study is focused on designing a new seed delivery system to:

- Maintain seed spacing, plant population and optimum depth for good plant stand.
- Seed orientation adjustment while coming down; which avoid size and shape issues for seeds like sunflower.
- Plant in higher speed regardless of field surface condition.

## DELIVERABLES:

On successful completion of this project and follow up recommendations, the sunflower farmers should be able to:

- Retrofit the seed delivery system of their precision planter,
- Maintain optimum seed depth and spacing with higher planting speed,
- Manage good plant stand and population.