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FURROW OPENER WITH CONSTRAINED SEED FLOW

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Abstract

A seeder should place seed in an environment for reliable germination. The main objective of sowing is to put seeds at a desired depth and spacing within the row. Uniform seed distribution within soil result in better germination and emergence and increase yield by minimizing competition between plants for available light, water, and nutrients. A number of factors affect seed distribution in soil. Seed metering system, seed delivery tube, furrow opener design, physical attributes of seed and soil conditions all play a part in determining seed distribution. The demand for uniform distribution into the soil of grain seeds and especially small grain seeds has increased during the last decade. Improvements had been made on new metering devices, furrow openers and grain flow. The present research was focused on improving seed distribution into the soil, regarding the furrow opener design and grain flow. Research was carried out in the Department of Mechanisation of the Faculty of Agriculture of the University of Agronomic Sciences and Veterinary Medicine of Bucharest and used a three row simulator of a conventional grain drill.

Key words: *conventional drills, furrow opener, seed distribution, uniformity.*

INTRODUCTION

What can you do with an old fashion gravity seed drill to give it extra performance and make it a good machine. The answer is to find out what can be done to improve some of its parameters. Uniform soil seed distribution was and is a major target with all major manufacturers of conventional grain drills in the world. Usually, the research was focused more on development of furrow openers and less on grain flow. The present research was focusing both on the flow of small grains (winter wheat) from the metering devices to the furrow opener and to study the changes of laying seeds into the soil. For this a simulator based on a conventional gravity drill was manufactured using parts and recicled parts of an old one. This simulator was tested and changes were made mainly in the flow of seeds within the furrow opener. Further researches are carrying on to cover the flow from the metering devices to the furrow opener and the results will be presented in future papers.

MATERIALS AND METHODS

The simulator (Figure 1) was manufactured more than 90% of recycled components and coppied entirely a real drill, except the fact that the seed bulk was designed to supply seeds for three rows instead of 29 or more rows. To simulate the passing over the field a fabric belt soaked in oil was used so the seeds were easily sticked.

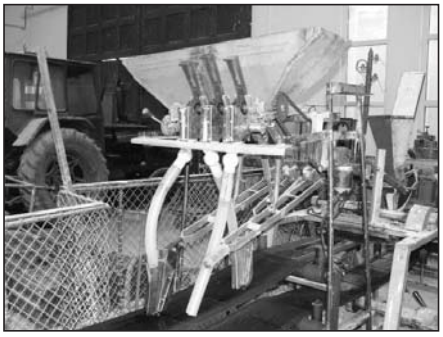

Figure 1. The conventional three row drill simulator

This belt was powered by an AC electric motor and covered two speeds (low speed and high speed). To simulate different seed rates, the metering device was powered by a 12 V DC electric motor and through the help of various ratios obtained by a chain drive transmission it could be covered up to 6 different rates (Figure 2).

After each test the sticked seeds were pictured and the quality of seed distribution on the belt was measured and also the number of seeds per

meter. For each test there were used just two furrow openers, one classic opener and the second one modified according to the protocols (Figure 3).

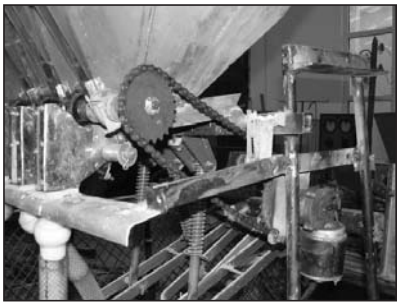

Figure 2. The chain drive transmission

Figure 3. A modified and a classic opener

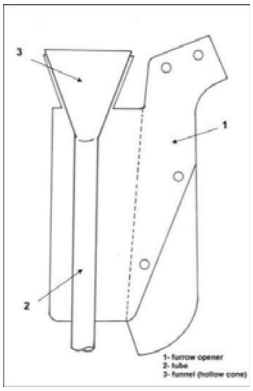

Figure 4. The vertical tubular device in the furrow opener

In this research the modified opener used an original design of a cone and tube device fixed in a classic opener wings, to narrow the channel of seeds but to properly keep the flow of seeds. The entire research used three different shapes of the tube, one vertical, one curved and the third of a narrow ***S*** shape (Figures 4, 5 and 6).

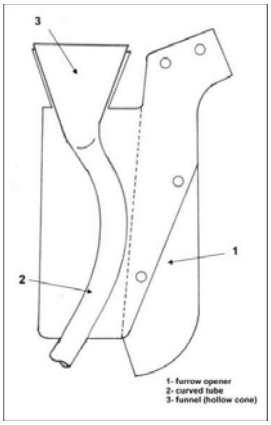

Figure 5. The curved tubular device in the furrow opener

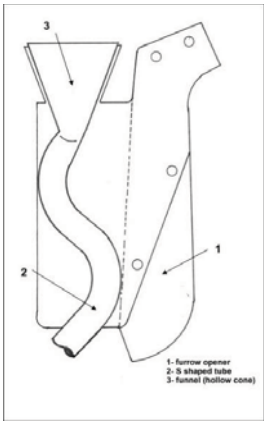

Figure 6. The ***S*** shaped tubular device in the furrow opener

RESULTS AND DISCUSSIONS

After each test the sticked seeds were measured as they were spread over the belt (quality factor) and as number of seeds per meter (quantity factor).

For each trial a number of five tests were done. Tests using vertical and curved devices showed none or minor improvement in longitudinal seed distribution.

But the great results were obtained using the ***S*** shaped device.The tests results for winter wheat seeds using the ***S*** shaped device are shown briefly in table 1.
As shown in figure 7 and figure 8 the tests shown an improvement in longitudinal seed distribution using this modified opener.
All tests with this type of device showed that modified opener was keeping seeds together and the gaps which appeared using the classical openers had a trend to dissapear, performing an improved longitudinal distribution of seeds.

Table 1. Longitudinal seed distribution specs

Trials	Band speed	Seed metering ratio	No. of seeds/ meter (classic/ modified opener)	Quality factor (longitudinal distribution)	
				classic opener	modified opener
V1_1	Low	30/22	120/116	G	I
V1_2	High	30/22	95/89	G	I
V2_1	High	30/16	108/112	G	I
V2_2	Low	30/16	123/131	G	I
V3_1	Low	30/10	142/158	G	I
V3_2	High	30/10	134/126	G	I
V4_1	High	30/9	141/150	G	I
V4_2	Low	30/9	165/156	G	I

G- grouped seeds; I- improved longitudinal distribution

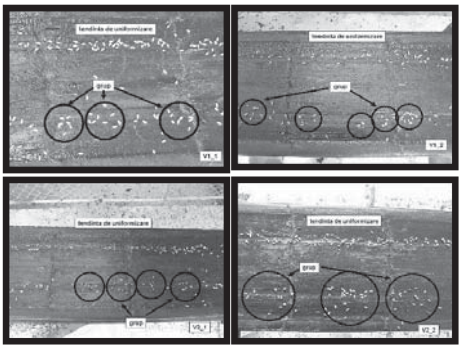

Figure 7. Improvements in longitudinal seed distribution (trials V1_1, V1_2, V2_1, V2_2)

For each trial a number of five tests were done.
As shown in figure 4 and figure 5 the tests shown an improvement in longitudinal seed distribution using various modified openers.
All tests showed that modified openers were keeping the seeds together and te gaps which appeared using the classical openers have had a trend to dissapear, performing an improved distribution of the seeds.

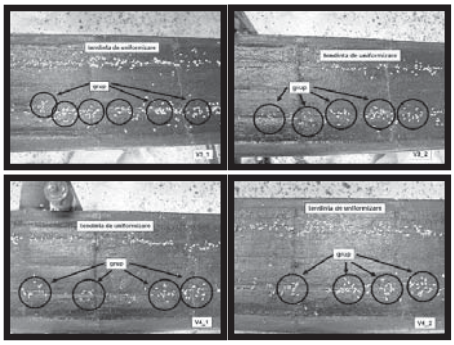

Figure 8. Improvements in longitudinal seed distribution (trials V3_1, V3_2, V4_1, V4_2)

CONCLUSIONS

1. Lab tests shown that it was possible to get a better longitudinal seed distribution into the soil for conventional grain drills, using modified openers.
2. No impediments and obstructions were observed in the flow of seeds from the mettering device to the furrow opener.
3. The seed rates in various tests were kept within resonable limits without any exceptions.
4. Further tests will be done using different devices adapted for classical openers to show the influence of the shape of the narrowed channel on the longitudinal seed distribution.

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