Influence the Coulter Type on the Seed - Soil Contact in No-till Technology

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Abstract. In the case of no tillage radical changes are to be noticed in relationship to the conditions of conventional technology. No-till technology doesn’t require any processing of the soil on the whole working width but only on the narrow range; depth is reduced (max. 10. cm) and crop residues remain on the surface. In these circumstances the entire aero-hydric soil system is different from conventional technology and soil characteristics (structure, density, permeability) are also different. The no-till machines can be equipped with chisel coulters or disc type furrow. Each of these options has advantages and disadvantages in terms of functionality and technology. This paper proposes a critical comparative analysis between two sections of the no-till machine equipped with specific coulter chisel and clutch disc type to identify the best solution for seedbed preparation and ensure maximum contact of the seeds with the surrounding soil.

Keywords: no till, seedbed, blade coulter, disk coulter, cone index

INTRODUCTION

The increasing development of new tillage technologies that are superior both economically and in terms of sustainable agriculture to classical technologies, more research is required in these technologies integrated machine to be respected as long as the requirements of plant growth and development.

Through no-till sowing the seed is directly seeded into unprepared soil prior to the opening of a channel or a narrow band of a width and depth sufficient only to achieve optimal coverage of the seed. Mobilization of soil in the seed placement is necessary but the degree of crushing is influenced by soil type, body type channel opening and speed. In terms of construction, between sowing machines used in classical technologies and no-till machines, there are some differences. Mainly, these differences consists in that they are equipped with other types of shares and some additional subsidiary bodies. Depending on the type of coulters the no-till sowing machines can have disc coulter type or chisel coulters or combined versions.

MATERIALS AND METHODS

Laboratory tests were conducted in the soil bin of Hohenheim University Stuttgart - Germany. There were three no-till direct sowing precision machines ie AMAZONE CONTUR further noted (Fig. 1) JOHN DEERE MAX EMERGE (Fig. 2) labeled B and Kleine Unicorn noted C (Fig. 3). Coulters fitted to these machines are combined, all of the inclined double disc. Between discs leads to additional coulter AMAZONE there is an narrow angle, and the sowing machine is fitted with a John Deere plow disc cutter to the front.
Fig. 1. Precision sowing machine AMAZONE Contour (A)

Fig. 2. Sowing machine John Deere Max Emerge (B)
The crushing and soil mobilization was assessed by soil cone index before and after passing of the tested machines. To measure soil cone index after passing machine, has been used a multipenetrometer with 11 pins connected to a computer equipped with data acquisition system. For data acquisition software was used LABTECH.

RESULTS AND DISCUSSIONS

Experimental try-outs results with A machine

Following the experiments for testing the A machine were obtained soil physical and mechanical parameters according isometric graphs shown in fig. 5 and 6.

Fig.5. Soil cone index after passing with Amazone machine at 3 km/h
Fig. 6. Soil cone index after passing with Amazone machine at 11 km/h

**Experimental try-outs results with John Deere machine**

Fig. 7. Soil cone index after passing with John Deere machine at 3 km/h
By analyzing the curves isometric for soil cone index in Fig. 7 and 8 it can be seen that this indicator decreases both in depth and in width as speed increases and seed placement in the soil cone index is lower at a higher speed.

**Experimental try-outs results with Kleine UniCorn machine**

![Fig 7. Soil cone index after passing with John Deere machine at 11 km/h](image)

![Fig 9. Soil cone index after passing with Kleine Uni Corn at 3 km/h](image)
Soil cone index after passing with Kleine Uni Corn at 11 km/h

Looking at Fig. 10 and 11 it can be seen that the soil cone index decreases as the depth and the width as speed increases and seed placement in the soil cone index is lower at higher speed. Also notice that the type couler chisel creates a very uneven soil especially in the area of placement of the seeds.

CONCLUSION

Comparing the data obtained for the three variants of the tried machines the following conclusions can be expressed:

- based on the results obtained in measuring the soil cone index and graphs that were drawn for soil cone index values can be determined exactly characteristics of the soil around the seed. Based on these results we can develop a program to interpret the data in real time in order to adjust the depth of seed placement to obtain more uniform conditions for all seeds;
- primary the soil cone index had values between 1 și 1,4 MPa;
- maximum thrust (after the X axis) occurs when no-till sowing machine and the minimum for machine B. This is explained by the difference in mass on the one hand but more in that machine B is equipped with corrugated disc type for soil mobilization and plant debris cutting;
- maximum downforce (after the Y axis) is found for B machine and the minimum for C machine in this case the difference is made primarily by the machine weight;
- maximum degree of fineness and soil cone index minimum was obtained for the machine which besides double disc couler is equipped at the front with a sharp angle couler that makes a great grinding of soil on a larger working width compared to machine B;
• the working speed directly influences the degree of fineness in particular has a section width of sowing, which is explained by the occurrence of higher impact speeds of soil aggregates and producing shock waves that are reflected in the sides of the coulters;
• for machine B equipped only with working disk type coulters the forces variations were very small compared with machines A and C that because of the presence of acute angle coulter induces operating shocks and thus raises the possibility of obtaining a uneven germination bed.

Based on observations and results we can say that machine B is the one that best fits the requirements of no-till technology except that it requires redesigning the disc for furrow opening to ensure better soil crumbling of lateral areas of the seed row. For corn sowing this requirement is higher because roots of plants need better tilled soil in early stages of growing.

REFERENCES