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Direct Seeding with Disc Coulter Seeding Machines

Investigations with Various Row Cleaning Tools for Improving Seed Placing

During direct seeding with disc coulter seeding machines, large amounts of harvest residues from the previous crop can cause problems with seed placing. A possible solution to this problem is the installation of row cleaning tools. Depending on the type of row cleaner and cleaning tool, field emergence could significantly be improved. Contrary to single spacing drills with up to a 75 cm row width, the row width of the experimental seeding machines was at most 20 cm, so that the cleaning tools bury mulch on the neighbouring rows, thereby further reducing field emergence. Proposals for solving this problem are discussed.

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This contribution is dedicated to Prof. Dr. Karlheinz Köller on the ocassion of his 60th birthday.

Keywords

Direct seeding, disc coulter seeding machine, row clean tools

Literature

[1] *Martin, H.D.*: Ground-driven rotary row cleaner. United States Patent Nummer 4,785,890. 22. November 1988
[2] *Yetter*: Firmenprospekt der Firma Yetter, Colchester, IL, USA, 1996
[3] *Beck, D.*: Seed right. NO-TILL FARMER, December (2000), pp. 6-7

Over a period of four vegetation cycles we were working at the Institute for Agricultural Engineering of Hohenheim University on the improvement of a commercially available row cleaner, and, later, on the development of several new versions of our own. Most commercially available row cleaners are designed for drills with a row spacing of at least 45 cm and are based on inventor Martin's patent [1]. In his patent he describes a ground driven row cleaner that is applied on cultivated soil, which removes residue out of the seeding row without moving the soil. For a row spacing with a maximum of 20 cm currently only the Yetter company is offering a row cleaner [2]. We are going to describe three row cleaner versions, which we developed ourselves, and, first, that one designed by Yetter.

Row cleaner versions

Yetter
Yetter offers a row cleaner for use with the John Deere 750 A drill. It is mounted directly onto the seeding unit of the John Deere 750 A. The working depth is controlled by the depth gauge of the 750 A seeding unit.

Row cleaner version 1
Figure 1 shows row cleaner version 1, which connects to the 750 A via a parallelogram-type suspension, which is fixed to the tool bar in between two seeding units. The working depth is gauged by a depth band fixed to the working tool. The vertical and horizontal angles of the working tool, as well as the pressure, with which the tool is held down, are adjustable.

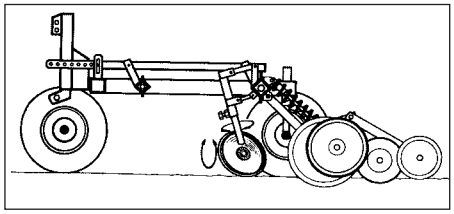

Fig. 1: Row clean tool, version 1 with device for adjusting angle of incidence

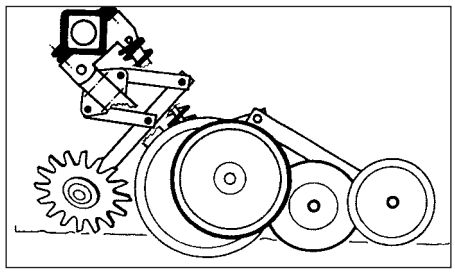

Fig. 2: Row cleantool, version 2

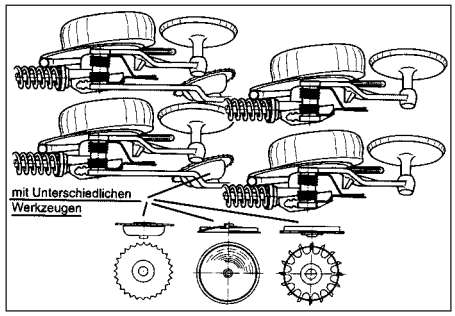

Fig. 3: Row clean tool, version 3 with a variety of tools

Row cleaner version 2
Figure 2 shows row cleaner version 2, which is an improvement of row cleaner version 1. It is directly mounted to the seeding unit of the 750 A by a parallelogram-type suspension. The vertical angle of each individual row cleaner tool in the direction of movement is 20°, and 65° horizontally to the ground surface.

Row cleaner version 3
Figure 3 shows row cleaner version 3. The tool now is no longer held by a parallelogram-type suspension, but is mounted on a hinged bar. The vertical and horizontal angles of the working tool are as in version 2.

Several different tools were evaluated on row cleaner version 1. *Figure 4* shows the distances the straw was displaced depending on the tool used. If we allow a maximum of 20 cm for the straw to be thrown, the double chain wheel and the two star wheels could be used with a horizontal angle of 63°, and a vertical angle of 15°. The disc and the single

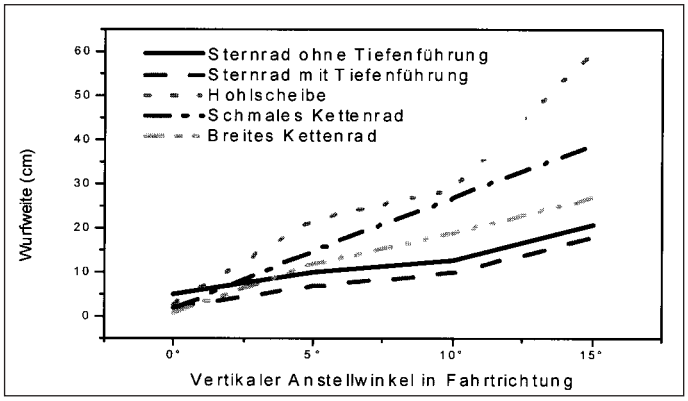

Fig. 4: Distance in which residue was displaced due to all tested tools; angle between ground surface and tool was 63°

chain wheel could be useful up to an angle of 5° maximum.

On top of measuring the distance of the straw displacement, we evaluated the degree of absence of straw in the seed furrow for each applied tool. We were using a system of five grades. Grade 1 meant a seed furrow completely devoid of straw, grade five meant a seed furrow, from which no residue was removed at all. *Figure 5* shows the results for the disc, which achieved the best grades.

A very good cleaning effect was observed using the disc at a vertical angle of 5°, which was not the case when using the star wheels. The area traversed by the disc was nearly cleared at 5°, and completely devoid of straw from 10° on, while the results with varied horizontal angles did not differ greatly.

Conclusions

The pressure of the tool onto the soil surface needs to be variable according to the moisture, the kind of soil and the amount and kind of residue. Technically, a spring or hydraulic cylinder could fill the task. The depth gauge of the tool has to be able to exactly scan the ground in order to avoid misplacement of the seed. Maximal insertion of the tool into the soil should not exceed 0.5 cm in order to minimise soil displacement. The tool should be as light as possible to allow for the tool bar to be manufactured light-weight. If its weight were too heavy the frame of the drill would have to be adjusted, causing additional expenses for heavier materials, bigger hydraulic cylinders and bigger brakes. The row cleaner has to be sturdy, it has to be nimble and it has to have an automatic trip. In grain maize residue and lodged grain, even under wet conditions, the row cleaner has to be able to clean the seed furrow without getting plugged. In order to make widest possible use of the row cleaner the farmer should be able to remove it quickly and without tools when not in use. The row cleaner needs to be maintenance-free. The residue must not bury the neighbouring row, therefore sometimes necessitating a straw deflector or wider row spacing.

A compromise between cleaning the seed furrow most thoroughly and not burying the neighbouring row with residue needs to be found. If the seed furrow gets completely cleaned, but the residue is thrown onto the next row, a decrease of the emerging rate will follow. In order to significantly improve the seed placement by means of a row cleaner mounted on a drill with a row spacing of up to 20 cm, it would be necessary to mount the seeding units with alternating distances of 12.5 and 25 cm e. g., thus ensuring a more exact residue placement in the greater gap. A similar machine is already being tested on Dakota Lakes Research Farm [3].

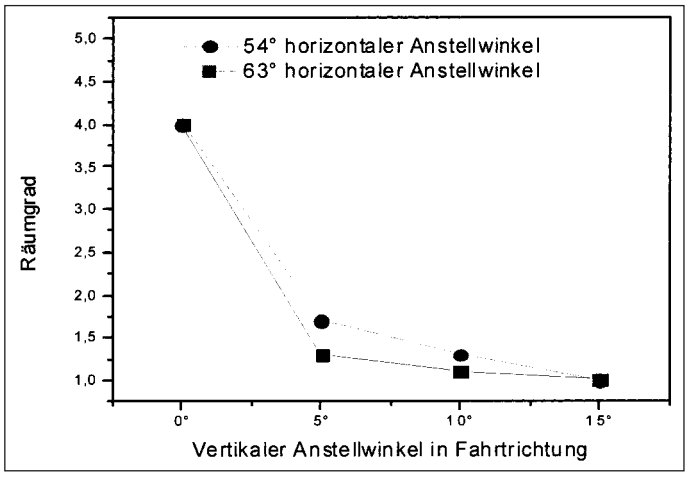

Fig. 5: Quality of residue left in seed bed after use of disc