RESEARCHERS ON THE OPERATING BEHAVIOR OF DIRECT SEED DRILLS AND THEIR INFLUENCE ON WORK QUALITY INDICES

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Abstract

The technology of direct sowing in stubble involves the direct introduction of seeds into the soil without prior preparation of the germinal bed.The sowing machines are built in such a way that they allow the opening of small holes in the sowing direction in which the seeds are inserted. That's why, for the success of various conservative practices, but especially of direct sowing, the farmer must take into account the method of managing the stubble on the surface, the plant residues of the preceding crop, through a good work of shredding and uniform spreading on the surface during summer - early autumn. The elimination of plant residues by burning is excluded, according to the Code of Good Farm Practices, made by the Research Institute for Pedology and Agrochemistry in Bucharest.

Key words: seed, drilling, indices

For this, the farmer has several options depending on the local specifics, and will choose the one that lends itself best, namely:

- the superficial mobilization of stubble up to a maximum depth of 10 cm, by applying a work, usually with a disk, on the entire surface of the soil, immediately after harvesting the previous crop;
- chopping plant residues and surface work only in strips, if the technology of sowing in strips is applied;
- chopping plant residues simultaneously with the harvest, if it has a seeder equipped with additional equipment for such an operation;
- in mixed farms it is recommended to practice controlled grazing.

Besides this, especially in the case of direct sowing, some other rules are necessary, which must be respected, namely:

- it is not applied on wet or heavy soils, but only in accordance with all the pre-established conditions, established in agreement with the specialists; it is usually suitable for soils that have a coarse and medium texture, loose and well-drained, on those that are already degraded by destructuring, erosion, secondary compaction;
- it is not practiced on heavily grassed or weedy lands;
- often a work of rolling the soil is necessary to ensure a better contact between the soil and the seeds; this work will not be applied when the soil is too wet;
- it is necessary to leave enough time to allow the weeds and weeds to germinate, after which they are combated by weeding. We specify that there is a very strong dependence on herbicides, since mechanical control is not applied (Badea F., 2018).

The assortment, doses of herbicides, the time of application must be respected according to the cultivated plant. For example, weed control by herbicide alone is not effective enough in the wheat-maize rotation, because before sowing no herbicides are applied to combat grass weeds, the situation changes if there are selective post-emergence herbicides for them; therefore, in order for such a system to succeed, the farmer must establish a crop rotation that includes as many different species as possible, the crop rotation with contrasting plants is a very important factor (Ibănescu A. 2015);

- it is beneficial only if the surface of the soil remains covered with vegetable remains, at least 30%, immediately after sowing. The farmer must take into account the fact that plant residues slow down or reduce the rate of soil heating, which is particularly important in the spring period, as it causes a delay in sowing, especially in northern areas; also, in such areas, the germination of seeds and their emergence can be slow and uneven, so

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that in cold springs this system is not recommended;

- organic fertilization, as well as the application of amendments, is not possible, therefore only mineral fertilizers with a high degree of solubility will be used, along with foliar fertilizers;

- the control of diseases and pests must be monitored very carefully because chemical substances cannot be incorporated into the soil, the seeds must be treated before sowing. Moreover, plant residues can encourage the emergence and multiplication of diseases and pests, so careful monitoring is particularly necessary (Leontescu M., 2016).

Specialists say that direct sowing or the no-tillage system is also known as slot sowing, stubble system, ecological system. Direct sowing involves the introduction of the seed directly into the stubble of the previous crop, without performing any previous soil loosening work, except for the simultaneous opening of a very narrow band (slit), only a few cm long, to allow the introduction of the seeds into the soil (Huzum N., 2013).

MATERIAL AND METHOD

In order to successfully implement the research-innovation activity, together with the researchers of USV Iași, the logistics and the methods necessary to achieve the objectives established for each agricultural machine were established;

- Displacement of research teams for the effective implementation of the proposed actions:

- Sowing work/ Iasi, FERMA DIDACTICA EZARENI, administrator USV Iasi;

- Open research action with invited farmers from the area of Braila and Iasi counties;

- Filming and dissemination of the two actions to the country's farmers.

The research activity period was 21.10.2021 – 29.10.2021

Location: Iasi

Host farm: EZARENI FARM/ Didactic Station of USV Iasi.

The agricultural crop on which the research activities were carried out: 5 ha compact soil on which wheat was cultivated and harvested, 5 ha compact soil from which, for five years, wheat has been harvested.

The agricultural machines that were involved in the research action in order to establish the impact on the quality indices in agricultural works were:

1. McCormick X7.624 tractor;
2. Tractor Versatile MFWD 370;
3. Tume Nova Combi Star seeder.

In order to carry out this agricultural work, the energy and quality parameters were analyzed for the TUME brand seeder, SUPER NOVA COMBI model (*figure 1*), with the following characteristics:

• Trailed seeder model for seeding both in prepared and unprepared land (stubble);
• Electrical distribution;
• Working width 4 m;
• Double disc seeding sections that integrate both the sowing and fertilizing sections;
• Sowing discs Ø 360 mm;
• Fertilization discs Ø 400 mm;
• Distance between seed sections 16 cm;
• 24 sowing sections;
• 12 Heavy Duty wheels with independent reinforced tires for adjusting the working depth and with a roller and soil compaction positioned in front of the sowing sections;
• mixed hopper for seed and fertilizer with a total capacity of 5500 liters;
• 9 rear wheels with double role: furrow cover and transport grouped in batteries of 2;
• Pressure on the coulter adjustable between 40 and 200 kg;
• ISOBUS compatibility;
• Own weight 5150 kg.

The tractor used for this work is a McCormick model X7.624 with the following specifications:

• Betapower engine mounted in the chassis with a cylinder capacity of 6728 cm3, 6 cylinders;
• "Common Rail" type injection system with high pressure pump;
• Air-Air Intercooler and Turbocharger with variable geometry;
• DOC+DPF+SCR exhaust system in accordance with Stage V norms;
• Maximum power 240 HP/176 Kw at 1900 Rpm;
• Maximum engine torque 983 Nm at 1500 Rpm;
• Transmission with continuous variation "VT-DRIVE" with 4 CVT steps;
• Multi-disc clutch in a wet environment;
• "Heavy-Duty" flange type rear axle;
• Front axle with electronically assisted independent suspension, with central pivot, direction sensor and lockable differential;
•Rear PTO with 4 speeds 540/540E/1000/1000E Rpm;
• Hydraulic pump with variable flow of 160 l/min for the circuit and 44 l/min for the direction;
• 4 rear hydraulic distributors with electric control + 2 front hydraulic distributors with Joystick control;
• Pneumatic braking system for trailers with 2 lines + 1 auxiliary line;
• Category 3 rear lifting system with side anchors with quick attachment and central tie rod with hydraulic adjustment;
• 3-point front lifting system with a lifting capacity of 3500 kg;

• Additional rear cylinders Ø100 mm to increase the lifting capacity - maximum 9300 kg.

Conservation tillage is a generic expression that refers to a multitude of tillage methods, from direct sowing, to loosening and mobilizing the entire soil profile, excluding turning the furrow and burning stubble, allowing the maintenance of plant residues on the soil surface or close to the soil surface and/or keeping the soil surface loose and granular, in order to reduce erosion and improve soil-water relations".

Figure 1 **Tractor Versatile MFWD 370 and Tume Nova Combi Star seeder**

RESULTS AND DISCUSSIONS

This technological system is based on the introduction of the seed directly into the stubble of the previous crop, without carrying out any kind of previous soil loosening work except the opening simultaneously with the sowing of a very narrow strip (slot), of only a few centimeters, to allow putting the seeds in the soil. To practice this system, special seeding machines are needed, which simultaneously ensure the opening of the slot and the introduction of the seeds.

Other works such as: ploughing, harrowing, harrowing, mechanical harrows, etc., necessary in the conventional system, in the case of the present one are no longer performed, the surface of the soil after practical sowing remains covered almost entirely with plant residues. Weed control, including for weeds, is carried out only by chemical methods, with the help of herbicides, and/or biological if possible.

This plant cultivation technology allows loosening and processing or mobilizing the soil in strips or narrow bands with a width of 5 to 20 cm, intended only for sowing, between these strips the soil remains completely undisturbed, uncultivated and covered with plant debris, so that the surface of the soil after sowing remains covered over at least 30%.

Compared to the previous work, which referred to direct sowing, by working in strips, the soil is disturbed to a somewhat greater extent, the degree of coverage of the surface with plant residues is reduced, but also the risk of long-term soil degradation is higher big.

Vertical tillage refers to loosening and mobilizing the soil to a depth of 20-30 cm, or even deeper, without turning the furrow. The soil surface remains covered after sowing with vegetable residues in a convenient proportion (over 30%), at the same time, soil compaction is reduced in the short term.

The most used agricultural equipment are different types of cultivators, cultivators and vibrocultivators. This "vertical work" is different from scarification, which is included in conventional systems, and is applied at certain periods of time in order to improve naturally or anthropogenically compacted layers that are located at a depth of more than 30 cm.

Cultivating the soil in furrows (comes) is a technological variant of plant cultivation that

allows the creation of furrows or "raised areas", used as a germination bed, where the seed is to be introduced, alternatively with lower areas that can be used as furrows watering or areas for the movement of agricultural machines, for carrying out other agricultural operations.

This technological practice is the result of permanent changes in agricultural production systems, in tillage methods, in the modernization and improvement of the machine system and, at the same time, it is the consequence of the intensification of the processes of soil degradation and other environmental resources, specific to conventional technologies.

The main results obtained during this research are:

• the significant decrease in the erosion risk and the increase in the soil water reserve due to the more compact state of settlement, as a result of very little mechanical processing and the large amount of plant remains on the surface, which it practically covers almost entirely, being the most useful on sloping soils.

• the movement regime of water and air in the soil was improved, by increasing the permeability of the soil to water and air, as a direct consequence of the change in the configuration of the macropores;

• the water reserve from the soil was increased by reducing water evaporation and increasing the microporous space, thus reducing the requirements for irrigation in areas with a dry climate and emphasizing the advantages of "dry-farming" techniques;

• the amount of organic matter on the surface was increased, thus improving the structural characteristics of the soil;

• stimulation of biological activity, especially that of macro-fauna, thereby increasing soil macroporosity and improving aeration processes;

• the reduction of soil temperature, and especially the large temperature variations in the first 10 cm, during the warm periods of the year;

• the risk of anthropogenic compaction due to the smaller number of entrances to the land was reduced, as well as the presence of plant remains on the soil surface that act as a buffer layer;

• the workability and trafficability characteristics during the sowing and harvesting period were improved, so that they can be carried out within a wider range of humidity (compared to the conventional system) and also facilitating harvesting in wetter periods or climates;

• the long-term increase, by at least one class, of the degree of soil fertility due to the improvement of the physical, chemical and biological condition and the reduction of the risk of degradation through destructuring, erosion and compaction;

• the reduction of fuel consumption (by 40 to 50%), due to the extremely low number of mechanical works. For example, for grain corn and soybean crops, total energy consumption is reduced by up to 50-75%.

CONCLUSIONS

For the practice of direct sowing, special sowing machines are needed, which simultaneously ensure the opening of the slot and the introduction of the seeds into the soil. Works such as ploughing, harrowing, harrowing, mechanical harrowing are no longer carried out, the surface of the soil after sowing being covered almost entirely with vegetable remains.

The prevention of soil degradation, of other environmental resources, as well as the improvement of degraded soils through conventional technologies, the reduction of energy consumption, the increase of the productive potential of soils, the increase of water use efficiency were decisive reasons for the implementation and expansion of sowing technology in modern agriculture directly into stubble.

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