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STUDIES REGARDING THE NO-TILLAGE OR DIRECT DRILL SYSTEM

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Abstract

Sustainable development is managing and conserving basic natural resources and choosing to make technological and institutional changes to meet human needs for current and future generations. Assessing the negative effects of ploughing such as practiced in intensive agriculture generated the idea of reducing the number of works – ***minimum tillage*** *– and even of totally removing it –* ***no tillage.***

Key words**:** *minimum tillage, no tillage, sustainable*

INTRODUCTION

Direct drill in the stubble is seen as the most conservative soil tillage system since it is the closest to the natural soil settlement state in perennial plants.
This is the system that combines in the most suggestive way the oldest ploughing practice and sowing seeds in the most natural way. [3].
This technological practice is the result of permanent changes in agricultural production systems, in soil tillage methods, in modernising and improving the machine system and, at the same time, a consequence of intensifying soil degradation specific to conventional technologies. [6].
Preventing soil degradation and the degradation of other natural resources and improving degraded soils through conventional technologies, reducing energy consumption, increasing soil productive potential and increasing the efficacy of water use have triggered the implementation and extension of direct drill in modern agriculture.
Direct drill is the most performing technology developed in agriculture nowadays [4].
This system involves sowing on no-tillage soil that is not maintained mechanically or treated for weed control [1].

MATERIALS AND METHODS

Direct drill can only be applied in a modern, performing agricultural system based on high-quality management inputs with strict requirements for good results to be observed.
One needs to mention that direct drill is a technology in which mulch is a must since this is the only way to prevent evaporation and preserve soil moisture.
This requires precision machines to sow, integrated pest control measures, and the proper fertilisation system.
The “no-tillage” system developed by Phillips and Young (U.S.A.), in 1960 in maize is not another way of preparing the soil, but a system in which all interventions (fertilisation, herbicide application, etc.) are done according to directions.
In the U.S.A. and Canada, they direct drill on 52% of the arable area; in Latin America, 44%, in Australia, 2%, and in Europe, Asia and Africa, about 2%.
Direct drill can be used in a wide range of crops except for potato, intensive vegetable crops and some special crops.
In passing from classical technology to direct drill we need a transition period of about 3-4 years.
During this time, production decreases but it adapt to the new tillage system.
From a cultivation point of view, soil structure improves, humus content increases due to increased mineralisation, soil porosity increases, and so does water availability [2].

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Passing to direct drill supposes the following steps:

-*Choosing the land*: the soil needs to be clayey, silt-loamy, be well-structured, properly aerated, biologically active, and with a high content of humus.

Among soils meeting these requirements are faeziom, chernozem, gleisol, etc.

Depending on the soil type, they apply solid, liquid mineral fertilisers or organic fertilisers;

-*Basic soil tillage in summer* (ploughing, aeration works) together with fertilisation;

-*Preparing the germination bed* and sowing winter cereal;

-*Harvesting the next year* maintaining plant debris (straw, stubble) on the soil;

-*Killing perennial weeds* on the stubble and direct drilling without any other soil work.

Since the soil is covered with plant debris from the previous crops and direct drill is done only on the stripes to be sowed, we need to ensure proper control of water and wind erosion and save labour force and fuel [7].

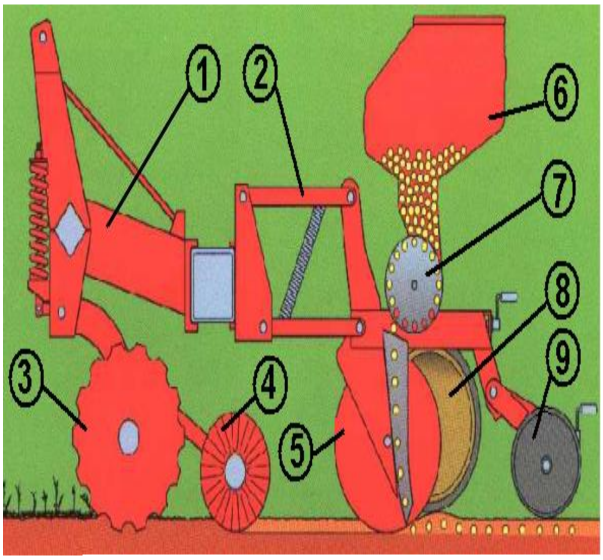

Fig. 1. The technological scheme of a sowing machine for sowing plants

Legend: 1-frame machine; 2-frame section; 3- disc for shredding vegetal remains; 4-disk cleaning line; 5-coulter double disc; 6-seed box; 7- distribution apparatus; 8-stroke depth adjustment; 9-row row compression.

A direct drill machine needs to aerate and mix the soil as little as possible and put the seed into the soil so that it enjoys optimum germination and growth conditions.

Working organs are devised to allow working on both dry and moist soils with large amounts of plant debris. [8].

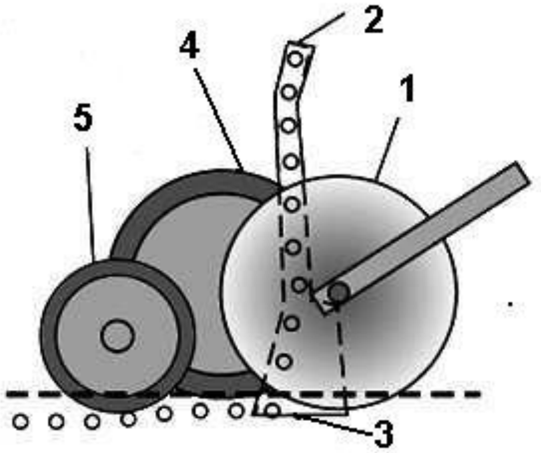

Fig. 2. Placement of seed in the soil at direct sowing machines

Legend: 1-disc for opening the soil strip; 2-tube signage control; 3-seed placement in the soil; 4-wheel for sowing depth adjustment; 5-stroke wheel.

Machine active organs operate narrow openings to introduce the seeds (disc furrow) and also, sometimes, fertilisers.

Fig. 3. Aggregate consisting of tractor and direct sowing machine

Direct drill machines differ from the ones used in classical technology mainly by using other types of coulters and some supplementary auxiliary organs to remove plant debris, to cover the soil with seeds, etc.

They use, in general, disc coulters and chisel coulters, but also combined coulters.

They have noted the efficacy of the corrugated coulters that ensure better mincing

of plant debris along the rows.
The direct drill machine needs to be able to operate with large amounts of plant debris.
For the disc coulters to penetrate the soil at the desired soil depth, we need a pressing force per coulter of about 270 daN.
This means, for a machine sowing straw cereals with a width of 3 m, a weight of at least 3 t.
Therefore, direct drill machines need high power tractors.
To reduce the general weight of direct drill machines and maintain coulter pressing force, they have designed precision machines that transfer the force from the hydraulic lift to the coulter with lever and arch mechanisms [5].
Chisel coulter direct drill machines need lower load and can be lighter.
These machines mix soil more along the rows and make better aeration favouring better heating and seepage of water around the seed; however, when the amount of straw is high, the machine cannot operate at its best.
Direct drill is another working system, not another sowing system, which is also obvious because of the acceptable weeding rate.
The failure to use direct drill is caused by improper weed control.

RESULTS AND DISCUSSIONS

Research show that effective weed control methods in direct drill need to rely on a complex of herbicides and mechanical and cultivation methods specific to each crop depending on the weed structure and biology. These weed control methods can be grouped into preventive methods, that prevent seeds from being brought in from other sources, and curative methods, that act directly on the weeds.
The no-tillage system differs from classical sowing technologies: in order to be successful, we need to observe all the steps involved in the sowing technology.

CONCLUSIONS

Agricultural research and practice show that disc direct drills remove the danger of clogging even with large amounts of plant debris.
There are deficiencies in functioning on moist soils where the disc does not cut plant debris but rolls them over pushing them at the bottom of the furrow and placing the seeds on them. With larger amounts of plant debris and under drought conditions, germination is hindered until plant roots penetrate the vegetal layer and ease the action of disc coulters of opening the ditch; direct drill machines have organs for the cleaning of the operated area.

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