COMBINED MACHINES AND WORKING UNITS FOR MINIMUM SOIL TILLAGE AND DIRECT DRILLING

Assoc. Prof. Zhivko Demirev, PhD
University of Ruse
8 Studentska street, 7017 Ruse, Bulgaria

Abstract

Technologies for minimizing soil tillage and direct drilling are considered. Their advantages over traditional technologies for cultivation and sowing are prominent.

The trends in machinery and techniques implementation are indicated and the most promising direction is design of machines having combined working bodies.

A combined unit for tillage and dispersed drilling into the subsoil is proposed, on the base of which a composite machine can be build.

Keywords: minimum tillage, subsoil direct drilling, combined working body, combined machine.

Introduction

The tendency to increase the qualities of machines for soil tillage and the efficient struggle with weeds brings about significant extension of working operations and number of transitions during crop cultivating. Except for the increase of energy expenses and labor, the repeated passage of the machines on the field tightens the soil and destroys its structure. This leads to negative results connected whit soil fertility and erosion. That is why new technologies with significant shortening of soil-tillage operations are developed/minimum cultivation/and their integration in one technological process [1, 4].

The integration of soil cultivation and drilling is considered to be especially successful.

Minimum soil tillage and direct drilling

The aim of minimum soil tillage is: under the specific conditions in different countries to achieve decreasing of tillage expenses and plant growing as much as necessary, but as less as possible.

Direct drilling is the next new direction in developing of minimum soil cultivation. The main concept is the plants to grow in non-cultivated soil. The main advantages of minimum soil cultivation and direct drilling are:

- Diminishing of working expenses in crops growing
- Diminishing of soil tightening, caused by repeated passing of machines over the soil
- Preserving the water supply in soil and shortening of agro technical time limit of drilling
- Preservation of soil structure and protecting of soil from wind and water erosion

Minimum soil cultivation and direct drilling are used in many countries. Summing up the foreign experience we can say that most widely these methods are spread in the USA and Canada.

Inspire of the advantages, the applying of direct drilling and minimum soil cultivation in all places leads to some negative results: for example spreading of weeds, roots, pests and illnesses.

That is way in applying direct drilling and minimum soil cultivation a specific outlook is needed. The specific soil-climate conditions, the presence of roots, weeds, the demands of plants must be taken into consideration.

Inspire of the pointed shortcomings doubtless is the following: the minimum soil cultivation is not only one of resources for increasing the efficiency of agricultural production, it is right way of

preserving the soil – diminishing of humus loss, preserving soil structure, preventing of erosion, improving the water supply.

Recently a tendency of applying direct drilling for winter cereal crops is developed. The aim of this method is sowing of optimum numbers of seeds with even spacing in surface and in depth.

Accurate spacing of cereal seeds is essential if maximum yields of winter cereal are to be obtained. Traditional drills provide a massive plant density, which is not evenly spaced. In fact, in the initial stages of growth only 25% of the field is being utilized to its maximum.

With winter cereals drilled conventionally there is too much overcrowding down the row and therefore, too much competition when the crop is under pressure as winter approaches with shortening days and sometimes severe weather.

Any overcrowding at this stage severely interferes with the limited amount of sun. it is obvious that even spacing of seeds can't be performed with conventional machines. A successful method in this field is the method of under layer spreading of seeds.

Designing of machines for minimum soil cultivation and direct drilling is based on the principles of integration of operations and combining them in one technological process. This is accomplished by combined machines and machines with combined working units.

Combined machines and working units

The combined aggregates are made by the present in serial production and exploitation machines, connected in series, fixed according to the demands of the technological process. Every machine performs only one operation in the whole technological process.

The advantage of the combined aggregate is in the possibility of using the separate machine independently out of the aggregate. This enables the increase of time for using them during the season. The disadvantages are in the big size, the poor maneuvering, the difficulties in their setting in transport and working position.

Combined machines are specialized machines for several operations integrated in one technological process. They can be divided into two groups:

The first group is the combined machines, supplied by working units performing only one operation in the technological process.

The second group– combined machines with new combined working units which perform simultaneously several operations in a new technological process.

For performing direct under layer spreading of seeds new technological principles have been created and new machines have been constructed.

One of the most successful working units is the cultivation foot combined with tow rotors fig.1 [3]. While moving forward the knives of the first rotor **1** cut the outer layer of the soil in stripes, after that these stripes are cut by the cultivation foot **5** and form a continuous soil layer moving along the working surface of the foot. The knives of the back rotor **2** destroy the lifted soil layer and help its movement along the working surface of the foot, cleaning the plant remains off. The smoothing of the soil layer is performed by the cover **3**, placed above the rotors. The packing of the soil is performed by the roller **4**.

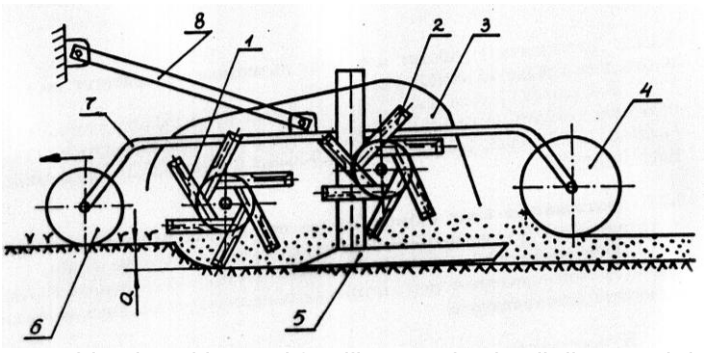

Fig.1. Combined working tool for tillage and subsoil dispersed drilling:

1- advanced rotor; 2-back rotor; 3-reflective jacket; 4- compacted roller; 5-subsurface cutter; 6-support wheel 7- frame; 8-hanging unit

Whit the air flow help the seeds enter into two distributing mechanisms **6** (fig. 2) placed under the foot. There the seeds are evenly spaced in the under layer surface [2].

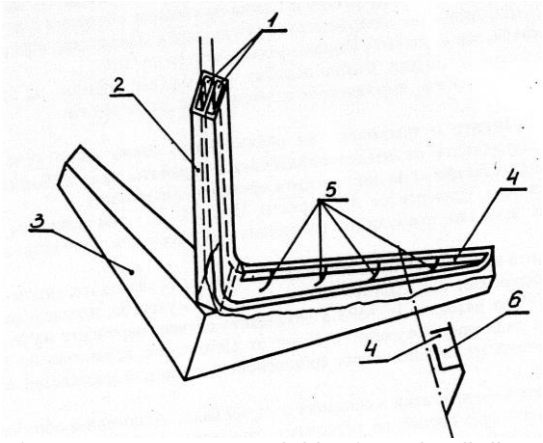

Fig.2. Subsurface cutter – spray sprinkler for subsoil dispersed drilling:
1-seed pipes; 2-stand; 3-plain cutter; 4-crevice hole; 5- reflective dividers; 6- furrow valves; 7- a bottom wall of the chute

After studies the main parameters of the combined working body and the distribution of subsurface structure are optimized.

Conclusion

1. Techniques of minimum soil tillage and direct subsoil seeding have several advantages over traditional technologies for sowing of crops.
2. The successful implementation of these techniques depends on machines that take place.
3. The most promising is the use of combined machines having new combined working tools.
4. The proposed combined tool for soil tillage and dispersed subsoil drilling satisfies agro-technical requirements and can be used as a basis for design and building a combined machine that combines the operations of tillage and sowing.

Literature

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