WORKING SPEED AND QUALITATIVE INDICES OF SOWING WORK

SĂRĂCIN ION[1], GLODEANU MIHNEA[1], VASILE CRISTIAN[1], ALEXANDRU TUDOR[1]

1- Universitatea din Craiova
tel. 0744162539, e-mail ion_saracin@yahoo.com

ABSTRACT

The sowing speed is a determining factor for the observance of the qualitative indices of the work in terms of the distance between nests in a row and the sowing depth.
This aspect is sometimes ignored compared to other links in cultivation technologies due to external factors such as: weather conditions, long distances between the soils to be sown, lack of seed supply, etc.
Most seeders, which have higher working rates, contain in the instructions for use data on the recommended working speeds for uniform sowing, and information on the maximum working speeds at sowing, which are often taken by the mechanic as a standard but sometimes users do not respect and exceed them, ignoring the real conditions in the field, respectively the quality of the germination bed, which influences the displacement of the aggregate with a negative effect on the sowing accuracy (distance between nests) or depth at sowing. Basically, the speeds that exceed the recommendations for a uniform sowing lead to non-uniformities horizontally and vertically . Horizontally on the distance between the nests, vertically on the working depth. Each of the two parameters in turn with a negative effect on the number of plants per surface unit.

INTRODUCTION

Most current seeders, which have good and very good qualities, contain instructions and speeds recommended for uniform sowing, but also contain information on maximum sowing speeds, which are often taken by the mechanizer as a standard or sometimes even exceeded, ignoring field conditions, such as preparing a suitable germination bed or sowing depth.
Basically, speeds that exceed the recommendations for uniform sowing lead to horizontal and vertical non-uniformities. Horizontal non-uniformities are given by the random distances between seeds in a row.
Due to the increasing presence of fast seeders, capable of working up to 15 km per hour, the ARVALIS Institute has tested several such equipments since 2012, to assess the impact of this technique on plant development and maize production.
Increasing the working speed can primarily affect the sowing depth. To remedy this, the producers have largely dimensioned the sowing elements, but also the pressures that apply to them, so that the element remains flat on the ground, regardless of speed.
In research conducted in 2013 and 2014, the increase in speed at a conventional seed drill is reflected by the shallower seeding (under conditions of identical depth and tension settings).
Conventional seed drills allow sowing of 9-11 km / h on well-prepared soils;
Tests performed allow the development of recommendations for precision sowing depending on soil preparation and type of seed drill.

• on well-prepared beds, a conventional precision seed drill with burial (American model) can operate up to 9 km / h without special precautions. On the other hand, it is recommended not to exceed 4-5 km / h in difficult conditions.
• corn sowing works can be carried out at 15 km / h with fast seeders on well-prepared soil if the scattering / selection parameters for the sown variety are optimized (depending on the size and shape of the seed).
However, if it is sown in difficult conditions, the speed with such equipment will not have to exceed 10-11 km / h - which is already twice the speed with a conventional seed drill in similar conditions!
On conventional seed drills, the seeds fall freely through the seed drill from the dispenser to the ground. When vibrations occur at higher speeds, the seeds jump into the tubes and much of the precision is lost here. This is one of the reasons why many seeders are limited to low sowing speeds.

MATERIAL AND METHOD

In the laboratory the sowing precision can be determined using a stand (shown in fig.1), which to simulate the sliding of the drive wheel
The stand for determining the sowing precision ensures test conditions for all types of sowing sections for hoeing crops, and the sowing accuracy can be tested by measuring the distance between the seeds glued to the strip of the stand.
The working speed was simulated with a low-speed, variable-speed electric motor that drives the centralized transmission of the drive wheel and the distributor, at speeds set in the range of 5-15 km / h., While adjusting the pushing force between the transmission wheels, rubber-coated wheels whose coefficient of friction is known, the slip of the wheel can also be determined, thus simulating the slip of the wheel on the ground and determining the influence of the slip of the wheel on the distance between nests in a row.

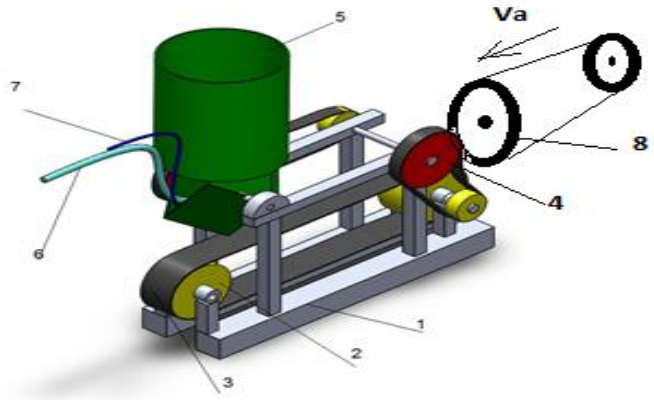

Fig.1 Stand for determining the precision of sowing with sliding of the drive wheel.a- of the construction of the stand, b- The equipment for simulating the slip of the wheel for transmitting the motion to the disc with holes

WORKING METHOD

According to the literature, the distance between nests in a row is calculated with the relation:
$Dc = \pi D r (1 + \xi) / i z$ (cm)

where: Dc represents the distance between nests in a row, cm
Dr - diameter of the drive wheel, cm
I - transmission ratio

Z - the number of holes on the distributor disc
ξ– slipping of the drive wheel
Documentation source arvalis institute, in research conducted in 2013 and 2014, on increasing the speed of a conventional seed drill and the influence on sowing precision reflected that the seeding depth is influenced in identical depth and tension settings well regulate. A rolling force or traction F parallel to the running track, which acts in the center of the wheel, is required to run the wheel. The reaction X of the tread together with the force F creates the torque that ensures the rotation of the wheel. for the constant speed movement of the free wheel, a pushing force F equal to the rolling resistance of the wheel is required (fig.2).

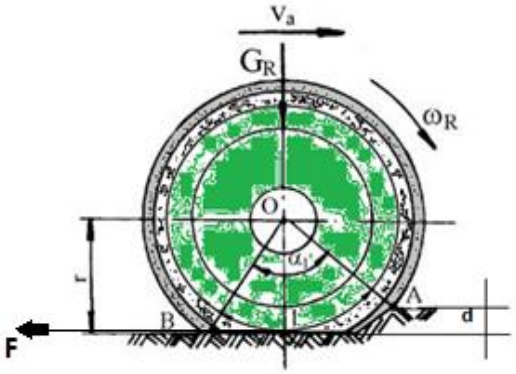

Fig. 2 Drive wheel of the sowing section (wheel driven in the literature) Gr- section weight distributed on the wheel, Ωr- rotation speed ,, Va -sowing speed of the seed drill, r- wheel radius, d- soil deformation at the wheel advance

Table 1

Average values of the rolling resistance coefficient

The kind of road	Road condition	Rolling resistance coefficient (f)
plowing	placed	0,120-0,140
Field	With fresh plowing	0,180...0,220
	cultivated	0,160...0,200

Table 2

The value of the wheel coefficient also depends on the condition of the road according to the table

The kind of road	The condition of the road or soil	
plowing	With fresh plowing	0,3 0,5
Field	cultivated	0,4.....0,6

By graphically representing the dependence between the specific tangential force and the slipping (or slipping) of the tire, the tread characteristic is obtained. It is observed that the specific tangential force increases with the increase of the skating, reaching a maximum value (ξmax = valori) for slip values between 0.15 and 0.30 (Untaru)

RESULTS AND COMMENTS

Influence of working speed on sowing accuracy.The sowing precision was theoretically determined for corn seeds, under the following conditions:
- mass of 1000 seeds of 344 g;
- distributor disc with 16 holes;
- depression of 340 mm col H2O;
- number of holes on the disc 16
- number of grains per hectare = 50.000
- simulated working speed: 5, 7, 9, 12, 15 km / h.
- slipping of the drive wheel of the discs with holes: ξ = 8 and ξ = 12, values provided in the specialized literature (Șt.Căproiu et al.1982)

Table 3

Influence of working speed on sowing accuracy

Speed [km/h]	Obtained distance[cm]	Slip[%]	Adjustale distance[cm]	Theoretic norm seminte/ha	Corn sowing precision[%]	Different norm seeds
		0	28	50000	100	
5	28,5	8	28	49824	98,2	176
	29,2	12		48600	97,2	1400
7	28,8	8	28	49305	97,1	695
	29,6	12		47972	95,9	2025
9	29,3	8	28	48464	95,4	1536
	30,1	12		45806	91,61	4194
12	29.8	8	28	47651	93,57	2349
	30,9	12		45954	91,9	4046
15	30,6	8	28	46405	92,3	3595
	31,4	12		45222	90,44	4778

CONCLUSIONS

• The increase of the sliding wheel of the distribution device leads directly to the decrease of the sowing precision, increasing the distance between the nests in a row and implicitly to the decrease of the number of plants per unit area.
• Speed variation within 5-9 km / h sowing accuracy decreases by approximately 5% at each gear.
• When simulating the 11 ° slope, the sowing accuracy decreases by approximately 7%.
• optimal preparation of the germination bed leads to the possibility of sowing at higher speeds which will increase productivity.
• The improvement of the sowing machines can be obtained by their constructive improvement by:
• automatic adjustment of the shaft speed that drives the distributor discs of the seed sections in correlation with the speed of movement of the machine measured by a sensor;

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