MECHANIZED PLANTING OF SEEDLINGS OBTAINED IN ALVEOLI

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ABSTRACT

In the paper, the authors present a study on the mechanized planting works of seedlings, made with an experimental machine with rotating seed pot planter. For this, seedling of tomatoes, eggplants and peppers were prepared and it started with obtaining the seedling by sowing in alveoli and studying its evolution and quality. The seeds were placed in well-chosen alveoli depending on the seeds size.Until the emergence and development of the seedlings, the germination bed was prepared according to the agrotechnical requirements. The seedlings were planted using the above equipment.

The obiective of the study is to evaluate the performance of the experimental machine with rotating seed pot planter. Determinations were made regarding the qualitative indices of the respective work, the planting depth and its uniformity, the distance between plants in a row and its uniformity, the degree of damage of the plants. The obtained results were compared with the data from the specialized literature and conclusions were drawn regarding the possibilities of using the experienced equipment for the mechanized planting work of the seedlings obtained in the alveoli.

As a result of the study, very good values of the qualitative indices of the work in case of the rotary distributor was found.

INTRODUCTION

Vegetable cultivation was one of the first practical activities of man, but with the evolution of society, technologies, knowledge and methods of growing vegetable plants have been continuously developed, this pace becoming particularly fast in the modern era.

The establishment of vegetable crops can be achieved by: sowing directly into the field (carrots, onions, tomatoes, peas, beans etc.), planting seedlings obtained by sowing in pots (tomatoes, eggplants, pappers ,cabbages etc) vegetative parts.[1]

The production of the seedling is carried out in a specially arranged space. It must be clean, disinfected and bright. The space for the production of seedlings must allow good control of the microclimate - temperature, humidity and ventilation.

Sowing in greenhouses is done 45-60 days before planting, repel into 7 × 7 × 7 cm nutritional cubes, 20 to 30 days after sowing to be planted in the field after 30 - 40 days . Sowing can also be produced by sowing directly into nutritious pots without the need for reprocessing, planting is done directly in the field [4].

Planting can be done manually on small surfaces or mechanized using automatic planters

An important problem is the fact that in the still widely used planting technologies are used seedlings that have root without nutritious soil, as planting material, which has some disadvantages, the most important of which is the increase in transplant trauma and implicitly, the heavier catching in the field, which leads to a significant percentage of mistakes when entering the vegetation, but also a late entry into the vegetation of the planted seedling.

One of the simplest machines from a constructive point of view being a semi-automatic planting machine, in a row [6], equipped with disc and articulated buckets.

MATERIAL AND METHOD

To carry out the experiments, a planting machine was used in a row, equipped with a distributor with articulated cups, fig. 1, consisting of the following assemblies [5].

Fig.1 Machine for planting vegetable seedlings and herbs in a row, MPA symbol (* INMA Bucharest, 2018)***

1-Frame, 2- planter, 3- transmission, 4- rear support wheels,5 –rcompaction wheels, 6- rack or crate holder, 7- track marker

The planting apparatus, fig. 2, the basic assembly of the machine is made up is fixed to the frame at the front and consists of: deformable parallelogram, item 1, is mounted by frame flanges, so that the position of the device on the bar can be easily adjusted and which serves and as a support for the wide-rimmed wheel, on which the section rests on the ground. The deformable parallelogram ensures the vertical movement of the planting device, allowing the faithful tracking of the soil unevenness; coulter, pos. 2, has the role of opening the gutter where the seedling will be placed, it is of the wedge type, with an obtuse penetration angle and it consists of two parts: the first part is the splitter, which opens the gutter into which the seedling will be inserted, and the second part, makes the seedling for fixing the seedling with the help of two fins, position 3; the planting distributor with cups, item 4, consists of a wheel (flywheel) on the rim of which holes are drilled in which the planting cups, item 5 are mounted by means of plugs; adjusting wheels, pos.6, adjusts the planting depth; crank mechanism, item 7; traction spring, item 8.[2]

Fig. 2 **The planter of the machine**

*(**** INMA Bucharest, 2018)*

1- deformable parallelogram, 2- furrow opener, 3- cover wings, 4- bucket planting distributor, 5- buckets, 6- depth adjustment wheel, 7- lifting mechanism, 8- traction spring

In order to use an optimal vegetable cultivation technology, all the factors that influence the establishment of a crop must be analyzed, respectively the preparatory works of the land, the planting material, its planting, the maintenance of the culture and the harvesting.

Planting material used

To obtain an optimal vegetable crop, it is preferable to use seedlings obtained in nutrient pots, this leading to the minimization of losses when catching the planted seedling and entering the vegetation normally about two weeks earlier than planting the seedlings. nutritious pots.

For the experiments, 50 seedlings, tomatoes, peppers and cabbage from each culture were used.

Planting seedlings

For planting, only quality, well-developed seedlings. 4-5 days before planting, a "start" fertilization with calcium nitrate is recommended, which ensures a reserve of mineral substances in the plant, after planting. Two days before the date of planting, phytosanitary treatments can be applied, and one day before planting, watering until saturation is applied, which will make it easier to remove the seedlings. The appropriate age for planting varies depending on the crop and the degree of development of the plant is monitored. In general, the seedling is ready for planting if it is vigorous, thick and with short internodes, has a well-developed root system, has between 6-10 leaves and a height between 10-20 cm, depending on the crop. Prior to planting in the field or in the gardens, for about 5-10 days, all the vegetable plants that will be planted in the seedling will be accustomed to temperatures that are much harsher, environmental conditions, than those that had them in seedlings, proceeding to the so-called hardening of the seedlings. To this end, a series of measures will be taken, as follows: trays with alveoli will be kept open all day and night (when there is no danger of frost), watering will be reduced and no additional fattening will be done [7].

When planting, it is not allowed for the seedling to be dehydrated, withered or to present diseases caused by bacteria and / or fungi, defoliating insects. The leaves should be arranged almost horizontally, and the white roots should be well branched and turgid. The stem of the seedling should not be too compact or elongated, with very thick internodes, because this will be to the detriment of flowering, respectively in the number of tied fruits lower.[3]

Planting depth

The seedlings are planted close to the first true leaf, knowing that, on the surface of the stem, adventitious roots are generated.

Calendar of planting in the garden or field

The planting period is established so that the plants are not affected by late spring frosts, respectively when the soil achieves temperatures above 15 ° C.

Planting distances established depending on the species and variety cultivated the mechanization of care work and the harvesting on smaller or larger areas of land.

Some planting distances, most often used for growing vegetables and herbs, are shown in Table 1, [8,9].

Table 1

Planting distances of seedlings

Culture	Distance between rows, cm	Distance between plants, cm
Tomatoes	70	30-40
Pepper	60	15-25
Cabbage	50	40

RESULTS AND DISCUSSION

Experiments have shown that both variants allow the row spacing and the plant spacing to be adjusted in line with the conditions laid down in the existing technical standards and the cultivation technologies used.

In experiments five measurements were carried out for the distance between the plants one at a time, the planting depth and the deflection of the planted seedbed from the vertical position and have been visually assessed, the degree of injury of the plants and the plants left on the ground surface, these parameters are the most important in the work to be planted.

The results of the experiments are given in tables 3, 4 and 5.

Using the determined values, the indices of appreciation have been calculated according to the relationships (1), absolute average, V_{ma}, with relation:

$$V_{ma} = \frac{\sum_{1}^{n} v_i}{n}; \quad (1)$$

where:

V_i –is the measured value, cm;

n - the number of measurements taken.

Table 3

Qualitative indications at planting-Tomatoes and Pepper

No. of the measurement	Between plants in a row, [cm]		Planting depth, [cm]		Deviations from the vertical position [^{0}]
	Adjusted value [cm]	Measured values, [cm]	Adjusted value, [cm]	Measured values, [cm]	
1	35	35.4	6	6.2	5
2		35.5		6.0	4
3		35.3		6.2	3
4		35.5		6.3	4,5
5		35.2		5.8	4
Absolute average, V_{ma}, [cm]		35.38		6.10	4,1

Table 4

Qualitative indications at planting – Cabbage

No. of the measurement	Between plants in a row, [cm]		Planting depth, [cm]		Deviations from the vertical position [^{0}]
	Adjusted value [cm]	Measured values, [cm]	Adjusted value,[cm]	Measured values, [cm]	
1	40	42.4	6	6.2	5,5
2		43.3		6.0	4
3		41.0		6.2	3,5
4		40.5		6.3	4
5		40.8		5.8	2
Absolute average, V_{ma}, [cm]		40.52		6.2	3,8

The assessment of mistakes and the degree of damage to planting is done by the percentage of improperly planted seedlings (covered with soil, left on the ground, damaged), a percentage that must be below 5%, according to the requirements [SR 13215: 1994- Seedling planters. Technical quality conditions].

The results determined in experiments in order to assess the faults and the degree of damage at planting, are presented in tables 5, in which:

g_i - identified fault or damaged plant

Table 5

Injured plants, inappropriate seedlings

Number of seedlings planted	The distance between plants in a row, 620mm – 3 cups			The distance between plants in a row, 460mm – 4 cups		
	v_l [km/h]	Faulty or damaged plant, g_i		v_l [km/h]	Faulty or damaged plant, g_i	
		[buc.]	[%]		[buc.]	[%]
30	1,1	0	0	1,2	0	0
30	1,54	0	0	1,59	0	0
30	2,25	1	3,33	2,35	1	3,33
30	**2,95**	2	**6,67**	**2,86**	3	**10**

To determine the planting depth of the seedling, measurements were made at 5 points at intervals of 2 m between points at three working speeds.

Based on the measurements performed, the following were calculated:

am - average planting depth, with the relation:

$$a_m = \frac{\sum_{1}^{n} a_i}{n}, \text{ m} \quad (2)$$

in which:

a_i - is the planting depth, mm;

n - number of measurements performed.

V_a - planting depth variation index, according to relation (.2):

$$V_a = \frac{\sigma_a}{a_m} \times 100, \% \quad (3)$$

in which:

- the mean square deviation of the planting depth, according to relation (4):

$$\sigma_a = \pm \sqrt{\frac{\sum_{i=1}^{n} (a_i - a_m)^2}{n-1}}, \text{ mm} \quad (4)$$

The values obtained from the experimental determinations for Variant I (trough planting), for planting depth, are presented in tables 6,7,8.

Table 6.

Determined planting depth, adjusted depth,50 mm -

No. crt.	v_l [km/h]	a_i [mm]	a_m [mm]	σ_a [mm]	V_a [%]
1	1,1	53	52,4	1,82	3,47
		50			
		55			
		52			
		52			
2	1,54	54	54,0	1,0	1,85
		55			
		53			
		55			
		53			
3	2,25	55	56,2	0,84	1,49
		57			
		56			
		56			
		57			

Table 7.

Determined planting depth, adjusted depth,70 mm

No. crt.	v_l [km/h]	a_i [mm]	a_m [mm]	σ_a [mm]	V_a [%]
1	1,15	73	72,2	1,68	2,32
		70			
		73			
		71			
		74			
2	1,61	73	73,4	1,14	1,55
		75			
		73			
		72			
		74			
3	2,28	75	76,6	1,14	1,49
		77			
		76			
		77			
		78			

Tabelul 8

Determined planting depth, adjusted depth, 90 mm

No. crt.	$v_{l,}$ [km/h]	$a_{i\ ,}$ [mm]	$a_{m,}$ [mm]	σ_a, [mm]	V_a [,%]
1	1,16	92	92,8	1,7	1,83
		94			
		91			
		95			
		92			
2	1,51	96	95,2	0,84	0,88
		95			
		96			
		94			
		95			
3	2,32	96	96,6	0,55	0,57
		97			
		96			
		97			
		97			

CONCLUSIONS

1. The deviations made from the planting distances between the rows are insignificant compared to the theoretical ones imposed, these being between 1.1-1.3%;
2. The deviations made at the planting depth compared to the theoretical ones imposed, are insignificant, being between 1.66-3.33%;
4. The percentage of degraded plants, broken or covered with soil above the technological level was less than 1%, much lower than that allowed by the planting technology;
4. Regarding the mistakes and damage of the plants, registered in the planting process, it can be stated that they tend to increase with the increase of the working speed. starting with a speed of 2.56 km / h the quality index of the damaged plants starts to no longer correspond to the quality standards from the specialized manuals.
5. If we analyze the qualitative index of the variation of the planting depth we can observe that with the increase of the speed of movement this index begins to decrease the experimental model does not have time to follow all the landslides.
6. In final conclusion, it can be stated with certainty that an optimal seedling planting technology involves preparing the land with a minimum of work, using nutritious potted seedlings, quality according to standards, planting in the recommended periods depending on each crop and use when planting technical equipment such as those equipped with planting devices with articulated buckets.

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