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# RESEARCH ON THE OPTIMIZATION OF PLANTWORK AS A LINK IN VEGETABLE GROWING TECHNOLOGY

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## ABSTRACT

The continuous increase of vegetable consumption has led to the intensification of research to improve and streamline vegetable cultivation technologies. Achieving an optimal technology involves obtaining the highest possible yields per unit of cultivated area, at a higher quality, under the conditions of using minimal human and financial resources.

The paper presents a series of experimental research on technologies for growing vegetables in the field, insisting on the work to be planted, on that depends the evolution of the crop from establishment to harvest. After a short review of the works necessary for the establishment of the culture, there is a system of different types of technical equipment for planting seedlings, some requirements of the planting work, presentation of a type of equipment, among the most efficient currently used, quality indices obtained from the experimentation of the mentioned equipment, conclusions and recommendations.

## 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.

Knowing the needs of each vegetable species in relation to environmental factors (heat, light, air, water, etc.) is of particular importance because through the technology used we can manage these factors in close accordance with the requirements of different vegetable species [5].

One of the important problems in the technological process that occurs when setting up vegetable crops is seedling planting, an operation that can be performed either manually, when it is done in individual households, greenhouses, solariums on small areas, or mechanized, when planting must be done on large areas.

Another 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.

Improving the planting technology of cultivated crops by using seedlings produced in nutrient pots, in parallel with research and development of planting equipment that can work with such seedlings, in order to increase the working speed of the planting unit in parallel with the growth the precision of planting but also the increase of the degree of attachment after transplantation represent some of the current preoccupations of the specialists in the field.

Over time, many authors have published scientific papers and books that presented all aspects of vegetable growing technologies, these being true guides for growers. [1,4].

The equipment for planting seedlings has experienced a spectacular development over time, technical solutions have been obtained, and especially for the planting apparatus have been very diversified [3] and following multiple comparative research. equipped with articulated discs and buckets, are among the simplest from the constructive point of view and the most economically reliable, realizing the working parameters for the work of planting seedlings, in accordance with the agrotechnical requirements, at the highest degree, in especially the vertical position at planting [2].

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 [6].


***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.


***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.

**Land preparation for planting**

The land intended for planting vegetable seedlings must meet the following conditions:
- to be crushed and loosened as well as possible;
- to be well leveled;
- not to present uncovered vegetal remains;
- to have a humidity corresponding to the accomplishment of the planting work, respectively the soil not to adhere to the working organs of the planting equipment.

The preparation works are preferable to be carried out with a minimum of works because the soil keeps its optimal fertility characteristics if it is intervened as little as possible mechanically, therefore, together with a plowing work, carried out in the previous autumn, it is preferable in the spring of the production year, to make a single preparation work, performed with a combined aggregate that includes crushing, loosening and leveling organs that can also perform the fertilization work with granular fertilizers.

**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: nurseries or 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 [8 ].

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.

**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, [9,10].

*Table 1*

**Planting distances of seedlings**

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

**Requirements imposed by regulations on the work of planting seedlings**

In addition to the above-mentioned agrotehnical conditions, in order to carry out seedlings in the best conditions, the technical equipment must in turn meet certain conditions, as follows [7]:

- the planted rows to be straight, the deviations from the allowed row axis are of max. 5% within ± 20 mm;
- the minimum distance between rows should be adjustable, preferably continuous, starting with min. 300 mm, to allow the mechanization of maintenance and possibly harvesting works;
- the distance between plants in a row should be adjustable continuously or in steps of 50 mm, within the limits 100-1200 mm;
- planting depth within the limits of 30-150 mm;
- fixing the seedling in a vertical position at planting;
- the percentage of improperly planted plants (inclined at more than 30 ° from the vertical, stems covered with earth, left on the ground, broken) should be below 5%.

Tests were carried out in aggregate with a 45 hp vegetable tractor, , with seedlings in nutrient pots, and was carried out in the experimental fields of INMA Bucharest

The size of the propagating material and its degree of growth are given in table 2.

*Table2*

**Materials for plant and the characteristics of their own**

| Crt. no. | Seedlings | Dimensions of the nutrient pot [mm], truncated cone Dxdxh | Seedlings stage of growth | | |
|---|---|---|---|---|---|
| | | | Height [mm] | Diameter of stem [mm] | Number of leaves |
| 1 | Tomatoes | 50x40x50 | 150-200 | 3-5 | 6-9 |
| 2 | Pepper | 50x40x50 | 120-150 | 2-3 | 6-8 |
| 3 | Cabbage | 50x40x50 | 100-120 | 1,5-2,5 | 5-7 |

## 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 and 4.

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

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

where:

$V_i$ –is the measured value, cm;

n - the number of measurements taken.

**Qualitative indications at planting-Tomatoes and Pepper**

*Table 3*

| **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 |

**Qualitative indications at planting – Cabbage**

*Table 4*

| 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 |

## 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;
5. 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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