

THE EFFECT OF DIFFERENT WAYS OF GROWING CELERY ON THE GROWTH DYNAMICS OF CELERY LEAF AND TOTAL CELERY WEIGHT

Goran PERKOVIC¹, Aleksandra GOVEDARICA - LUCIC¹, Natasa MIRECKI²

¹Faculty of Agriculture, University East Sarajevo, Republic of Srpska, Bosnia and Herzegovina

²Biotechnical Institute, Podgorica, Montenegro

(Corresponding author: perkan66@gmail.com)

Abstract

The aim of this study is to determine the effect of different modes of celery production on the dynamics of formation and growth of leaf weight, as well as to determine the dependence and correlation between the formation of leaf weight and root weight. Dynamics of celery growth depends on agro-technical measures applied during production process as well as agro ecological conditions that occur during the growing season. In the experiment, the effect of six different methods of cultivation was being studied, as follows:

1. celery from direct sowing,
2. bare-root seedlings,
3. seedling in containers,
4. soil mulching,
5. no soil mulching.

Every variance was cultivated on bare and mulching soil

The results clearly indicate that, regardless of the way of production, growth and development of the celery is happening through five different periods. The way of producing has a significant effect on weight gain dynamics and total celery weight. The most intense increase was found in celery produced from the container seedlings, while the weakest growth intensity was found in celery produced by direct sowing.

Key words: celery, direct sowing, seedling production, seedling in containers, method of cultivation, growth, yield.

Introduction

Celery production is a very long process that consists of a series of agricultural measures for which there should not be a failure. Any failure is reflected in the success of the production which is the reason why this production is extremely challenging and lucrative.

Specific growth rate, especially of thickened roots, and, high sensitivity in the phase of rooting stage make celery production one of the most complex productions. Slow germination (very small seed, a lot of essential oils), requires that the celery be most commonly produced from seedlings. Although the production of seedlings is the most sensitive stage in the production of celery, it enables the celery growth under the optimal conditions of the protected enclosures.

Leaf weight affects the amount of absorbed light energy, and therefore the yield is, up to a certain limit, in close relation with the dimension of the leaf weight and the length of its duration. Since thickened root is the result of the transition of nutrients from the leaves to hypocotyls, epicotyl and radical, the intensity of leaf weight increases, its photosynthetic activity and duration affect the intensity of the increasing of root weight.

Celery seedlings at the time of planting must be optimally developed, allowing the quick recovery of the root, rooting and further growth of the plant. Too young seedlings root

rapidly but grow slowly, while too old seedlings slowly restore root system, and therefore a certain number of leaves dries out.

Materials and methods

Experiments were carried out on land belonging to gray-brown non-calcareous chernozem soil type (area of Semberija), where the two-factorial trial with three variants in four replications was set. The basic plot size was 5 m² with 40 plants each.

In the production of seedlings, planting was done in the land of hot bed and in containers (dimensions of the containers were 50x30x8 with 110 globoid dents) on 15th March and planting in the field on 17th April (1995) i.e. 20th April (1996).

Celery was planted (18th May 1995 i.e. 20th May in 1996) in the inter-row at a distance of 50 cm, and the distance in rows was 25 cm. Sowing and planting were done by hand in an optimal agro-technical term. Simultaneously with the sowing and planting, the mulching of soil with photodegradeable mulch (folium) was done.

During the growing season, every thirty days the plants were analyzed with the aim of monitoring the growth dynamics. On that occasion, the following was determined: the total weight of the plant, and weight of leaves, the weight of roots, the number of leaves, the length of the roots and leaves.

Results and discussion

Growth dynamics of celery weight and growth dynamics of leaf weight have five characteristic periods. The first period is the period from sowing to the formation of the first 4 leaves; the second period lasts from the time of planting to the period of the end of the rooting. The third period when the celery intensively increases leaf and root weight begins in July. During the fourth period, during the hot days of August, celery weight increases slowly. In the fifth period, the phase of the harvest maturity, the celery weight begins to increase more intensively.

Slower increase in weight in the first period of vegetation is characteristic for most vegetable crops.

The common feature is that in the beginning of vegetation leaf weight slowly increases (20th June), which is followed by the period of more intensive increasing of leaf weight, which coincides with the periods of the total intense of increase of plant (20th July).

During August, the growth is slow, which is similar to the second period. Thus, daily increase in leaf weight, during June and August (second and fourth period) is 1.2 g / day.

Table 1. Average growth dynamics of leaf weight during the growing season

| Period | 20.3. - 20.5. | 20.5. - 20.6. | 20.6. - 20.7. | 20.7. - 20.8. | 20.8 - 20.9 |
|-----------------|---------------|---------------|---------------|---------------|-------------|
| Average (g/day) | 0,033 | 1,31 | 4,90 | 1,25 | 3,28 |

However, in the period of harvest maturity (September), a new, more intensive, increase in leaf weight occurs with the formation of five to seven new leaves.

The specificity of increase of assimilation apparatus of celery is also reflected in the fact that during the period of maturation (20.8. - 20.9.) i.e. at the end of the growing season there is no reduction in leaf weight, which is specific for many root species. It is interesting that in this period increasing of leaf weight occurs more intensively (3.28 g / day). However, this rapid growth at the end of growing season is still somewhat more weakly expressed compared to the maximum intensity of growth, which is characteristic of the third decade of June and the first two decades of July. More intensive growth of leaf weight at the end of the growing season, takes place at the expense of nutrients from the root which is considered as

harmful effect. Different ways of growing celery significantly influenced the increase in the intensity of leaf weight throughout the growing season.

Different ways of growing celery had a significant impact on the intensity of increasing of leaf weight throughout the growing season, which is consistent with the results of research by *Dyduch, J (1980)*.

Growth intensity of leaf weight in relation to the method of growing and growing season

At the beginning of the vegetation, during June, there are a significant differences in intensity of the increase in leaf weight produced using bare vessels and container seedlings with mulching.

Table 2. The average daily increase in leaf mass under different growing (g/plant/day)

| Way of breeding | Growing season | | | | | Average |
|--------------------------------------|----------------|-------------|-------------|-------------|-------------|-------------|
| | I | II | III | IV | V | |
| Bare-root seedlings | 0,042 | 1,58 | 8,33 | 0,83 | 0,63 | 1,84 |
| seedling in containers | 0,026 | 1,50 | 5,36 | 1,83 | 3,00 | 2,02 |
| celery from direct sowing | 0,030 | 1,16 | 3,10 | 2,33 | 3,65 | 1,81 |
| Bare-root seedlings with mulching | 0,042 | 1,58 | 4,83 | 0,50 | 3,80 | 1,90 |
| seedling in containers with mulching | 0,026 | 0,78 | 5,00 | 0,85 | 3,82 | 1,85 |
| direct seeding with mulching celery | 0,030 | 1,26 | 2,70 | 1,16 | 4,80 | 1,82 |
| Average | 0,033 | 1,31 | 4,90 | 1,25 | 3,28 | - |

Celery produced from direct seeding with and without mulching had the approximate intensity of the increase of leaf weight (1.1 - 1,2 g/day). Celery produced from direct sowing had a slower intensity of increase in leaf weight by 27%. For other types of growing celery the intensity of increase in leaf weight was constant (1.5 g / day).

During July, among other ways of growing celery, there are the greatest differences in intensity in leaf weight increase. During vegetation, there are two periods of intense increase in leaf weight. The most intense increase of leaf weight, in July, had celery seedlings produced from bare vessels (8.3 g/day).

The slow intensity in the increase of leaf weight, had celery produced from direct seeding with and without mulching. During this period, celery from direct seeding increases the weight by an average of 3.1 g / day, and celery produced from direct seeding with mulching increases weight by 2.7 g / day. Among other methods of cultivation there are no significant differences, but in relation to the production of celery seedlings from bare vessels, the intensity of the increase in leaf weight was 30-35% lesser.

The intensity of the growth of the total weight of celery in relation to the method of growing and growing season

The dynamics of growth of the variants examined is equable early in the season and during the first and second period and in the stage of technological maturity of celery root density (fifth term).

The biggest differences in the weight dynamics occurs between control (seedlings bare veins) and other ways of growing in the period of intensive growth of weight (period III) and in the fourth period when celery weight increases slowly.

The intensity of daily increase in weight of celery is equable in the first period and there are no significant differences between the various methods of cultivation. During the

second period, daily increase in weight of celery produced from seedlings of bare veins is 2.38 g / day, and the most intense daily increase in weight has celery produced from container seedlings (2.53 g / day). The lowest daily weight increase has celery seedlings produced from container with mulching (1.46 g / day), celery from direct seeding without mulching (1.7 g / day) and with mulching (1.8 g / day).

Celery seedlings produced from bare - vein seedlings have the highest intensity of growth of the total weight (11.66 g / day) compared to other methods of cultivation during the third period

The smallest increase in the total weight has celery produced in direct seeding with and without mulching (4.1 and 5.86 g / day).

Celery seedlings produced from bare vein (2.83 g / day), the container seedlings (2.81 g / day) and from direct seeding with mulching (2.5 g / day) have the equal daily growth of total weight in the fourth period.

Celery produced from direct seeding (4.0 g / day) has the greatest increase in total weight in the fourth period. Celery seedlings produced from bare vein with mulching (1.0 g/day) has the smallest increase in the total weight in the fourth period.

Different ways of growing demand that the periods of slow and intensive growth of weight occur in different periods of vegetation, which is taken as the basic difference.

When considering the total mass of celery root density, the yield increases significantly with increasing leaf mass. Although there are different and often conflicting opinions, the prevailing attitude would be that the yield of the majority of cultivated plants increases with increasing leaf mass (*Kastori R., 1991.*)

Our results confirm that there is a positive correlation between the root mass density and leaf mass. (Table 3)

Table 3. Correlation coefficients, determination and undetermination of different ways of growing celery

| Way of breeding | Coefficient | | |
|--------------------------------------|--------------|---------------|-----------------|
| | correlations | determination | undetermination |
| Bare-veins seedlings | 0,8058 | 64,90 | 35,06 |
| seedling in containers | 0,8932 | 79,78 | 20,22 |
| celery from direct sowing | 0,9717 | 94,43 | 5,57 |
| bare--veins seedlings with mulching | 0,9360 | 87,61 | 12,39 |
| seedling in containers with mulching | 0,9183 | 84,34 | 15,66 |
| direct seeding with mulching celery | 0,9683 | 93,77 | 6,23 |
| Average | 0,9155 | 84,14 | 15,85 |

Interdependence increases leaf and root mass and being showed most clearly with the analysis at the celery plants produced by direct seeding. Specifically, the growth of all plants run continuously throughout the growing season and depends of the biological characteristics of species and production conditions. This is confirmed by the fact that it is precisely this mode of production that has a high correlation coefficient ($r = 0.9717$) and the lowest coefficient of undetermination (factor unanalyzed $k^2 = 5.57$). Similar results come from *Borovic, J. (1990) and Markovic, V.et all (1992)*. These authors emphasize the impact of development of root in container seedling on the intensity of the mass of the vegetation.

On average correlation coefficient was high in all the variants, which indicates that with an increase in leaf mass the mass of root density increases too, and that the greatest impact have unanalyzed factors in the production of seedlings and without mulching.

Regression analysis showed that the dynamics of mass root density depends on the leaf mass and takes the form of second-order parabolic curve expressed general formulay = a + bx + cx².

Less value is shown in these analyzed parameters and celery production of direct seeding in relation to the production of seedlings which corresponds to significant differences in relation to the production of seedlings. The parameter b indicates the change in value (mass of thickened root) which, depending on the value of leaf mass (x) has a positive value in the direct production of seeds directly reflecting the ever-growing and high significant value of the quadratic equation coefficient.

Conclusion

Based on the two-year investigation of testing methods of growing influence on growth rate of leaf mass and total weight of celery, the following conclusions could be drawn:

- During vegetation the most intense magnification of leaf mass has celery produced using containerized seedlings (2.02 g / day), and the lowest increase of leaf mass intensity (1.82 g / day) has celery produced by direct seeding with and without mulching
- Celery manufactured with use of container seedlings increases its mass most intensely and achieves the highest total yield.
- Production of celery in direct seeding gives significantly worse results in comparison with the production of celery seedlings which is a result of the great vulnerability of young plants in the initial phase of the open field..
- The best method of production (for the Semberija and areas with similar climatic and soil conditions) is the production of celery from high quality, well-cultivated container seedlings.
- Good results can be achieved by using celery seedlings bare veins, taking into account some benefits (social and biological) of such a mode of growing.
- Mulching in these studies did not produce the expected results because of inadequate materials (PE foil) and absence of intertillage treatment which adversely affected the growth of roots. In addition to the celery mulching organic origin materials should be used, which will enable the application of some agricultural practices (interrow tillage, irrigation) at the time and in the manner that best suits celery.

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