Acta Universitatis Sapientiae
Agriculture and Environment, **4**, (2012) 11–17

The influence of planting density upon the obtained yield with corn-salad (*Valerianella olitoria Maench*) culture

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Abstract. The leafy vegetables are consumed raw, in salads, ensuring the full use of vitamins and chlorophyll. This group of vegetables includes corn-salad (*Valerianella olitoria Maench*, sin. *Valerianella locusta* L.), which in our country is used for consumption from spontaneous flora. The experiment was conducted in the unheated greenhouse of the Vegetable Growing Department of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, in spring culture in 2009 and 2010. The agrobiological behaviour of three varieties of corn-salad was studied such as D'Olanda, Volhart, and Elan. Biometric measurements were conducted to determine growth capacity, increase in the number of leaves, diameter of leaf rosette, plant weight, and obtained yield. The obtained results show that the studied varieties have the same behaviour and the number of leaves decreases at variants with higher density, thereby influencing plant weight.

Keywords: leafy vegetables, lamb's lettuce, corn-salad

1 Introduction

Corn-salad comes from the spontaneous flora. This vegetable is grown in large areas in Western European countries, both in open field culture and

in covered crops. In our country, it is less known and cultivated, and for consumption is harvested from spontaneous flora [2].

Corn-salad is an annual herbaceous plant. The root is pivoting and grows in the surface soil, the vast majority of roots penetrating up to 20-25 cm deep. At the surface, it develops a rosette of leaves. The leaves are of light green colour (depends on variety) and there are known two groups of varieties that differ by the shape of the leaf. The leaves are trapped on a short stalk that can be found in axillary bud-shaped side-rosettes of the small leaves that determine the bush aspect of the plant.

The flowering stem forms many branches of 10-20 cm long whose flowers are small, white, or bluish white, and they are grouped in terminal bunches.

Corn-salad has reduced requirements regarding growth factors, it is easily adapting to different variations of soil types and climate conditions [1].

2 Material and method

Three different varieties were studied as follows:

Elan is a variety from the group with large leaves and short growing season, resistant to cold and diseases, especially downy mildew and powdery mildew. Ideal for cultivation in protected areas.

Also part of the previous group is **D'Olanda**. Early variety with large and long leaves, cold resistant, reaches maturity in 65-80 days. This variety has a bitter-sweet flavour and a high productivity. Volhart is the representative of the other group (those with small leaves and compact rosette), it is a frost resistant, bright green coloured variety with a distinctive commercial aspect and better productivity.

The culture of corn-salad may be established by direct sowing; in the case of small areas, seedlings may be produced. The seeds are sowed in cubes or pots, distributing 4-5 seeds in each cell. Corn-salad is a species that lends itself to high density. In the case of each variety, 3, 5, and 7 seeds/pot were sowed. Planting different densities was achieved by assigning a different number of pots:

- 10 pots were planted/lm at each variant
- 15 pots were planted/lm at each variant

During the experiments, various observations were made on the morphological features of plants. Data were recorded on the:

- number of leaves/plant
- average weight (g) of plants

3 Results and discussion

The obtained results show that the studied varieties had a similar behaviour and the number of leaves decreased at higher density, thereby influencing plant weight (Table 1).

Table 1: Development of corn-salad plants at maturity

Variant			**2009**		**2010**	
Variety	Number of seeds/pot	Number of pots/lm	Average number of leaves/plant	Average weight of plants (g)	Average number of leaves/plant	Average weight of plants (g)
V_1 D'Olanda	3	10	30	33.90	30	33.90
V_2 D'Olanda	3	15	30	27.11	26	30.50
V_3 D'Olanda	5	10	26	36.81	28	32.25
V_4 D'Olanda	5	15	20	28.49	24	28.25
V_5 D'Olanda	7	10	22	39.88	24	35.85
V_6 D'Olanda	7	15	18	30.99	20	33.75
V_7 Volhart	3	10	34	25.81	32	26.25
V_8 Volhart	3	15	32	23.59	30	26.60
V_9 Volhart	5	10	30	26.09	30	31.66
V_{10} Volhart	5	15	28	24.64	26	30.00
V_{11} Volhart	7	10	22	24.84	22	31.16
V_{12} Volhart	7	15	20	19.13	18	28.20
V_{13} Elan	3	10	32	32.90	34	28.05
V_{14} Elan	3	15	32	30.22	30	29.63
V_{15} Elan	5	10	30	35.01	28	26.25
V_{16} Elan	5	15	26	32.76	24	29.80
V_{17} Elan	7	10	26	33.81	24	35.00
V_{18} Elan	7	15	22	30.60	20	30.00

Analysing the data presented in Table 1, we can find a slight difference at the concerned varieties in the number of leaves/plant. D'Olanda achieved between 18-30 leaves/plant, Volhart has 20-34 leaves/plant, and Elan reached values between 22-32 leaves/plant.

Regarding the average number of leaves/plant, the variants with a reduced number of seeds/pot (3 seeds/pot) presented the highest value (between 30-35 leaves) while the variants with 7 seeds/pot reached the least number of leaves (18-22 and 26, respectively) at all three varieties (Fig. 1).

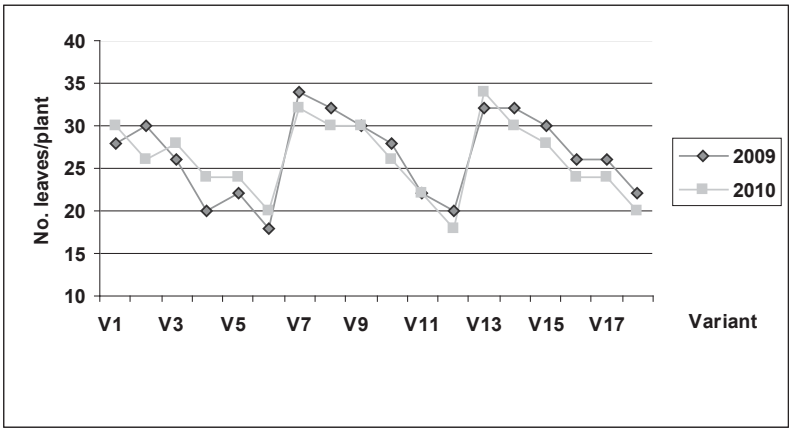

Figure 1: Average number of leaves at corn-salad plants

Concerning the average weight of corn-salad plants and comparing the variants (Fig. 2), D'Olanda shows higher values for variants with 5, 7 seeds/pot at a density of 10 pots/lm as compared to Volhart and Elan varieties. In 2010, the obtained values were lower than in 2009. In the case of variety Volhart, the average weight is lower in 2009 while in 2010, it stands out with relatively high values at variants with 5, 7 seeds/pot at both densities (10 and 15 pots/lm). Elan variety gets higher values in 2009 and the plant weights were lower in 2010.

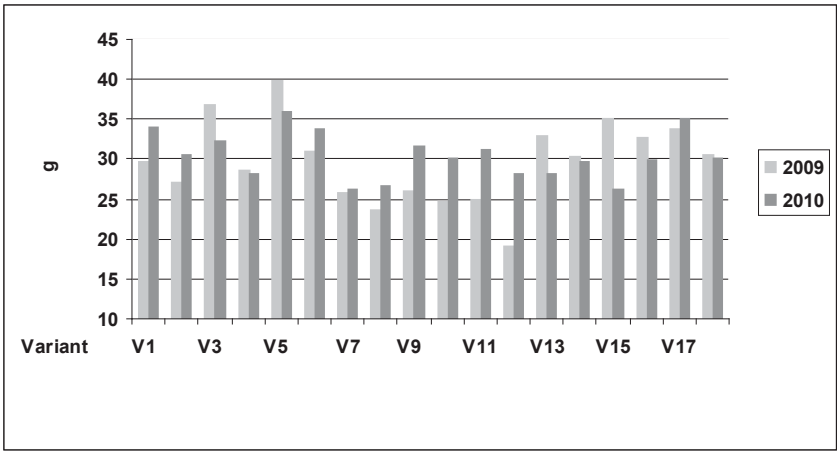

Figure 2: Average weight of corn-salad plants in 2009 and 2010

The achieved yields depend on the variety, developing stage, and harvest time, and they range from 0.8 to 1.5 kg/m^2 [2] or 1.5 to 2 kg/m^2 [3] – after [4] the optimal harvest is realized, when the plants reached 5-7 leaves, depending on how the culture was set up (Fig. 2).

Direct sown crops can produce between 1 and 1.5 kg/m^2 and may reach values from 1.8 to 2 kg/m^2 by planting seedlings.

Table 2: The obtained yield in the experimental years at corn-salad culture (kg/m^2)

		2009		**2010**	
Variant		10 pots/lm	15 pots/lm	10 pots/lm	15 15 pots/lm
D'Olanda	3	1.21	1.62	1.32	1.52
D'Olanda	5	1.56	1.75	1.61	1.93
D'Olanda	7	2.16	2.38	1.94	2.29
Volhart	3	1.61	1.75	1.23	1.44
Volhart	5	2.57	3.04	1.22	1.52
Volhart	7	2.65	3.72	1.44	1.56
Elan	3	1.82	2.24	1.70	1.79
Elan	5	1.89	2.96	1.84	1.97
Elan	7	2.82	3.41	1.76	2.41

As shown in Table 2, production in 2009 ranged from 1.2 to 3.4 kg/m^2, which is considered to be a very good production.

Having the same thickness, Volhart (with 5, 7 seeds/pot, planted with 15 pots/lm) and Elan variety stand out from among the studied variants. It follows that the corn-salad varieties perform well at high density.

Considering the production in 2010 (Table 2), it was a moderate production, without large differences between the studied variants. Considering the obtained yield, D'Olanda and Elan varieties are remarkable.

Considering Volhart variety behaviour, which in 2009 reached the highest values, in 2010, it shows a steady production (yields are almost the same for each density), lower compared to other variants.

Year 2009 is characterized by high yields in both densities. What becomes clear from Fig. 3 is that the variants planted at high density (15 pots/lm) with a large number of seeds/pot generated higher yields than those planted at lower density (10 pots/lm).

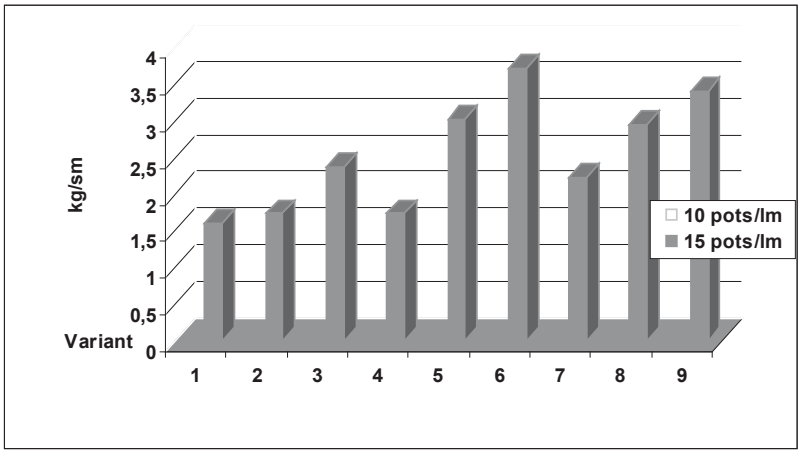

Figure 3: Yield evolution in 2009

In 2010, production values and even the differences between variants (10 pots/lm and 15 pots/lm) were not large. This can be explained by the fact that the location of experience was not changed in 2010 and plant health problems were recorded (Fig. 4.).

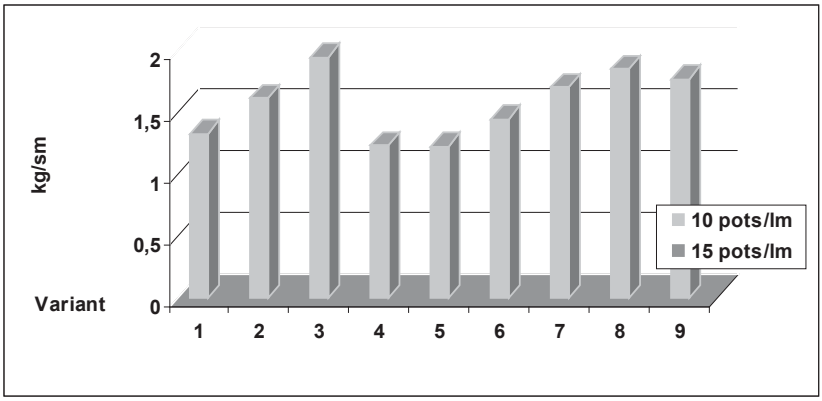

Figure 4: Yield evolution in 2010

Although when planting, the seedlings were selected, there were problems with gray mould (*Botrytis cinerea*) in lettuce crops, and corn-salad culture was also compromised, being in the same protected space. Because it has a short growing season, they did not perform treatments, but it was necessary to remove leaves from the base of the plants; so, there were losses in production.

4 Conclusion

Corn-salad culture is suitable for high density without decreasing the commercial quality.

Through increasing density (from 10 pots/lm to 15 pots/lm), a more efficient use of land can be achieved.

Increasing the number of seeds from 3 seeds/pot to 7 seeds/pot provides a better production without reducing the quality of the obtained product.

Regarding the behaviour of varieties, the behaviour of Elan is remarkable: it ensured the highest production in 2009: 3.40 kg/m^2 at a density of 10 pots/lm and 2.41 kg/m^2 at 15 pots/lm density in 2010.

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