

The Influence of Plant Density upon Corn Salad (*Valerianella olitoria* L.) Production, in Protected Culture

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Abstract. Corn salad (*Valerianella olitoria*), is part of green vegetables group and is used fresh or in salads. It contains high quantities of vitamins A and B₁, minerals like Ca, Mg, K, Fe, Zn, carbohydrates and it is an important source of fibres. It can be grown in open field (in autumn and spring) by direct sowing, and also in protected spaces (in short day conditions) by seedlings. Plant density has a direct influence upon production. During the present study, conducted at Cluj-Napoca (Romania), in 2011, in early protected culture, three cultivars were used: D'Olanda, Madarsalata, Corn salad. In order to produce seedlings, three, five and seven seeds/cube were used and the planting was done with 10 and 15 cube/m². The experiment had multiple factors and 18 experimental variants resulted. The obtained yield was higher at Corn salad cultivar, when there were used seven seeds/cube and there were planted 15 cubes/m².

Keywords: corn salad, cultivar, density, green vegetables, protected culture

INTRODUCTION

Green vegetables have a big dietary importance, through their high content in minerals, vitamins, enzymes and fibers. Almost all green vegetables help to eliminate toxins from the human body through urine. All the vegetables species can be considered plants with medicinal effect, due to the high content of fitoncide, ester oils, vitamins, being known for their therapeutic effects from the ancient times, and in our days due to the herbal medicine (Drăghici, 2011; Popescu and Popescu, 2008; Berar *et al.*, 2012). Corn salad (*Valerianella olitoria* L.), is an appreciated plant by the consumers from Western Europe, being considered to prevent insomnia, tiredness and antis stress (Chaux and Foury, 1994). It has a high content in beta carotene and an important source of folic acid, with a medium content in vitamin C and poor in sodium (Ciofu *et al.*, 2003).

The culture of corn salad can be started by direct sowing or, on small surfaces by seedlings, in pots, with 4-5 seeds in each pot.

The species can be grown at high densities. If the culture is started by direct sowing, on a square meter of stratum, there should be 500 plants. If the culture is started by small seedlings, there should be 50 seedlings/ m² (Ciofu *et al.*, 2003) or between 50 or 67 pots/m² with more seeds on one pot, four, six or eight seeds (Bleyaert, 1991, cited by Henter, 2008). Fontana and Nicola (2009) present precise planting schemes, with fixed densities, to obtain bigger yields. High planting densities were studied, reaching 1067 plants/m².

Terbe (2000) stated that seedlings should be produced in cubes of 4x4 cm, with 5-10 seed in one cube, at planting there will be 50-80 plants/ m². Bleyaert (1991, cited by Henter, 2008) used to produce seedlings four, six and eight seeds/cube and at planting the distances were 15/10 cm, 20/10 cm, and 20/12.5 cm.

MATERIALS AND METHODS

In the present study conducted at Cluj-Napoca (Romania), in 2011, in early protected culture, three cultivars have been used: D'Olanda, Madarsalata, Corn Salad. Cluj county is situated in Nord-East Transylvania, between 23° 39' 47'' and 47° 28' 44'' north latitude and 23° 39' 22'' and 24° 13' 46'' east longitude. Cluj-Napoca city is in central-north-west part of Romania at an altitude of 345-360 m.

Hybrid D'Olanda has big and long leafs, is resistant to cold and reaches maturity after 65-80 days, with a specific bitter-sweet taste. It is very productive.

Corn Salad, is a hybrid with small leafs, compact rosette, resistant to cold. It is very productive and the color is a very bright green.

Madársaláta, is a hybrid with small leafs with a bright green color. Is resistant to cold and is very productive.

To produce the seedlings, three, five and seven seeds/pot were sowed and these seeds were sowed in pots of 10 and 15 millimeters. The experience had more factors and 18 experimental variants.

The seeds were sowed in 19.02.2011, at a depth of 1 cm, in 5 cm pots. The sowed seeds were kept in a greenhouse at a temperature of 16-18 degrees, in conditions of air humidity reaching 60-80% and soil humidity, reaching 55-75%. The substrate in where the seeds were sowed was made of peat.

Before planting, the seedlings went to a process of thinning, where only the healthy, well developed and of the same size plants were kept, so the culture would be uniform and the maintenance work for the crop can be done at the same time. Planting took place on 28.03.2011 and harvesting started in 09.05.2011. During the vegetation period, measurements regarding plants growth, qualitative and quantitative production, where made. The usual maintenance work has been done for protected culture, and harvesting was done at the optimum moment.

RESULTS AND DISCUSSIONS

Plant development after reaching maturity, varied as follows: the medium number of leafs/plant varied between 22 and 36 leafs/plant, plant hight varied between 10.84 and 13.54 cm. Rosette diameter had the following values: at D'Olanda variety 12.80 - 13.98 cm, at Madársaláta between 8.86 and 10.90 cm and at Corn Salad between 13.80 and 14.84 cm.

Data regarding plants weight varied between: 30.00 – 37.20 g at D'Olanda, 25.94 - 31.80 g at Madársaláta and 34.80 - 38.50 g at Corn Salad (Tab.1).

The leaf production was between 1.65 kg/m² at Madársaláta variety and 2.10 kg/m² at Corn Salad, the average between the three varieties was 1.84 kg/m² (Tab. 2). Compared to D'Olanda variety, Corn Salad variety, has an increase of production of 17.3% with a difference in production distinct significant and towards the average, the increase in productions was 14.3%, the difference being significant.

By increasing the number of seeds/pot, the leaf production grows (Tab. 3). The highest production of leafs was obtained at the variants with 7 seeds (1.98 kg/m², with 15.1% more compared with the variants with 3 seeds/pot and with 7.6% more than the average.

With a plant density increase from 10 pots/linear meter to 15 pots/linear meter, the increase in leaf production is of 24% and the difference in production is highly significant (Tab. 4).

Tab. 1

Development of cornsalad at maturity

Variety	Variant		Average leaf number/plant	Average plant weight (g)	Average plant height (cm)	Plant diameter (cm)
	Nr. Seeds/pot	Nr.pots/lm				
D'Olanda	3	10	26	34.20	13.22	13.80
	3	15	22	30.00	13.50	13.93
	5	10	24	36.50	12.84	13.00
	5	15	22	32.40	12.61	13.75
	7	10	26	37.20	12.90	12.80
	7	15	24	34.15	13.00	13.57
Madársaláta	3	10	36	30.20	11.50	9.05
	3	15	30	25.94	11.35	8.86
	5	10	32	28.80	11.92	9.60
	5	15	28	27.36	10.84	9.00
	7	10	30	31.80	12.40	10.50
	7	15	28	29.65	11.60	10.90
Corn salad	3	10	34	36.00	13.50	14.26
	3	15	32	34.80	12.90	14.84
	5	10	30	38.22	13.00	14.52
	5	15	26	36.40	12.73	15.00
	7	10	30	38.50	13.54	13.80
	7	15	28	37.65	12.86	14.65

Tab. 2

The variety influence upon yield at corn salad culture

Variant Variety	Production		±d	Significance	Relative	±d	Significance
	kg/m ²	%	(kg/m ²)	of difference	production (%)	(kg/m ²)	of difference
D'Olanda	1.79	100.0	0.00	mt	98.9	-0.05	-
Madársaláta	1.65	92.1	-0.14	-	89.6	-0.19	0
Corn salad	2.10	117.3	0.47	**	114.3	0.26	*
Average	1.84				100.0	0.00	mt

LSD (p 5%)

0.15

LSD (p 1%)

0.35

LSD (p 0.1%)

0.49

Tab. 3

The number of seeds/pot influence upon yield

Variant Nr.seeds	Production kg/m ²	%	±d (kg/m ²)	Significance of difference	Relative production (%)	±d (kg/m ²)	Significance of difference
3	1.72	100.0	0.00	mt	93.4	-0.12	
5	1.82	105.8	0.11		98.9	-0.02	
7	1.98	115.1	0.26	*	107.6	0.14	*
Average	1.84				100.0	0.00	mt

LSD (p 5%)

0.13

LSD (p 1%)

0.28

LSD (p 0,1%)

0.39

Tab. 4

Thickness influence upon yield

Variant Nr. pots/lm	Production kg/m ²	%	±d (kg/m ²)	Significance of difference	Relative production (%)	±d (kg/m ²)	Significance of difference
10	1.65	100.0	0.00		89.6	-0.19	0
15	2.04	124.0	0.40	***	110.8	0.20	*
Average	1.84				100.0	0.00	mt
LSD (p 5%)			0.15				
LSD (p 1%)			0.21				
LSD (p 0,1%)			0.38				

Tab. 5

Interaction between variety, number of seeds/pot and density upon yield

V a r i a n t			Production		±d (kg/mp)	Significance of difference	
Variety	Nr.seeds/pot	Nr.pot/lm	kg/m ²	%			
D'Olanda	3	10	1.50	100.0	0.00	mt	
Madársaláta	3	10	1.24	82.9	-0.26		
Corn salad	3	10	1.93	12.7	0.43	*	
D'Olanda	3	15	1.70	100.0	0.00	mt	
Madársaláta	3	15	1.58	93.0	-0.12		
Corn salad	3	15	2.38	139.4	0.68	**	
D'Olanda	5	10	1.64	100.0	0.00	mt	
Madársaláta	5	10	1.68	102.4	0.04		
Corn salad	5	10	1.74	106.5	0.11		
D'Olanda	5	15	2.00	100.0	0.00	mt	
Madársaláta	5	15	1.74	87.3	-0.25		
Corn salad	5	15	2.15	107.7	0.15		
D'Olanda	7	10	1.68	100.0	0.00	mt	
Madársaláta	7	10	1.70	101.4	0.02		
Corn salad	7	10	1.70	101.4	0.02		
D'Olanda	7	15	2.21	100.0	0.00	mt	
Madársaláta	7	15	1.93	87.3	-0.28		
Corn salad	7	15	2.68	121.1	0.47	*	
LSD (p 5%)					0.41		
LSD (p 1%)					0.50		
LSD (p 0,1%)					0.83		

From the interaction of analysed factors (variety, number of seeds/pot, and number of pots/linear meter) it can be observed that, by growing the number of plants, production also grows (Tab. 5). If at the lowest density (3 seeds/pot and 10 pots/ linear meter), the production was between 1.24 kg/m² and 1.93 kg/m², production end's up being of 1.93 kg/m² and 2.68 kg/m² at the maximum density (7 seeds/pot and 15 pots/ linear meter). The highest yields were obtained by Corn Salad variety followed by D'Olanda variety.

CONCLUSION

Growth measurements showed that with the growing of seeds numbers/pot, there was a decrease of leaf number but plant height was the same.

The obtained results confirm that density influence upon production is very important. Production obtained when using 3 seed/pot, was of 1.60 kg/m², at 5 seeds/pot 1.99 kg/m² and with 7 seeds/pot 2.37 kg/m², the differences were significant between the three variants.

The best results can be obtained by using a density of 15 pot/linear meter, the difference in production being significant compared to the density of 10 pot/linear meter.

It can be noticed that at the variants with a higher number of seeds, five or seven, the yields have grown very significant compared to control (three seeds/pot).

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