

THE EFFECT OF PLANT DENSITY AND FRUIT LIMITATION ON THE QUANTITY AND QUALITY OF EGGPLANT SEEDS

INFLUENȚA DENSITĂȚII ȘI A LIMITĂRII NUMĂRULUI DE FRUCTE ASUPRA CANTITĂȚII ȘI CALITĂȚII SEMINTELOR LA PĂTLĂGELELE VINETE

DASCĂLU (CONSTANTIN) Delia - Cristina^{1*}, MUNTEANU N.¹, SCURTU I.², BUZATU Mihaela – Alina²

*Corresponding author e-mail: deliacristinadascalu@yahoo.com

Abstract. *The present work aims to evaluate the influence of different planting schemes and the limiting of the number of fruits on the quantity and quality of eggplant seeds. The cultivar Luiza used in this experiment was planted at densities of 30.000, 35.000 and 40.000 plants per hectare. In these, the number of fruits was limited to three, four or five fruits per plant.*

The use of lower densities leads to a higher percentage of germinated seeds. However, the use of higher densities can lead to higher seed quantities. The results indicate that limiting the number of fruits has a positive effect on the mass of seeds in one fruit and the mass of 1000 seeds, regardless of plant density. The seed production per hectare was less influenced by the limitation of the number of fruits, by the compensation due to the densities used in the experimental variants. Seed vigor index was influenced by density rather than fruit number.

Key words: germination, seed production, seed vigor

Rezumat. *Lucrarea de față își propune să evalueze influența unor scheme de plantare și a limitării numărului de fructe asupra cantității și calității semințelor. Soiul Luiza folosit în acest experiment a fost plantat la densități de 30.000, 35.000 și 40.000 de plante la hectar. Numărul fructelor a fost limitat la trei, patru sau cinci fructe pe plantă.*

Utilizarea densităților mai mici duce la un procent mai mare de semințe germinate. Cu toate acestea, schemele de plantare cu densități mai mari poate duce la cantități mai mari de semințe. Rezultatele indică faptul că limitarea numărului de fructe are un efect pozitiv asupra masei semințelor în fruct și asupra masei a 1000 de semințe, indiferent de densitatea plantelor. Producția de semințe la hectar a fost mai puțin influențată de limitarea numărului de fructe, diferența fiind compensată prin densitățile utilizate în variantele experimentale. Indicele de vigoare a semințelor a fost influențat mai degrabă de densitate decât de numărul fructelor.

Cuvinte cheie: germinație, producția semințelor, vigoarea semințelor

¹“Ion Ionescu de la Brad” University of Life Sciences, Iasi, Romania

² Research and Development Institute for Vegetable and Flower Growing Vidra, Romania

INTRODUCTION

Planting distances can strongly influence fruit and seed production in any of the cultivated species. They are established according to the habitus of the plants, the fertility of the soil and the mechanization system. The appropriate density allows plants to meet their requirements for light, soil nutrients and atmospheric humidity. Too high density causes the plants to shade each other, also maintaining high air humidity, a fact with negative consequences on the formation of flowers and pollination, the fruits being formed in a smaller number. (Stan and Stan, 2010).

In Romania, the most recommended planting scheme for eggplant indicates a distance of 70-80 cm between rows and 40-45 cm between plants per row, which ensures a density of 30.000-35.000 plants/ha (Munteanu, 2003; Popescu and Zăvoianu, 2013; Stan *et al.*, 2003). Other planting schemes are used in the country, which accept the decrease of the distance between plants in a row up to 35 cm (Ceașescu, 1983) or even up to 30 cm (Apahidean and Apahidean, 2001), which ensures a density of 40.000-45.000 plants/ha. In general, lower plant densities are chosen, because the high costs for the production of seedlings make it unjustified to use a higher plant density per hectare (Munteanu, 2003; Stan *et al.*, 2003). Culture technology developed at Research and Development Institute for Vegetable and Flower Growing Vidra Vidra recommends planting seedlings in two rows per furrow, 70 cm between rows and 35-40 cm between plants (Ceașescu, 1983).

Limiting the number of fruits is done to force an earlier ripening of the stored fruits, so that they reach technological maturity before the risk of early autumn frosts. This limitation is closely related to the number of plants per surface unit. In Romania, it is recommended to retain and harvest a number of 2-4 fruits per plant for the production of eggplant seed (Tudor *et al.*, 2009). The fruits that are kept are the first fruits that form on the plant and correspond to the shape, size and color typical of the variety. After the formation of the required number of fruits, the growth tips are fleshed and any flowers, which are still forming, are removed (Apahidean and Apahidean, 2001).

MATERIAL AND METHOD

During May - October 2019, at RDIVFG Vidra, an experiment was carried out that aimed at the influence of the planting density and keeping a limited number of fruits on the amount of seed in eggplant. As biological material, the eggplant variety Luiza was used.

The experience realized is a bifactorial one, the layout being realized in subdivided plots, in three replications. The first factor (A) is the density factor, with three gradations: 40.000 plants/ha, 35.000 plants/ha and 30.000 plants/ha. The second factor (B) is constituted by the load of fruits per plant, with three gradations: three, four and five fruits. When the eggplant fruits reached physiological maturity, they were harvested, weighed, cut and left to macerate in order to extract the seeds, then the weight of the seeds per fruit, per plant and per hectare, the weight of 1000 seeds was calculated. Then, the seeds obtained on each variant were germinated,

according to the SR 1634/1999 standard. Sowing was carried out on filter paper, in Petri dishes, with 50 seeds per dish, which were placed in the incubator for 14 days, at an alternate temperature of 20°C for 16 hours and at 30°C for 8 hours. After the passage of a number of 14 days, the final germination percentage was calculated, and the seedlings were measured, to determine the value of the seed vigor index. The seed vigor index (SVI) was calculated according to the formula:

SVI = the length of the plantlets (cm) x final germination percentage (%) (Abdul and Anderson, 1973)

The data obtained were processed by specific statistical-mathematical methods, and the significance of the differences between the variants was evaluated using the Duncan multiple range test, performed at $P \leq 0.05$.

RESULTS AND DISCUSSIONS

Table 1 shows the influence of density and the number of fruits on the amount of seeds in eggplant plots.

Table 1

Results regarding the influence of plant densities and the number of fruits per plant on the quantity of eggplant seeds, in the variety Luiza

Variant	Density	Number of fruits	Seed weight per fruit	Seed weight per plant	Seed weight per hectare
			g/ fruit	g/ plant	Kg/ ha
V1	40.000 plants/ha	3	1.97 bc	5.92 b	236.70 b
V2		4	1.75 cd	6.98 ab	279.33 ab
V3		5	1.47 d	7.34 ab	293.77 a
V4	35.000 plants/ha	3	2.21 ab	6.62 ab	231.70 b
V5		4	1.65 cd	6.59 ab	230.50 b
V6		5	1.36 d	6.78 ab	237.43 b
V7	30.000 plants/ha	3	2.54 a	7.63 a	228.90 b
V8		4	1.94 bc	7.76 a	232.73 b
V9		5	1.57 cd	7.83 a	235.03 b

*Values followed by different letters within each column are significantly different based on Duncan multiple range test ($P \leq 0.05$)

Seed weight per fruit

The decrease in plant density determined an increase in the weight of seeds per fruit, when three fruits per plant were kept. Significant differences are observed between the V7 variant (30.000 plants/ha, three fruits per plant), with 2.54 g of seeds/ fruit, and V1 variant (40.000 plants/ha, three fruits per plant), with 1.97 g of seeds/ fruit. At the same time, it is observed that, with the increase in the number of fruits per plant, there is a significant decrease in the mass of seeds per fruit.

Seed weight per plant

The decrease in plant density has a positive influence, in the case of the weight of the seeds per plant. The variants with a density of 30.000 plants/ha had a significantly higher amount of seeds per plant than the V1 variant (40.000 plants/ha, three fruits per plant). Also, it is observed that the weight of seeds per

plant increases, in general, with the increase in the number of fruits per plant, unlike the weight of seeds per fruit.

Based on the results regarding the weight of seeds per fruit and per plant, the weight of seeds per hectare was calculated.

Seed weight per hectare

The variant that showed significant increases in seed production per hectare, compared to the other variants, was variant V3 (40.000 plants per hectare, five fruits/plant). These differences can be explained by the increasing of the number of fruits/ha, determined by the increasing of the number of plants/ha (40.000 plants/ha) and by the bigger number of fruits kept per plant (five fruits per plant).

In table 2 are shown the differences determined by the density and the number of fruits at the 1000 seeds weight.

Table 2

Results regarding the influence of plant densities and the number of fruits per plant on 1000 seeds weight, in eggplant, Luiza variety

Variant	Density	Number of fruits	1000 seeds weight
			<i>g</i>
V1	40.000 plants/ha	3	4.78 bcd
V2		4	4.77 bcd
V3		5	4.67 d
V4	35.000 plants/ha	3	4.88 ab
V5		4	4.81 bc
V6		5	4.69 cd
V7	30.000 plants/ha	3	4.97 a
V8		4	4.80 bcd
V9		5	4.74 cd

*Values followed by different letters are significantly different based on Duncan multiple range test ($P \leq 0.05$)

1000 seeds weight of eggplant can be significantly influenced, both by density and by limiting the number of fruits per plant.

The density significantly influenced 1000 seed weight when the number of fruits was limited to three, the increase in the number of plants per hectare from 30.000 (V7 variant) to 40.000 (V1 variant) causing significant decreases.

At the same time, keeping a number of five fruits per plant determined the significant decrease of 1000 seeds weight, in the case of densities of 35.000 and 30.000 plants/ha. At a density of 35.000 plants/ha, significant decreases were observed in the case of keeping a number of five fruits (variant V6) compared to keeping a number of three fruits (variant V4). At a density of 30.000 plants/ha, differences are observed between all variants, significant decreases registering both the variant in which five fruits are kept, as well as the variant in which four fruits are kept, compared to the variant in which there are three fruits per plant.

At a density of 40.000 plants/ha, the differences determined by the number of fruits were insignificant.

Table 3 shows the influence of plant density and the number of fruits per plant on the percentage of germinated seeds, on the length of seedlings at the age of 14 days and on the seed vigor index.

Table 1

Results regarding the final germination percentage, the length of seedlings and seed vigor index

Variant	Density	Number of fruits	Final germination percentage	The seedling length	Seed vigor index
			%	cm	
V1	40.000 plants/ha	3	76.67 b	6.34 a	485.57 b
V2		4	80.67 ab	6.28 a	507.78 b
V3		5	80.00 ab	6.89 a	551.53 b
V4	35.000 plants/ha	3	77.33 b	6.57 a	508.03 b
V5		4	86.00 ab	6.31 a	541.57 b
V6		5	83.33 ab	6.70 a	557.95 b
V7	30.000 plants/ha	3	83.33 ab	6.99 a	583.26 a
V8		4	88.67 a	6.60 a	585.49 a
V9		5	85.33 ab	6.94 a	591.75 a

*Values followed by different letters within each column are significantly different based on Duncan multiple range test ($P \leq 0.05$)

Final germination percentage

The number of germinated seeds tended to increase with the decrease in plant density and with the increase in the number of fruits kept per plant.

However, significant increases were only given by variant V8 (30.000 plants/ha, four fruits per plant) compared to variants V1 (40.000 plants/ha, three fruits/plant) and V4 (35.000 plants/ha, three fruits/plant).

Seedling length was not significantly influenced by plant density and the number of fruits kept per plant.

The seed vigor index increased significantly in the case of the variants that were planted at low densities, of 30.000 plants/ha (V7, V8 and V9). At the same time, there were increasing trends with the increase in the number of fruits per plant, but the differences given were insignificant.

CONCLUSIONS

1. Increasing plant density can have positive influences on seed yield per hectare, but with negative effects on 1000 seeds weight, and even on germination and seed vigor index.

2. Limiting the number of fruits leads to a higher value of the amount of seeds per fruit, with 1000 seeds weight higher.

3. Variants V2 and V3 led to obtaining the highest seed productions. In these variants, the plant density was 40,000 plants/ha, with four (V2) and five (V3) fruits per plant.

4. The V8 variant (30.000 plants/ha, four fruits/plant) led to obtaining the highest percentage of germinated seeds.

5. The variants V7, V8 and V9 (30.000 plants/ha) led to the highest values of the seed vigor index.

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