

EFFECTS OF ORGANIC FERTILIZERS ON THE GROWTH SEEDLINGS OF ASPARAGUS

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Abstract

The study was conducted within the Horticulture Faculty in Bucharest using asparagus (*Asparagus officinalis* L.) the Argenteuil cultivar. We used three types of substrate, peat, perlite and mixture of perlite and peat. After 15 days of emergence they were transplanted in 10 cm diameter pots. The fertilization variants were as follows: V1 - unfertilized control; V2 - Amalgerol; V3 - Formulex; V4 - Vermiplant; V5 - Poco and V6 - Iguana. Care work has been aimed at observing the technology of culture, maintaining temperature and light, applying watering, proper fertilization. We watched the dynamics of seed germination, the dynamics of transplant growth in the height. The paper reports preliminary results of a research in order to identify the best option for obtaining quality asparagus seedlings.

Key words: asparagus, transplants, fertilizers, quality.

INTRODUCTION

Asparagus (*Asparagus officinalis* var. *altilis* L.) In Romania, asparagus (*Asparagus officinalis* L.) is grown on very small areas compared to other countries from Europe, such as England, Italy, Spain, France. The shoots are mainly consumed for their high mineral content. Usually asparagus is grown in temperate climates, so harvesting is restricted to the spring and early summer period. In recent years there has been a growing interest (particularly by supermarkets) in developed and affluent countries to have fresh asparagus available year round (Nicola & Basoccu, 2000; Soare & Duta, 2011; Drăghici et al., 2015). Dinu et al. (2012) conducted a study to accelerate germination of seeds using humic acids and seed extract of *Vitis vinifera*.

The optimum germination temperature of the asparagus seeds is between 20-25°C (Drăghici, 2014). The initial seed quality has a marked effect on the success of the priming (Nascimento, 1998; 2003). Evans and Pill (1989) did not obtain a priming benefit for asparagus seeds with high physiological quality (Mário Lúcio de Carvalho Bittencourt et al., 2005) They show that the asparagus seeds have germinated in a higher percentage compared to

the non-moistened seeds, also the crop has emerged in a shorter time. The asparagus variety react differently to the temperature, some growing faster at high temperature, while others prefer low temperatures (Chen et al., 2018).

Another aspect is the quality of the seedlings, they depend on the percentage of rooting after planting (Elmer, 2018).

It is very important that the transplant is of a very good quality because the next culture depends on this.

MATERIALS AND METHODS

The experiment was made in the Research greenhouse condition and in the Research Center for Studies of Food Quality and Agricultural Products of University of Agronomic Sciences and Veterinary Medicine of Bucharest.

In this study we used Argenteuil cultivar. The seeds were sown in peat substrates and at ten days after emergence they were transplanted in pots filled with growing substrates. We used two types of substrates, peat and a mix of peat and perlite with 4 mm granulation and five types of fertilizers. The fertilized variant was: V1 - control; V2 - Amalgerol; V3 - Formulex;

V4 - Vermiplant; V5 - Poco and V6 - Iguana. Amalgerol - a product with a unique combination of natural oils, plant extracts and organic carbohydrates with effect on the plant and the soil. Effects on the plant: Increases the root mass of plants and the absorption of nutrients: N, P, K and microelements; It leads to better water retention in the soil and better development of the root system due to good aeration; Vermiplant. The liquid is a totally natural product, it is obtained from earthworms. It contains a wide range of microelements such as barium, zinc, iron, manganese, as well as a number of amino acids, all of which contribute to better growth and development of plants. POCO contains - Calcium 0.04-0.05%; Iodine: 6.30-12.70 mg/l; Magnesium 0,50-0,80 mg/l; Nitrogen: 0.025-0.038 mg/l; Potassium: 0.50-0.64%; Sodium: 0.088-0.120%; Sulfur 0.028-0.050%; Orange oil: 0.10-0.12%, rape oil: 0.04-0.06%; Organic acids: 0.20-0.25%; pH: 8.5-9.5. Iguana is a 100% organic product. Contains 4% nitrogen, 3% phosphorus, 6% potassium. Formulex contains nitric nitrogen 2.19%; ammoniacal nitrogen 0.21%; phosphorus (P₂O₅) 0.85%; Potassium (K₂O) 3.36 %; Calcium (CaO) 1.85 %; Bor 0.0108 %; Cobalt 0.0006%; Copper EDTA 0.0025 ; Iron Chelate EDTA 0.0526%; Manganese Chelate EDTA 0.0131%; Molybdenum 0.0012%; and Zinc chelated EDTA 0.0036%.

The care work consisted of watering, fertilization, temperature and light monitoring. I followed the dynamics of seed germination, seedling growth dynamics in height. We have correlated the plant mass, fertilizer type and substrate type. The purpose of the study was to identify the best option for obtaining quality asparagus seedlings.

The moisture and dry matter content of the asparagus roots was determined by an oven-drying method at 105°C for 24 h until the samples reached a constant mass, according with European Pharmacopoeia 7th and Commission Regulation (EC) No 152/2009.

RESULTS AND DISCUSSIONS

Analysing the data regarding the germination of asparagus seeds we have found that it varied according to the crop substrate and the fertilizer used for wetting. We have found that the

asparagus seeds in the perlite substrate have germinated in a lower percentage of 90.22% (Table 2), in comparison with the other variants, 93.33% for the substrate with 50% peat and 50% perlite (Table 3), respectively 92% for the peat substrate (Table 5). The lowest percentage was recorded to all variants in which we watered the substrate only with water. In the variants that have been watered with Iguana product, the percentage of emerged seeds was the biggest.

Another observation is that at three day after sowing, the seeds have emerged in a higher percentage than any other cases in which we used organic fertilizers, exception being variants 5 and 6 (Table 3).

Table 1. The percentage of seeds of Asparagus emerged - in peat substrate

Variants	after 4 days	after 5 days	after 6 days
	(%)	(%)	(%)
V1 - control	0	20.67	69.55
V2	17.66	55.67	21.75
V3	21.33	70.67	4.00
V4	22.25	62.67	9.67
V5	17.00	50.67	27.67
V6	23.25	71.33	2.00

Table 2. Influence of fertilizers on the emergence of asparagus seeds - the variant in perlite

Variants	Percentage of seeds sprung (%)	Differences (%)	Signification (%)
V (0) average	94.67	4.45	104.93
V (1)	90.22	0.00	100.00
V (2)	95.08	4.86	105.39
V (3)	96.22	6.00	106.65
V (4)	94.59	4.37	104.84
V (5)	95.34	5.12	105.68
V (6)	96.58	6.36	107.05

LSD 5% = 3.370 LSD5% in % = 3.7353; LSD1% = 4.800
LSD 1% in % = 5.3203 LSD1% = 6.940 LSD1% in % = 7.6923

Table 3. The percentage of seeds of asparagus emerged - in perlite substrate

Variants	after 4 days	after 5 days	after 6 days
	(%)	(%)	(%)
V1 - control	0	21.33	72.00
V2	15.75	57.00	20.33
V3	28.55	66.55	-
V4	24.25	64.33	5.25
V5	8.25	60	27.67
V6	25.25	72.33	0

Table 4. The influence of fertilizers on the emergence of asparagus seed - perlite variant

Variants	Percentage of seeds sprung (%)	Differences (%)	Significance (%)	
V(0)	94.81	1.48	101.58	N
V(1)	93.33	0.00	100.00	Ct
V(2)	93.08	-0.25	99.73	N
V(3)	95.10	1.77	101.90	N
V(4)	93.83	0.50	100.54	N
V(5)	95.92	2.59	102.78	*
V(6)	97.58	4.25	104.55	**

LSD 5% = 2.280 LSD 5% in % = 2.4429 LSD 1% = 3.250 LSD 1% in % = 3.4823 LSD 01% = 4.710 LSD 01% in % = 5.0466

Table 5. The percentage of seeds of asparagus emerged - in mixed substrate 50% perlite + 50% peat

Variants	after 4 days	after 5 days	after 6 days	total
	(%)	(%)	(%)	(%)
V1 - control	0	41.00	51.00	92.00
V2	6.00	80.25	5.00	91.25
V3	21.25	75.55	-	96.80
V4	21.25	73.00	1.00	95.25
V5	2.00	64	29.25	95.25
V6	27.00	69.85	0.00	96.85

Table 6. The influence of asparagus seeds emergence on the variant - substrate 50% perlite + 50% peat

Variants	Percentage of seeds sprung (%)	Differences (%)	Significance (%)	
V(0) Average	92.90	0.90	100.98	N
V(1)	92.00	0.00	100.00	Ct
V(2)	81.25	-10.75	88.32	N
V(3)	96.80	4.80	105.22	N
V(4)	95.25	3.25	103.53	N
V(5)	95.25	3.25	103.53	N
V(6)	96.85	4.85	105.27	N

LSD 5% = 15.290 LSD 5% in % = 16.6196 LSD 1% = 21.760
LSD 1% in % = 23.6522 LSD 01% = 31.470 LSD 01% in % = 4.2065

In the case of asparagus seedling that were obtained in peat substrate, in the first year, at 90 days after sowing, the greatest height was obtained in variant 3 - 38.33 cm, and the lowest height in variant 1 (Figure. 1.).

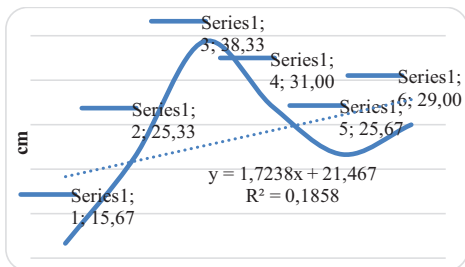


Figure 1. Influence of the fertilizer on the height of seedlings of asparagus - in peat substrate

In the case of the perlite substrate, the seedlings have obtained a height of 34.55 cm in variant 3, and the lowest in variant 1 (Figure 2).

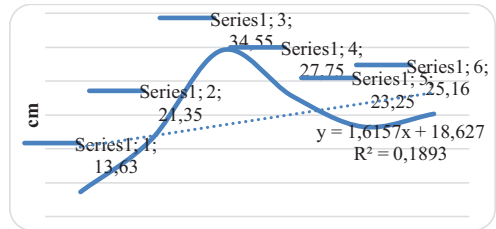


Figure 2. Influence of the fertilizer on the height of seedlings of asparagus - in perlite substrate

In the case of the variant grown in 50% perlite substrate and 50% peat substrate, the lowest height was obtained in variant 1 and the greatest in variant 3 (Figure 3).

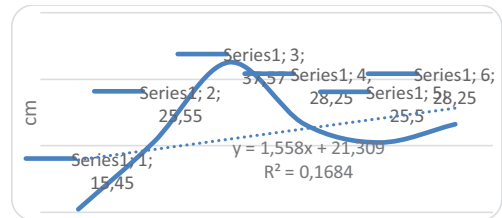


Figure 3. Influence of the fertilizer on the height of seedlings of asparagus - in peat substrate

We have found that on perlite substrate the height of the asparagus seedling was bigger in all the variants in which organic fertilizers were applied. There have been statistical differences that varied in every variant. The biggest difference was in variant 3 (Table 7).

Table 7. The height of the asparagus seedling grown on peat substrate.

Variants	Height (cm)	Differences (cm)	Significance (%)	
V(0) average	27.50	11.83	175.49	***
V(1)	15.67	0.00	100.00	Ct
V(2)	25.33	9.66	161.65	***
V(3)	38.33	22.66	244.61	***
V(4)	31.00	15.33	197.83	***
V(5)	25.67	10.00	163.82	***
V(6)	29.00	13.33	185.07	***

LSD 5% = 1.970 LSD 5% in % = 12.5718 LSD 1% = 2.800
LSD 1% in % = 17.8685 LSD 01% = 4.050 LSD 01% in % = 25.8456

In the case of the seedling grown on perlite substrate we have found that the statistic differences were very significant results

concerning the height of the seedling. The greatest height was recorded in variant 3 with 253.48 cm and the lowest with 156.64 cm (Table 8).

Table 8. The height of the Asparagus seedling grown on perlite substrate

VARIANT	Hight (cm)	DIFERENCES (cm)	SIGNIFICNCE (%)	
V(0) average	24.28	10.65	178.15	***
V(1)	13.63	0.00	100.00	Ct
V(2)	21.35	7.72	156.64	***
V(3)	34.55	20.92	253.48	***
V(4)	27.75	14.12	203.60	***
V(5)	23.25	9.62	170.58	***
V(6)	25.16	11.53	184.59	***

DL5% = 0.390 DL5% in % = 2.8613 DL1% = 0.550 DL1% in % = 4.0352 DL01% = 0.800 DL01% in % = 5.8694

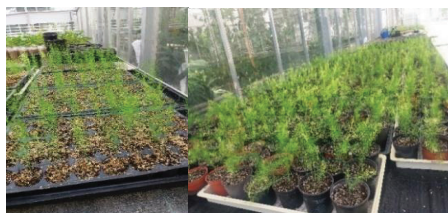


Figure 4. Asparagus seedlings

In the case of the seedling grown on substrate made of 50% peat and 50% perlite we have discovered that the height varied between 165.05 cm in V5 and 243.17 cm in V3. Also in this variant the statistic differences were very significant, in a positive way (Table 9).

Table 9. The height of the asparagus seedling grown on peat substrate

VARIANT	Hight (cm)	DIFERENCES (cm)	SIGNIFICNCE (%)	
V(0) Average	26.76	11.31	173.21	***
V(1)	15.45	0.00	100.00	Mt
V(2)	25.55	10.10	165.37	***
V(3)	37.57	22.12	243.17	***
V(4)	28.25	12.80	182.85	***
V(5)	25.50	10.05	165.05	***
V(6)	28.25	12.80	182.85	***

DL5% = 0.260 DL5% in % = 1.6828 DL1% = 0.370 DL1% in % = 2.3948 DL01% = 0.530 DL01% in % = 3.4304

The content of dry basis was bigger in V6 in the case of using the peat substrate and the both peat and perlite substrate, of 0.16980%, respectively 0.63850%. The lowest content of dry basis was recorded in V1, in the case of all types of substrate (Table 10).

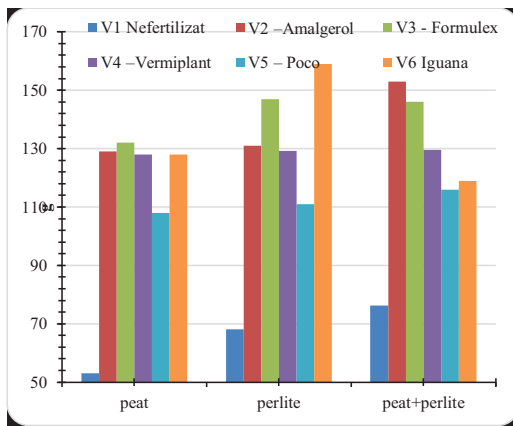


Figure 5. Average weight of asparagus roots

Figures 5-11 show how was influenced the average weight of the roots by the type of substrate and fertilizers.

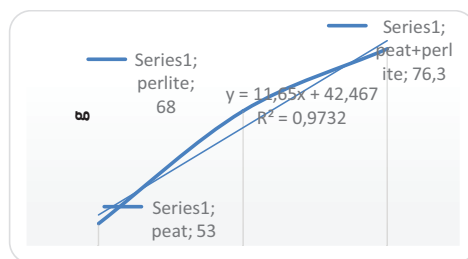


Figure 6. The influence of the substrate on the average weight of the root - Control

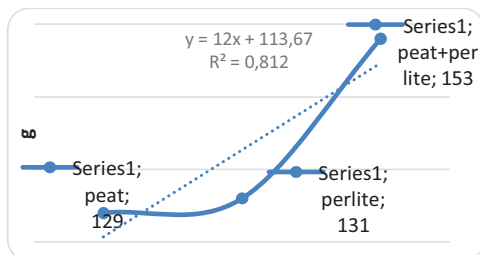


Figure 7. The influence of the substrate on the average weight of the root - variant V2 with Amalgerol

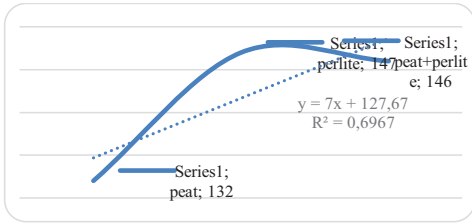


Figure 8. The influence of the substrate on the average weight of the root – variant V3 with Formulex

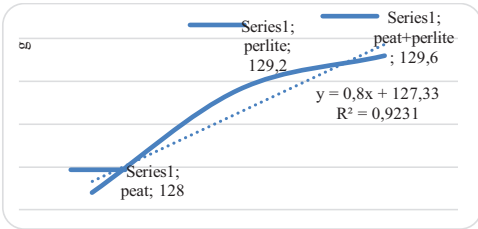


Figure 9. The influence of the substrate on the average weight of the root – Variant V4 with Vermiplant

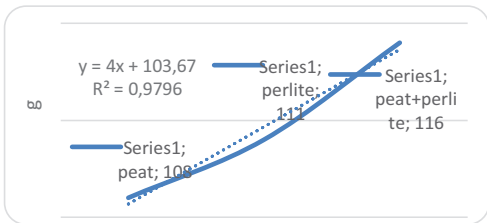


Figure 10. The influence of the substrate on the average weight of the root - Variant V5 with Poco

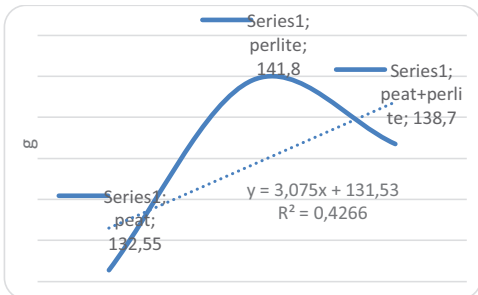


Figure 11. The influence of the substrate on the average weight of the root - Variant V6 with Iguana

Asparagus dry matter content it is influenced both by the substrat and fertilizer variants (Figure 12). Between V1-V3 and V1-V4 fertilizer variants it can be noteced a strong positive correlation ($r = 0.999$). A negative strong correlation it was found between V1-V5 and V2-V6 (Table 10).

Table 10. Correlation between fertilization variants depending on the substrate

Variants	V1	V2	V3	V4	V5	V6
V1	1.000					
V2	-0.774	1.000				
V3	0.999	-0.745	1.000			
V4	0.999	-0.745	1.000	1.000		
V5	-0.999	0.745	-1.000	-1.000	1.000	
V6	0.421	-0.900	0.380	0.380	-0.380	1.000

V1 - Control ;V2 -Amalgerol; V3 - Formulex; V4 - Vermiplant; V5 – Poco; V6 - Iguana

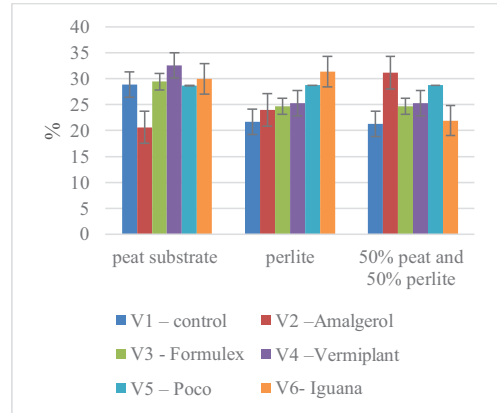


Figure 12. Asparagus dry matter content, in percent

CONCLUSIONS

In the variant in which we used peat as a substrate, the asparagus seeds have emerged after four days in the lowest percentage of 17.00% in V5 and 23.25% in V6. In the case of the unfertilized variant, there aren't any emerged seeds. At 5 days after sowing, the highest percentage of emergence of 71.33% was recorded in V6. Statistically, the differences were very significant, in a positive way, in the variants V2, V3, V5 and V6.

In the case of perlite substrate, the germination percentage was between 93.08% in V2 and 97.58% in V6. A high percentage of emerged seeds was recorded at 5 days after sowing, of 21.33% and 72.33% in V6. In V6 the highest percentage of emerged seeds was recorded, of 72%. In the case of the fertilized variants, insignificant differences were recorded in V2, V3 and V4, but very significant in V6.

In the case of the mixed substrate (50% peat and 50% perlite), at 5 days after sowing the highest percentage of germinated seeds was recorded, of 41% in V1 and 80.25% in V2.

Statistically, there weren't any differences regarding the final percentage of germination. The greatest height of asparagus seedling was recorded in V3 (38.33 cm), obtained in the case of peat substrate, and the lowest in V3 (34.55 cm), in the case of the perlite substrate variants. In the case if all organic fertilized variants we have recorded a biggest content of organic substance, in comparison with the unfertilized variant.

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