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BIO-BASED COMPOSITE USE IN FERTILIZATION OF PETUNIA AND CARNATION CULTURE

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Abstract

Bio-based composite were used in NPK biodegradable fertilizers. The composition of fertilizers contains 0%, 5%, 10%, 15%, 20% starch from wood flour and the form of them were sticks. For the plant test there were used Petunia hybrid and Dyanthus caryophyllus in 8 cm diameter pots filled with 1:1 peat and garden soil. At every pot was used 0.5 g fertilizer stick. The biodegradable process of sticks determines the slow release of fertilizers in the pot. During vegetation period there were made some biometrical determinations (length, number of shoots) and agrochemical analysis at substrates and plants. Comparison between petunia and carnation development show that petunia answer better at fertilization process. From the point of view of experimental variants the best results were at variants with with 15% and 20% wood flour.

Key words: *biocompost, slow release fertilizer, wood flour*

INTRODUCTION

During the last years the use of vegetal-derived materials (wood flour, plant fibres, reprocessed cotton) has shown continuous growth [2, 4]. The drivers for this trend are the cost savings, weight reduction and recyclability: in the last years cost efficient technologies has been developed to manufacture vegetal based composite as a result. The forest biomass represents an abundant, renewable, no-food competition and low cost resource that can play an alternative role to petro-resources. The production and use of forest biomass energy is greenhouse neutral while the expansion of plantation forestry is a positive benefit to greenhouse gas reduction through increasing the forests as a carbon sink. Wood fibres can be used as natural fillers to replace synthetic and glass fibres in composites production [3, 1]. Loading of wood fibres is limited by difficult compatibility with hydrophobic polymers [5]. Research activity was devoted to the production of composites based on wood fibres with biodegradable polymeric matrices (polylactic acid, polycaprolactone, polyhydroxyalkanoates, etc.) and with polypropylene. A high fibre content will be achieved by increasing toughness of polymeric matrices. Materials developed for applications in agriculture were enriched with active substances respectivelly fertilizers.

MATERIAL AND METHOD

Experience was organized in seven variants of 10 repetitions. Experimental scheme is presented in Table 1.

Table 1. Experimental scheme

No.	Variant	Specification
1.	Ct unf.	Unfertilized
2.	Ct	Vilmorin*Sticks
3.	V1	Starch - 50 % NKP fertilizer
4.	V2	Starch - 5 % FT400 (wood flour) - 50 % NKP fertilizer
5.	V3	Starch - 10 % FT400 (wood flour) - 50 % NKP fertilizer
6.	V4	Starch - 15 % FT400 (wood flour) - 50 % NKP fertilizer
7.	V5	Starch - 20 % FT400 (wood flour) - 50 % NKP fertilizer

*N:P:K – 10:6:7

Before mounting the experience fertilizers were analyzed to determine pH, the amount of available K in the form of total NP (Table 2).

Table 2. Fertilizers analyses

No.	Fertilizer	pH	Total content %		
			N	P	K
1.	S-50-NKP	5.48	5.66	9.75	8.19
2.	S-5-WF-50 NKP	5.31	5.62	9.40	8.19
3.	S-10-WF-50-NKP	4.91	5.95	9.75	8.34
4.	S-15-WF-50 NKP	5.02	5.60	9.00	8.34
5.	S-20-WF-50-NKP	4.96	5.90	9.75	8.48

For the experiment were made *Petunia* and *Dianthus* transplants and when they have reached 5 cm tall they were transplanted into pots of about 8cm diameter and for substrat was used a mixture of celery soil and peat in 1:1 ratio, analysis of this substrate is shown in Table 3.

Table 3. The analyze regarding the culture substratum before transplanting

No.	Specif.	pH	Soluble salts CE	Soluble form content, ppm			
				N-NH4	N-NO3	P-PO4	K
1.	Substratum	7.58	0.58	9.56	256.6	50.0	355

When transplanting in pots was introduced one bar of fertilizer which was weighed prior to the fertilizer put in experience to be similar in weight. During the vegetation, biometric observations were made on plant growth and development: plant height, number of shoots, number of flowers. Also periodically weeks away when the plant samples were collected and passed substrates corresponding to that.

Biometric measurements analysis was performed using the line. Substrate tests were performed in soluble form, extract distilled water in 1:5 ratio and pH in 1:2.5 ratio. pH determination has been made with potentiometers. Conductivity soluble salts, ammoniacal nitrogen and phosphorus colorimetrically and potassium flamfotometric. Methods are standardized.

RESULTS AND DISCUSSIONS

Petunia

Measurements of the petunia plant height varied during the experiment according to added fertilizer. If initial planting their height ranged from 5.1 cm (control unfertilized) and 6.15 cm (V2) in the second period of measurement plants reached 11.33 cm (V5). Later plants have developed very well reaching 20.22 cm at V5 at 24 May and 36.50 cm in variant V3 at 7 June. In terms of alternatives are found if initial second harvest period (17 May) Variants V4 and V5 have been the greatest heights of petunias on 24 May the best alternative was a V3 and V5 height of 18.56 cm with a height of 20.22 cm. Then the only option at 31 May V5 recorded the highest height of 28.71 cm, followed by variant V2 with 27.29 cm 7 June. A week to record heights was variants V3 and V4 with 36.50 cm to 35.17 cm.

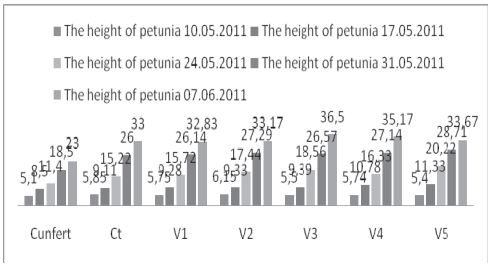

Fig. 1. The evolution of height of petunia plants during vegetation period

Examining variants fertilized versus unfertilized control can be seen that the latter had a downturn because it has available the required amount of N, P, K development.

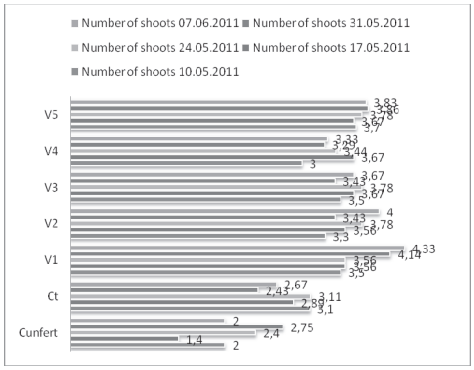

Fig. 2. Evolution of number of shoots during vegetation period

Record number of shoots (Fig. 2) also varied depending on experimental variants that fertilizers applied. If the original versions had a similar number of shoots after the first week after planting the number of shoots varied very little reaching 3.67 in the second week 24 May the number of shoots increased also least almost equal among them being the largest number of 3.78 shoots the variants V2, V3 and V5. In last week's record number of shoots reached 4.33 and 4.00 on a variant to variant V2. Examination of the experimental variants clearly shows that unfertilized variant is slower. Control fertilized with Vilmorin has fared worse than the variants fertilized with bars containing flour starch and sawdust. After applying the fertilizer sticks and watering after the first week they were so scattered in the soil were not found in tests conducted at periodic substrates experiences. These analyzes were performed with analysis of plants.

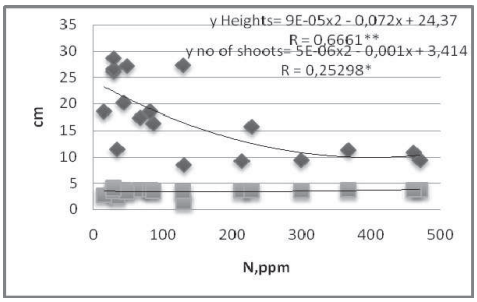

Fig. 3. The correlation between nitrogen content of substratum and the development of Petunia plants

To see the influence of main nutrients on plant growth and development has been the interpretation of statistical correlations between N use and plant height, N the number of shoots from experimental variants (Fig. 3), P and plant height and number of shoots (Fig. 4) and K correlated with plant height and number of shoots (Fig. 5). It is known that nitrogen is the main element that directly influences plant growth, correlation analysis of this element with the main biometric characteristics of plants (Fig. 3) shows that this factor influenced significantly distinct plant height and number of shoots significantly only.

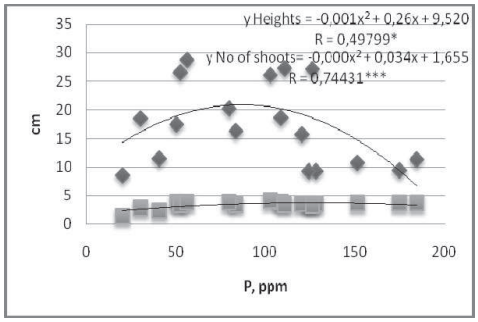

Fig. 4. The correlation between phosphorus content of substratum and the development of Petunia plants

Phosphorus is the second nutrient cofactor in plant growth and development influenced plant growth in height but less intensely significant number of shoots produced (Fig. 4).

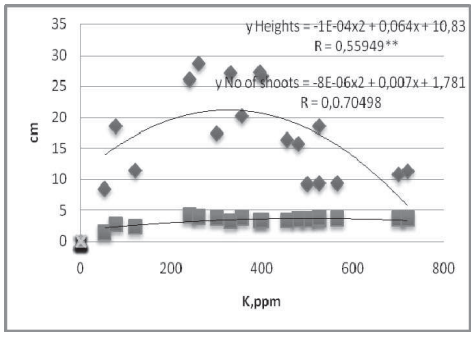

Fig. 5. The correlation between potassium content of substratum and the development of Petunia plants

Potassium content provided distinct substrates significantly increased plant height and shoot emergence significantly intense in petunias. To see the influence of the flour content of wood flour on growth and development of Petunia

plants were performed correlations between biometric measurements and percentage of wood flour (Fig. 6, 7).

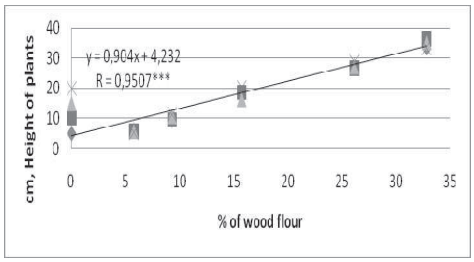

Fig. 6. The correlation between wood flour and the height of plants

If wood flour contents influence on growth in height of plants is very significant 0.9507 coefficient obtained when the number of shoots and the correlation coefficient is just significant 0.70922.

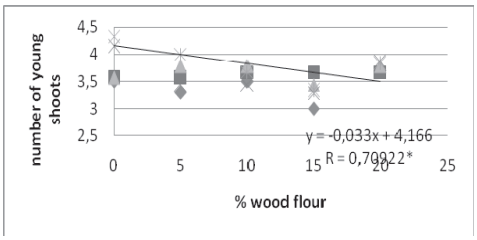

Fig. 7. The correlation between wood flour and the number of shoots Dianthus

Dianthus were planted and after emergence and development have been cropped so as to experience start from the same plant height. After entering the bar with fertilizer plants have evolved and weekly samples were collected from plants and substrate.

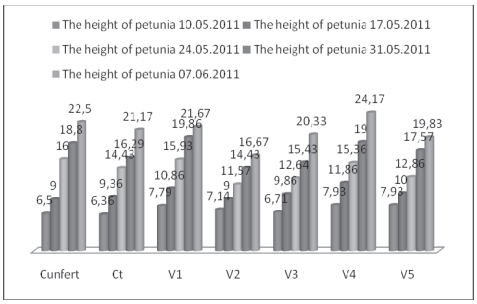

Fig. 8. The heights of Dianthus during vegetation periods

Height (Fig. 8) increased dianthus whichever experimental biggest increase was registered version 5 which is composed of 20% wood flour. Examination of average height variation can be observed that the control had fertilized most average height of 31.00 cm and between variants fertilized variant 5 with 20% wood flour had a height of 26.00 cm. Variant who presented the poor results, worse even than the control was unfertilized variant 3 with 10% flour wood flour. Because unfertilized control reached heights close to the fertilized variants can be said dianthus were not affected by fertilization.

In the case of shoots (Fig. 9) the number of them were stronger in five variants with 4.67 shoots from 6 June and version 4 with a number of 5.00 shoots in the end.

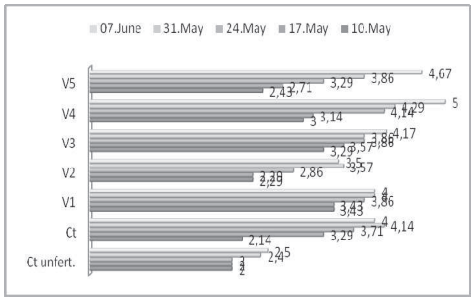

Fig. 9. Number of dianthus shoots during vegetation period

Examining the average number of shoots obtained in the experimental variants shows that unfertilized control recorded the lowest number between 2.71 and 10% wood flour V3 variants showed the highest number of shoots of 4.86. Every week they collected samples were analyzed agrochemical substrate. If the initial pH decreased from 7.58 to 6.65, pH gradually returned to baseline. To see the influence of fertilizers on plant growth and development of dianthus they started to make correlations between elements N, P, K and plant height and number of shoots (Fig. 10, 11, 12). If substrate nitrogen content influence significantly distinct the shoots and dianthus insignificant increase in height.

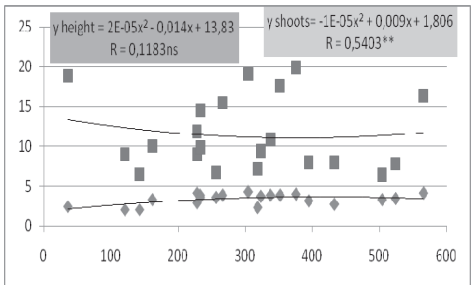

Fig. 10. The correlation between nitrogen content of substratum and the development of Dianthus plants

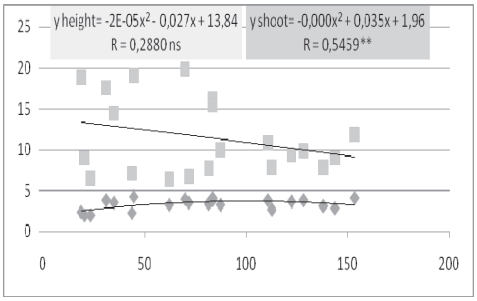

Fig. 11. The correlation between phosphorus content of substratum and the development of Dianthus plants

The phosphorus correlations performed (Fig. 11) shows that the number of shoots was statistically significantly distinct compared with plant height where correlation is obtained unsignificantly statistically assured.

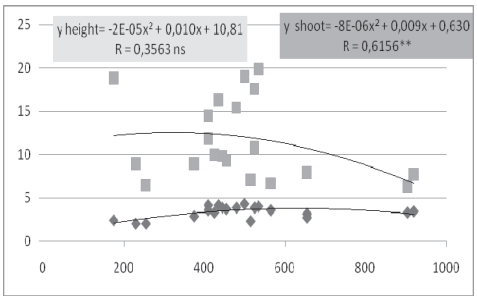

Fig. 12. The correlation between potassium content of substratum and the development of Dianthus plants

Potassium, an element which was released slowly during the growing season significantly affects plant growth in height and distinctly significant number of shoots.

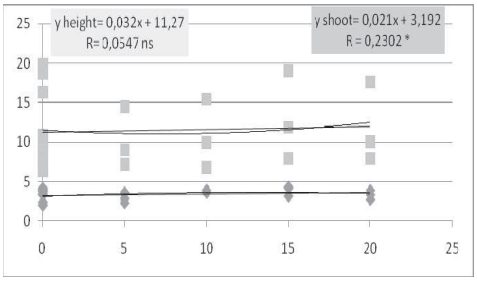

Fig. 13. The correlation between the wood flour content from fertilizers and the development of plants

CONCLUSIONS

1. The height of plants increased during the vegetation period, variants determined the best results are 15% flour V4 and V5 with 20% wood flour.
2. Because unfertilized control from dianthus plants reached heights close to fertilized variants can be said that carnations were not affected by fertilization.
3. The number of shoots increased to a lesser extent with good results and variants are variants fertilized V1 to V5, insignificant differences between them are small;
4. Growing media analysis showed that variants fertilized with manure had experienced:
a. pH decreased immediately after application of fertilyzers and during vegetation period grew;
b. Although ammoniac N fertilizers was predominant during the vegetation period it was transformed into N-NO3 and consummated;
c. Phosphorus and potassium in fertilizer during the experiment provided a high content of culture substrate;
5. Statistical analysis at petunia plants showed significantly distinct influence of nitrogen and potassium in plant growth and development in height and number of shoots was influenced by P and K in the substrate;
6. In the presence of different concentrations of wood flour correlation made between the two indicators which also resulted in a coefficient is insignificant, so dianthus species is less influenced by the presence of wood flour into fertilizer;
7. In the case of petunia plants the presence of wood flour influenced intense significantly the heights of plants and only a positively influence of the development of shoots.

8.The use of bio based composite in the preparation of fertilizers have no negative influence, a nontoxic one so the plants have a good development during vegetation period.

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