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THE EFFECT OF DIFFERENT CULTIVATION METHODS OF YOUNG *SANTOLINA CHAMAECYPARISSUS* PLANTS ON THEIR FURTHER GROWTH IN FIELD CONDITIONS

Summary. In the presented studies, an estimation was made regarding the effect of the applied cultivation methods of *Santolina chamaecyparissus* L. young plants on the further growth in field patches. Experimental material consisted of young plants produced in plastic pots, in multipot pallets, in cellulose pots and in field patches, in a non-heated foil tunnel. The plants originated from two terms of rooting of cuttings: 16th of August and 16th of September 2007. Differences in the growth of plants originating from different methods of young plant cultivation found during the first measurement, remained until the end of studies. Among the applied methods of growing of rooted cuttings, the most favourable one proved to be growing in plastic pots. Plants produced in plastic pots, after being transferred to open air, were characterised by the strongest growth. The poorest growth in field patches was found in plants originating from the cultivation in cellulose pots and in multipot pallets. No effect was found to be exerted by the date rooting of *S. chamaecyparissus* cuttings on the outdoor growth of this plant.

Key words: *Santolina chamaecyparissus* L., methods of young plant preparing, growing in outdoor

Introduction

High quality plants guarantee good effects in the outdoor growing of perennials. In the early period of growing, different environmental factors exert some influence. The studies of SZCZEPANIAK and CZUCHAJ (2007) indicated that both selection of an adequate substrate, its volume and fertilization are very important. On the other hand, DOMATO et AL. (1994) called attention to the method of young plants preparation and their age. The use of different containers in the cultivation permits to mechanize some work, among others planting and spacing out of plants on the tables.

According to BABIK (2002), the possibility to take care of plants depends on the method of young plants preparation and as a consequence the quality of root system is very differentiated.

The objective of the presented studies was to define the age and cultivation method of rooted *Santolina chamaecyparissus* 'Tomentosa' cultivar plants for their further growing in the open air.

Material and methods

Experiment was carried out in field conditions from May 2 to September 16, 2008. The studied material consisted of young plants of *S. chamaecyparissus* 'Tomentosa' cultivar produced in an unheated tunnel. Four methods of young plants cultivation were applied: 1) in multipot pallets with 8 cm diameter openings, 2) in plastic flower pots with 8 cm diameter, 3) in cellulose pots of 8 cm diameter and 4) in field patches supplemented with an 8 cm substrate layer. The spacing of plants was 8 × 8 cm.

Plant material originated from two rooting terms of cuttings: the 16th of August and the 16th of September 2007. Two months after plantation, the rooted cuttings were transplanted to the substrate, according to the accepted diagram.

During the winter period, the unheated foil tunnel was aerated and the plants were individually irrigated, depending on the need. The substrate for the young plants consisted of coconut and peat (from Ceres Co.) with pH 6.0. Multicomponent fertilizer with a delayed action – Hydrocote (13-13-13-2) 2.5 g/dm³ was added. In all types of containers and in the field patches, the same substrate was applied. For prophylactic purposes against fungal diseases, a spraying with Topsin M – 0.1% was three times applied. From the end of March, every 20 days, nutrition with green Kristalon (18-18-18-3 Mikro) 0.3% was applied to the leaves.

At the end of March, from all plants, shoots were pinched off at the plant height of 4 cm.

Field experiment was established on the 2nd of May 2008 in an insulated place shielded from wind. The substrate consisted of maternal soil of slightly loamy sand with pH 6.0 which was enriched with a multicomponent "Azofoska" (nitrophoska) fertilizer in the dose of 3 kg per 100 m². Plants were planted in 40 × 20 cm spacing. Two-factorial experiment (four methods of young plant growing × two terms of rooting) was established in a completely random design. In each of eight combinations, 10 replications were used; one replication consisted of one plant. During growing, typical cultivation treatments for plants grown in field patches were applied – weeding, soil loosening and irrigation. During the whole growing period, no plant protection agents were applied.

Measurements of the height and diameter of plants were carried out three times in intervals of 45 days from the term of experiments establishment (16th of June, 2nd of August and 16th of September).

Results were statistically elaborated. Two-factorial analysis of variance was applied and the differences were determined with Duncan's test at the significance level of $\alpha = 0.05$.

Results and discussion

In the growing of *S. chamaecyparissus* in field patches, no significant effect was exerted by the rooting term of cuttings on the height of plants (Table 1), either on plant diameter (Table 2). Plants prepared in plastic pots were significantly higher in the period from June to August, as compared with plants produced in the other types of containers or in field patches (Table 1). Not before the end of the vegetative period (16th of September), a similar height was shown by plants from plastic pots (23.3 cm) and plants produced loosely in field patches (22.3 cm).

Table 1. Height of *Santolina chamaecyparissus* plants depending on the date of rooting of cuttings and method of young plants preparing

Tabela 1. Wysokość roślin santoliny cyprysikowatej w zależności od terminu ukorzenia się sadzonek i sposobu przygotowania młodych roślin

Date of rooting of cuttings	Methods of young plants preparing				
	in plastic pots	in multipot pallets	in cellulose pots	grown in field patches	mean
For measurement on 16th of June					
August	19.1 c	15.5 a	16.4 ab	17.3 abc	17.07 a
September	18.6 bc	15.2 a	15.2 a	16.2 a	16.30 a
Mean	18.9 b	15.4 a	15.8 a	16.8 a	
For measurement on 2nd of August					
August	22.1 cd	19.1 ab	17.7 a	20.8 bc	19.92 a
September	23.1 d	18.8 ab	18.4 a	19.1 ab	19.85 a
Mean	22.6 c	19.0 ab	18.1 a	19.9 b	
For measurement on 16th of September					
August	22.4 bcd	21.3 abc	19.9 a	23.2 cd	21.72 a
September	24.1 d	20.7 ab	21.4 abc	21.3 abc	21.87 a
Mean	23.3 c	21.0 ab	20.7 a	22.3 bc	

Means followed by the same letter are not significantly different at $\alpha = 0.05$.

The lowest growth was presented during the whole vegetation period by plants prepared in cellulose pots.

In all measurement dates the diameter of plants produced in plastic pots was significantly higher than that of young plants prepared by other plant preparation methods (Table 2). Plants of the smallest diameter were obtained in multipot pallets and in cellulose pots.

Differences in the growth found during the first measurements in plants originating from different methods of young plant growing were maintained until the end of the experiment.

Table 2. Diameter of *Santolina chamaecyparissus* plants depending on the date of rooting of cuttings and method of young plants preparing

Tabela 2. Średnica roślin santoliny cyprysikowatej w zależności od terminu ukorzenia sadzonek i sposobu przygotowania młodych roślin

Date of rooting of cuttings	Methods of young plants preparing				
	in plastic pots	in multipot pallets	in cellulose pots	grown in field patches	mean
For measurement on 16th of June					
August	21.1 c	17.9 ab	17.8 ab	18.8 abc	18.90 a
September	20.9 bc	16.9 a	17.8 ab	17.0 a	18.15 a
Mean	21.0 b	17.4 a	17.8 a	17.9 a	
For measurement on 2nd of August					
August	24.0 d	19.8 ab	19.3 a	22.2 bcd	21.33 a
September	23.2 cd	19.5 a	19.6 a	21.0 abc	20.82 a
Mean	23.6 c	19.7 a	19.5 a	21.6 b	
For measurement on 16th of September					
August	25.0 d	21.3 abc	20.0 a	23.0 bcd	22.32 a
September	23.9 cd	19.2 a	21.1 ab	21.9 abc	21.52 a
Mean	24.5 c	20.3 a	20.6 a	22.5 b	

Means followed by the same letter are not significantly different at $\alpha = 0.05$.

The highest growth of *S. chamaecyparissus* grown outdoor defined on the basis of the measurement of plant height and diameter was shown in case when young plants were produced in plastic pots. In the production of young plants in containers, primary the following factors are important: water capacity, air capacity and retention of available water. These factors depend first of all on the size and shape of the container, as well as on the material from which the pot is made (DRZAL 1999). The experiments of STROJNY (1998) and JAROSZUK and SŁOWIŃSKA-JURKIEWICZ (2005) indicated, that considering of drying up of substrate during the plant growing in containers the choice of suitable type of substrate is very important. ARGO and BIERNBAUM (1995) determined that the amount of water lost by evaporation from the pot surface during plant growing reaches 25-30% of the total amount of water supplied during irrigation. Cellulose pots release water by their total surface, hence water losses certainly were the highest among the studied methods of young plant preparation. NOWAK and STROJNY (1997) found a decrease in the growth of *Poinsettia* plants by 40% in result of a systematic overdrying of substrate to the potential of 50 kPa in the container, in turn, a frequent irrigation aiming at the prevention of such situation, caused a quicker washout of nutritive components from the substrate. Problems connected, among others, with a quick depletion of nutritive components from the substrate and its excessive drying were noticed also by BABIK (2002) in multipot pallets. Attention was called to the fact that it can cause an accelerated ageing of the transplants and deterioration of their quality.

Air content remains in a close relation with water content in the substrate. Roots of young plants require a high amount of oxygen because of their rather small expansion and because of the intensive physiological processes connected with respiration. CHMIEL (1993) reported that ornamental plants grown in not-porous containers (made of artificial materials) show a root system which is less concentrated at the pot walls, but it rather homogeneously penetrates the total clod of substrate, in comparison with pots made of porous materials. In consequence of this situation, in our own experiment, there occurred the fact that the highest growth of plants was obtained in the permanent place with plant material prepared in plastic pots. The weak growth of plants produced in cellulose pots can be caused by a decrease of the substrate temperature as a result of the water evaporation through the porous walls of these pots. Nowadays, the possibility of automatization of plant production causes that loose growing of young plants is not recommended while, as it is known, the quality of these plants is rather satisfactory (Tables 1, 2).

Conclusions

1. *Santolina chamaecyparissus* growth in field patches was not influenced by rooting term of cuttings, but rather by the cultivation method of young plants.
2. The strongest growth of *S. chamaecyparissus* was found when young plants were grown in plastic pots, while the poorest growth was shown in cellulose pots and in multipot pallets.

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WPLYW RÓŻNYCH SPOSOBÓW UPRAWY MŁODYCH ROŚLIN SANTOLINY CYPRYSIKOWATEJ NA DALSZY WZROST W WARUNKACH POLOWYCH

Streszczenie. W badaniach oceniono wpływ sposobów uprawy młodych roślin santoliny cyprysikowatej (*Santolina chamaecyparissus* L.) na dalszy wzrost w gruncie. Materiałem doświadczalnym były młode rośliny wyprodukowane: w doniczkach plastikowych, w paletach wielodonieczkowych, w doniczkach celulozowych oraz na zagonach, w tunelu foliowym nieogrzewanym. Rośliny pochodziły z dwóch terminów ukorzenia sádzonek: 16 sierpnia i 16 września. Stwierdzone podczas pierwszych pomiarów różnice we wzroście roślin pochodzących z różnych sposobów uprawy młodych roślin utrzymały się do końca badań. Spośród zastosowanych sposobów uprawy ukorzenionych sádzonek najkorzystniejsza okazała się uprawa w doniczkach plastikowych. Rośliny tak wyprodukowane cechowały się na miejscu stałym najsilniejszym wzrostem. Najslabszy wzrost w gruncie stwierdzono u roślin pochodzących z uprawy w doniczkach celulozowych oraz w paletach wielodonieczkowych. Nie stwierdzono wpływu terminu ukorzenia sádzonek na wzrost santoliny cyprysikowatej w gruncie.

Słowa kluczowe: *Santolina chamaecyparissus* L., metody przygotowania młodych roślin, uprawa w gruncie

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