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INFLUENCE OF DIFFERENT SOIL SUBSTRATES, PLANTING TIME AND STEM CUTTINGS TYPE ON VEGETATIVE PROPAGATION AND GROWTH CHARACTERISTICS OF *VITEX AGNUS-CASTUS* L.

VPLYV RÔZNYCH PÔDNYCH SUBSTRÁTOV, ČASU VÝSADBY A TYPOV STONKOVÝCH ODREZKOV NA VEGETATÍVNE ROZMNOŽOVANIE A RASTOVÉ VLASTNOSTI *VITEX AGNUS-CASTUS* L.

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The study of vegetative propagation of the *Vitex agnus-castus* L., was conducted in the Agriculture College – Salahaddin University field under controlled condition (plastic greenhouse) in two periods (summer time: from 26.5.2008 to 2.9.2008 and winter time: from 15.1.2009 to 28.4.2009). The object of the studies were different soil substrates (sand and river (sharp) sand – sand and peat moss – sand and river (sharp) sand and peat moss). We used two types of stem cuttings (semi-hardwood cuttings „m“ – softwood cuttings „a“). The statistical analysis is based on the experimental project Complete Randomized Design (CRD) with three replications. The results were compared with results from Duncan test at 0.05 level. The study showed that planting in the second period (T2) causes increase in number of branches and leaves, whereas planting in the first period (T1) causes increase in number of roots and root length, the increase in the weight of biomass and dry mass has been observed in the second period of planting (T2). Planting in the sand substrate using semi-hardwood cuttings (m) causes increase in number of branches, leaves, fresh weight, number of roots and root length.

Keywords: *Vitex agnus-castus*, propagation, cuttings, soil substrates

Vitex agnus-castus L. belongs to the *Verbenaceae* family, native to the Mediterranean and Central Asia. The fruit has a spicy pepper like aroma and taste. The dried ripe fruits are used medicinally (Sima et al., 2007). *Vitex* is an excellent choice for a large shrub or small flowering tree in a smaller modern suburban landscape. The blossoms of *Vitex* emerge from May to September. The aromatic leaves are palmate, with five to seven leaflets. All deadwood and lower branches may be removed from the shrubs in winter time. Propagation by cuttings takes place in the summer or winter. Lower branches may be layered by burying in the soil. There are sometimes also volunteer seedlings that may be transplanted elsewhere in the garden. *Vitex* grows best in full sun, in a variety of soils, provided they are well drained (Welch, 2008).

Cuttings are probably the most important method for starting new plants. A cutting is any detached plant part which, under favorable conditions for regeneration, will produce a new plant identical to the parent plant (Mohyeldeen, 2009). The period of the year when cuttings are collected is one of the most important factors controlling the success of rooting. Some cuttings, like *Forsythia*, can be rooted at almost any time of the year while others will only be successful during two to three month-long periods (Wells, 1985). The media should be well drained and yet retain sufficient water to reduce the frequency of watering. Other parameters to consider include costs, availability, and consistency between batches and stability in the media overtime. Selection of the proper media components is crucial for a successful production of plants (Robbins

and Evans, 2009). The main objectives of this study are to investigate the propagation of *Vitex agnus-castus* L. by using stem cuttings, and to determine the suitable time for planting using the different soil substrates.

Material and methods

To study the effects of the propagation media on the rate of growth of *Vitex agnus-castus*, a study was carried out in the plastic greenhouse at the Salahaddin University in Erbil in two periods during T1 (from 26. 5. 2008 to 2. 9. 2008) and T2 (from 15. 1. 2009 to 28. 4. 2009).

The rooting substrates were composed primarily of sand, particles from 2 mm to 0.06 mm (S); sand and river (sharp) sand, particles from 0.425mm to 0.075 mm (sz) at ratio 1 : 1; sand mixed with peat moss (sp) at ratio 1 : 1 and sand with river (sharp) sand with peat moss (szp) at ratio 1 : 1 : 1. Two types of stem cuttings were taken from nursery stock plants (soft stem cuttings (a) and semi-hardwood stem cuttings (m). grown in polyethylene bags 20 × 30 cm). The cuttings were taken from the medium and basal parts of the main branches of mature plants. They were about 25–30 cm in length. All the cuttings were treated with fungicide (Ridomil). The plants were irrigated daily with fresh water. The experiment was laid out in Complete Randomized Design (CRD) with tree replications and the treatments were tested by Duncan test under level of significance 0.05 (Alrawi and Khalaf, 1980). The following phenological characters have been measured:

1. Number of branches.
2. The average length of shoots.
3. The average number of leaves
4. The average length of roots (cm)
5. Fresh weight of roots (g).
6. The average number of roots (cm).
7. Fresh weight of shoots (g).
8. Dry weight of shoots (g).
9. Dry weight of roots (g).

Results and discussion

As seen in the Table 1, the planting time significantly affects the number of branches (T2) affected the number of branches in more significant way compared to (T1), planting in the (T2) led to increase in the number of leaves compared to (T1) and the difference was significant, while planting in (T1) led to increased root numbers and root length compared to (T2). These results agree with Elgimabi (2008) who proved that (T1) led to an increase in the number of roots and root length compared to (T2) in *Ixora coccinea*.

Whereas increased fresh weight and dry weight of shoots was detected significantly in the (T2) and this agrees with Mahfoud and Makhoul (2006) who proved that (T2) caused the highest percentage of rooting compared to (T1) in kiwi fruit. The fresh weight of roots has increased in (T1), while the dry weight of roots was not affected by the date of planting.

Table 2 shows that planting in sand media (s) using semi-hardwood cuttings (m) led to an increase in the number of branches and the highest percentage compared to other treatments and differences which agrees with Alkutub et al. (1997). They stated that this is more advisable media for *Jasminum officinalis*. Perhaps because of the absence of sand microbiological activity which is typical for good ventilation. As if they were getting larger number of leaves when planted in the sand using mind wooden half and the difference was significant compared to the soil mixture (sand peat moss and sand agricultural = sand agricultural peat moss) with the use of reason is soft, perhaps because containment this mixture on the excess moisture and persistent even be a good compromise for the proliferation of micro organisms responsible for microbial degradation of organic matter and this is what is causing adverse effects

Table 1 Effect of planting date on studied characteristics of *Vitex agnus-castus* L.

Planting time (2)	Studied characteristics (1)								
	number of branches (3) (pc)	average number of leaves (4) (pc)	average length of shoots (5) in cm	number of roots (6) (pc)	average length of roots (7) in cm	fresh weight of shoots (8) in g	fresh weight of roots (9) in g	dry weight of shoots (10) in g	dry weight of roots (11) in g
(T2)	a3.01	a13.98	b3.70	b2.46	a6.36	a15.76	b0.23	a8.46	a0.12
5/1/2009									
(T1)	b2.08	b10.29	a6.94	a4.04	a7.12	b1.96	a0.50	b0.83	a0.23
26/5/2008									

Tabuľka 1 Vplyv dátumu výsadby na pozorované charakteristické vlastnosti *Vitex agnus-castus* L.

(1) pozorované charakteristické vlastnosti, (2) čas výsadby, (3) počet vetiev (pc), (4) priemerný počet listov (pc), (5) priemerná dĺžka výhonkov v cm, (6) počet koreňov (pc), (7) priemerná dĺžka koreňov v cm, (8) čerstvá hmotnosť výhonkov v g, (9) čerstvá hmotnosť koreňov v g, (10) suchá hmotnosť výhonkov in g, (11) suchá hmotnosť koreňov v g

Table 2 Effect of different soil substrate mixtures and cuttings types on studied characteristics *Vitex agnus-castus* L.

Soil substrates + cuttings type (2)	Studied characteristics (1)								
	number of branches (3) (pc)	average number of foliage (4) (pc)	average length of shoots (5) in cm	number of roots (6) (pc)	average length of roots (7) in cm	fresh weight of shoots (8) in g	fresh weight of roots (9) in g	dry weight of shoots (10) in g	dry weight of roots (11) in g
S+m	a4	a18.77	a14.43	ab5.67	a16.92	a13.67	a0.71	a6.69	a0.21
sp+m	ab3.33	a18.10	b8.13	bc4.17	ab13.32	a12.32	ab0.57	a6.46	a0.33
szp+m	ab3.30	a15.93	b4.75	a7.58	cb9.58	a12.29	abc0.54	a6.34	ab0.30
Sz+m	ab3.15	a16.87	b7.88	bcd2.67	cd5.80	a12.82	abcd0.37	a6.39	ab0.21
szp+a	bc2.35	b9.00	c2.07	bd2.50	d2.75	b5.78	bcd0.21	b3.81	ab0.17
sp+a	c1.57	b6.5	c1.27	cd1.67	d1.30	b4.22	abcd0.43	b2.46	ab0.09
Sz+a	c1.42	b5.97	c2.35	d0.58	d2.50	b4.68	cd0.07	b2.45	b0.03
S+a	c1.27	b5.93	c1.27	cd1.17	d1.75	b4.87	d0.05	b2.48	b0.01

Tabuľka 2 Vplyv rozličných zmesí pôdnych substrátov a typov odrezkov na pozorované charakteristické vlastnosti *Vitex agnus-castus* L.

(1) pozorované charakteristické vlastnosti, (2) pôdne substráty + typy odrezkov, (3) počet vetiev (pc), (4) priemerný počet listov (pc), (5) priemerná dĺžka výhonkov v cm, (6) počet koreňov (pc), (7) priemerná dĺžka koreňov v cm, (8) čerstvá hmotnosť výhonkov v g, (9) čerstvá hmotnosť koreňov v g, (10) suchá hmotnosť výhonkov v g, (11) suchá hmotnosť koreňov v g

Table 3 Effect of interaction between planting time, soil substrate mixtures and cuttings types on studied characteristics *Vitex agnus-castus* L.

Planting time, cuttings type and soil substrates (2)	Studied characteristics (1)								
	number of branches (3) (pc)	average number of leaves (4) (pc)	average length of shoots (5) in cm	number of roots (6) (pc)	average length of roots (7) in cm	Fresh weight of shoots (8) in g	fresh weight of roots (9) in g	dry weight of shoots (10) in g	dry weight of roots (11) in g
(T2)	a4.00	a20.53	bcd6.10	bc4.67	b17.13	a22.83	abc0.43	a12.33	ab0.18
Sp + m									
(T1)	a4.00	a20.67	a23.67	b7.00	a26.50	bc6.86	a1.13	cd2.68	ab0.31
S + m									
(T2)	a4.00	abc16.87	bcd5.20	bc4.33	c7.33	a20.87	bc0.28	a10.70	ab0.11
S + m									
(T2)	a3.63	abc16.40	bcd4.80	c1.67	c6.50	a22.57	bc0.30	a11.57	ab0.09
Sz + m									
(T1)	a3.33	ab17.67	bcd4.40	a11.67	bc8.67	d1.81	abc0.48	ed0.83	ab0.28
Szp + m									
(T2)	a3.27	abc14.20	bcd5.10	bc3.50	bc10.50	a22.77	abc0.60	a11.87	ab0.32
Szp + m									
(T1)	ab2.66	abc15.67	bc10.17	bc3.67	bc9.50	d1.81	abc0.69	ed0.59	a0.48
Sp + m									
(T1)	ab2.66	abc17.33	b10.93	bc3.67	c5.10	cd3.07	abc0.44	ed1.23	ab0.33
Sz + m									
(T2)	ab2.53	bcd11.87	cd3.37	c2.00	c3.50	b9.73	c0.06	bC4.97	b0.02
(T2)	ab2.37	bcd12.33	d1.63	c0.33	c0.17	b10.17	c0.17	b6.84	ab0.07
Szp + a									
(T1)	ab2.33	def5.67	d2.50	bc4.67	c5.33	d1.39	bc0.41	ed0.77	ab0.27
(T2)	ab2.17	bcde10.27	d1.67	c1.17	c5.00	b9.33	bC0.13	bC4.73	ab0.05
Sz + a									
(T2)	ab2.13	cde9.33	d1.70	c2.00	c0.77	b7.77	c0.03	bC4.54	b0.01
Sp + a									
(T1) sp + a	bc1.00	ef3.67	d0.83	c1.33	c1.83	d0.67	ab0.87	ed0.37	ab0.17
(T1)	bc0.67	f1.67	d3.03	c0.00	c0.00	d0.03	c0.00	e0.17	b0.00
Sz + a									
(T1)	c0.00	f0.00	d0.00	c0.33	c0.007	d0.00	c0.03	e0.00	b0.0003
S + a									

* – similar characters means there is no significant difference between treatments; a – best among the treatments (The highest value compared to the other treatments)

* – podobné znaky znamenajú, že medzi postupmi nie je žiadny významný rozdiel; a – najlepšie z opatrení (Najvyššia hodnota v porovnaní s ostatnými postupmi)

Tabuľka 3 Vplyv vzájomného pôsobenia času výsadby, zmesí pôdných substrátov a typov odrezkov na pozorované charakteristické vlastnosti *Vitex agnus-castus* L.

(1) pozorované charakteristické vlastnosti, (2) čas výsadby, typy odrezkov a pôdne substráty, (3) počet vetiev (pc), (4) priemerný počet listov (pc), (5) priemerná dĺžka výhonkov v cm, (6) počet koreňov (pc), (7) priemerná dĺžka koreňov v cm, (8) čerstvá hmotnosť výhonkov v g, (9) čerstvá hmotnosť koreňov v g, (10) suchá hmotnosť výhonkov v g, (11) suchá hmotnosť koreňov v g

on the roots what agrees with Garnar and Hatcher (1955) who proved that the rooting rate is decreased in hardwood cuttings planted in the sand and using the semi-hardwood cuttings increases the length of shoots as well as it increases the number of roots, the root length and the fresh weight of shoots and roots. All of these differences were significant.

Table 3 shows that planting in the sand by using semi-hardwood cuttings during (T1, T2) as well as planting in the sand + peat moss and using the same kind of cuttings during the T2, led to an increase in the number of branches and the differences were significant compared to other treatments. The addition of organic matter in the form of peat can improve the physical status of soil for better root development because of increased aeration in the media (Al-Menaie et al., 2010), while planting in T2 increased the number of leaves in the soil mixture (sand + peat moss) in semi hardwood cuttings what agrees with Rasul et al. (1984). Planting in (spz) in T1 due to increasing in root numbers, while fresh and dry weight increase in T2 by using (spz), sp) and (sz) in semi hardwood cuttings. Effect of media may be due to the difference between them in their ability to retain a sufficient quantity of water for the processing of the cuttings and to divert excess water and ventilation rate.

Conclusion

Planting in the first period (T1) causes increase in root numbers and root length, increase in fresh and dry weight has been observed in the second period of planting. Planting in the sand media using semi hardwood cuttings (m) causes increase in number of branches and leaves, fresh weight, root numbers and root length. So we suggest that planting in the first period and using semi-hardwood cuttings is more advisable.

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Súhrn

Výskum vegetatívneho rozmnožovania *Vitex agnus-castus* L. bol realizovaný na výskumných plochách Poľnohospodárskeho inštitútu Univerzity Salahaddin, v kontrolovaných podmienkach (fóliovník) v dvoch sledovaných obdobiach (letné obdobie: 26. 5. 2008 – 2. 9. 2008 a zimné obdobie: 15. 1. 2009 – 28. 4. 2009). Skúmaný bol vplyv rôznych pôdnych substrátov (piesok – piesok; riečny piesok – piesok; rašelina – piesok; riečny piesok a rašelina). Použili sme dva druhy stonkových odrezkov (odrezky z polotvrdého dreva „m“; odrezky z mäkkého dreva „a“). Štatistická analýza vychádza z experimentálneho projektu (Complete Randomized Design CRD) s tromi opakovaniemi. Výsledky získané prostredníctvom CRD boli následne porovnané s výsledkami získanými Duncanovým testom na úrovni 0,05. Výskumom sme dokázali, že výsadba v druhom sledovanom období (T2) vykazuje nárast počtu vetiev a počtu listov, kým výsadby v prvom sledovanom období (T1) vykazujú zvýšenie počtu a dĺžky koreňov a výsadby v druhom sledovanom období (T2) vykazujú zvýšenie hmotnosti biomasy, ako aj hmotnosti sušiny. Výsadba

do pieskových substrátov za použitia odrezkov z polotvrdého dreva (m) spôsobuje nárast počtu vetiev, listov a koreňov, zvýšenie čerstvej váhy a predĺženie koreňov.

Kľúčové slová: *Vitex agnus-castus*, rozmnožovanie rastlín, odrezky, pôdne substráty

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