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The influence of rooting biostimulators and substrate on biometric characteristics of *Kerria japonica* (L.) DC seedlings

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Abstract Japanese Rose is a species whose propagation by division or seeds are quite difficult. Propagation by cuttings is an alternative for obtaining seedlings of *Kerria japonica*. Research has aimed the influence of biostimulators on rooting. Two biostimulators have been used: Atonik, in solution with a dose of 1:4000, respectively 0.25 ml to 1 liter of water and Radistim 1 in powder form. Rooting was done in the sandy. The characters analised were root length and root diameter. The influence of soil media on seedling growth was another studied aspect. Rooted cuttings were planted in different soil media made of sand or a mixture of sand and peat in various proportions. For every seedlings has been determined: height increment, root collar diameter increment, root lenght and diameter lenght increment. It was observed that steam cuttings treated by Atonik had a rooting percentage of 71, while cuttings treated Radistim had a rooting percentage of 80%.In terms of soil media, it has influenced all biometrical characters studied. Best results were obtain for the experimental trials with 25% or 50% of peat in soil mixture.

Key words:

steam cutting, soil mixture, biostimulators

Kerria japonica (L.) D.C. is an ornamental shrub using in parks and gardens. As a result of very small requirements from soil and climate the species is resistant to frost, but sometimes when winter temperatures are very low, shoots freeze

This species is used alone, in groups or can be supported on trellis. It is noted particulary by the beauty of orange-yellow flowers and long blooming period, from May to September.

Due to their biological and ornamental characters the request of this species is increasing.

Division is a variant of Japanese Rose propagation but sometimes problems appear to seedling survival. Generative propagation by seeds are also difficult to realise. This is the reason why cuttings is the best solution to produce Japanese Rose seedlings [5].

Researches have been made in 2011, to Experimental Station from Banat's University of Agricultural Science and Veterinary Medicine Timişoara. The aim was to put in evidence the influence of biostimulators and soil media on seedling biometrical characters.

Materials and Methods

Biological material is represented by *Kerria japonica* seedlings, obtained by cuttings. Two rooting stimulators were used: Atonik for 100 steam cuttings and Radistim for another 100 steam cuttings.

Atonik biostimulator was used for the dose of 1:4000 (0.25 ml/1l water). Cuttings were introduced in aqueous solution for 7 minutes. Steam cuttings base was wetting immediately after harvesting.

The second biostimulator used was Radistim 1. Cuttings base was introduced in powder for a height of 1-2 cm. Excess powder was removed by tapping the cuttings.

After being treated with biostimulators, steam cuttings were carefully placed in the soil mixture in a hole previously made [3]. Steam cuttings were made in January 1, 2011. After rooting, seedlings was transplanting in April 4, 2011, after 94 days, in different soil mixture [4]:

V_1: 100% sandy;
V_2: 25% sandy and 75% peat;
V_3: 50% sandy + 50% peat;
V_4: 75% sandy + 25% peat.

The following biometric characters were measured: steam height, root collar diameter, root lenght and root diameter [1].

Steam height and root lenght were measured using a tape measure with an accuracy of 1 mm

Root collar diameter and root diameter (diameter at the midlle of the root lenght) were measured using an electronic calliper with an accuracy of 0.01mm.

To highlight the influence of soil mixture about the studied characters, measurement were made before replanting and after a period of 120 days from that.

The dates were statistically analyzed by using STATISTICA 10 programme. The mean, standard error of mean, standard deviation and coefficient of variation has been determined.

Results and Discussions

To highlight the influence of biostimulators about rooting, the rooting percentage of cuttings and two biometrical characters, root legth and root diameter have been studied.

Results showed that using Radistim, rooting percentage is higher (80%) than using Atonik (71%). In terms of analysed character values of root lenght and root diameter are higher for Atonik (Table 1 and Table 2).

Table 1

Statistical parameters for the character "root length"

The experimental trial	No.	Mean (cm)	Standard error of mean	Variances	Standard deviation	Coefficient of variation %
Radistim	80	7,147500	0,197884	3,132652	1,769930	8,66
Atonik	71	7,283099	0,216790	3,336853	1,826706	7,26
All group	151	7,211258	0,145840	3,211672	1,792114	-

Table 2

Statistical parameters for the character "root diameter"

The experimental trial	No.	Mean (cm)	Standard error of mean	Variances	Standard deviation	Coefficient of variation %
Radistim	80	17,36575	0,173593	2,410756	1,552661	2,35
Atonik	71	17,43718	0,192914	2,642335	1,625526	2,17
All group	151	17,39934	0,128775	2,504034	1,582414	-

Small values of the coefficient of variation were obtained for root lenght and root diameter too. This shows a low variability for both characters. No significant differences were established between the analyzed characters (Table 3).

Table 3

Duncan's test for root character

Experimental trials	Analyses characthers	
	root length	**Root diameter**
	Marked differences are significant at p < ,05000	
Radistim - Atonik	0,574202	0,319908

The other aims of this research is about the seedling development according to the soil mixture. The results are presented in table 4 for character „height increment", table 5 for character „root collar diameter increment", table 6 for character „root length increment" and table 7 for character „root diameter increment".

Analysis show higher value for the mean of the character „height increment" in experimental trial V_3 and V_4 for both biostimulators. Hight average values for the experimental trial V_3 and V_4 where obtain for the other studied characters too. We have to notice that the most appropiate value for the „mean" values were obtain for the character „root collar diameter increment". Also, we have to notice that the values for analysed root characters, „root leght increment" and „root diameter increment", are much more higher for the experimental trial V_3 and V_4. This probabaly because the seedlings initially strengthen their root system then activates height and diameter growth

There has been found high values of the coefficient of variation for all examined characters. This point out an accentuated variability which is characteristic for the increment of biometric characters of woody species [2]. The pronounced variability can be also explained by the relatively low number of seedlings for each experimental trials.

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Table 4

Statistical parameters for the character "height increment"

Biosti-mulator	The experimental trial	No.	Mean (cm)	Standard error of mean	Variances	Standard deviation	Coefficient of variation %
Radistim	V_1	15	1,39000	0,12967	0,23540	0,50221	36,13
	V_2	13	1,11692	0,13023	0,20353	0,46956	42,04
	V_3	21	1,60000	0,07171	0,10286	0,32863	20,54
	V_4	22	1,65500	0,09550	0,19152	0,44793	27,07
	Radistim-all group	71	1,48423	0,05559	0,21635	0,46844	31,44
Atonik	V_1	15	1,33400	0,12182	0,20777	0,47182	35,37
	V_2	11	1,64818	0,08471	0,07176	0,28096	17,05
	V_3	20	1,68000	0,08291	0,13060	0,37077	22,07
	V_4	21	1,77190	0,10884	0,23693	0,49877	28,15
	Atonik-all groups	67	1,62612	0,05481	0,19826	0,44862	25,66
All group		138	1,55312	0,03939	0,21259	0,46276	28.55

Table 5

Statistical parameters for the character "root collar diameter increment"

Biosti-mulator	The experimental trial	No.	Mean (cm)	Standard error of mean	Variances	Standard deviation	Coefficient of variation %
Radistim	V_1	15	0,11200	0,00932	0,00122	0,03610	32,23
	V_2	14	0,08786	0,00933	0,00113	0,03490	39,73
	V_3	20	0,12450	0,01297	0,00319	0,05799	46,58
	V_4	22	0,09500	0,00696	0,00102	0,03262	34,34
	Radistim-all group	71	0,10549	0,00521	0,00190	0,04391	38,22
Atonik	V_1	15	0,08067	0,00918	0,00118	0,03555	44,07
	V_2	11	0,09091	0,00756	0,00057	0,02508	27,59
	V_3	20	0,09850	0,00998	0,00189	0,04464	45,32
	V_4	20	0,06800	0,00468	0,00042	0,02093	30,77
	Atonik-all groups	66	0,08394	0,00432	0,00122	0,03512	36,94
All group		137	0,09511	0,00352	0,00169	0,04122	37.58

Table 6

Statistical parameters for the character "root lenght increment"

Biosti-mulator	The experimental trial	No.	Mean (cm)	Standard error of mean	Variances	Standard deviation	Coefficient of variation %
Radistim	V_1	15	0,07864	0,00611	0,00078	0,02867	36,46
	V_2	13	0,97533	0,07204	0,07265	0,27900	28,61
	V_3	21	0,95462	0,07643	0,07010	0,27558	28,87
	V_4	22	1,33810	0,13827	0,38236	0,63362	47,35
	Radistim-all group	71	1,34704	0,06964	0,33952	0,58683	32,59
Atonik	V_1	15	1,00800	0,04262	0,02543	0,16506	16,38
	V_2	11	1,13636	0,04106	0,01686	0,13618	11,98
	V_3	20	1,62000	0,09420	0,16860	0,42128	26,00
	V_4	20	1,89000	0,14177	0,38190	0,63403	33,55
	Atonik-all groups	66	1,48212	0,06823	0,30260	0,55430	21,98
All group		137	1,41212	0,04898	0,32629	0,57331	27.28

Table 7

Statistical parameters for the character "root diameter increment"

Biosti-mulator	The experimental trial	No.	Mean (cm)	Standard error of mean	Variances	Standard deviation	Coefficient of variation %
Radistim	V_1	15	0,83400	0,09978	0,13938	0,38645	46,34
	V_2	13	1,34615	0,08176	0,08021	0,29478	21,90
	V_3	21	1,67952	0,09576	0,18339	0,43881	26,13
	V_4	21	2,05190	0,13098	0,34309	0,60021	29,25
	Radistim-all group	70	1,54814	0,07622	0,40088	0,63772	30,90
Atonik	V_1	15	1,09667	0,10357	0,15018	0,40114	36,58
	V_2	7	1,35714	0,22505	0,30388	0,59542	43,87
	V_3	19	1,81211	0,09228	0,15329	0,40225	22,20
	V_4	21	2,30667	0,11178	0,24989	0,51223	22,21
	Atonik-all groups	62	1,75516	0,08387	0,42907	0,66038	31,21
All group		137	1,64538	1,64538	1,64538	1,64538	31.06

Table 8

Duncan's test for increment of analysed characters

Experimental trials	Analyses characthers			
	height increment	root collar diameter increment	root lenght increment	root diameter increment
	Marked differences are significant at p < ,05000			
R V_1 – R V_2	0,086769	0,111773	0,896038	**0,005049**
R V_1 – R V_3	0,163774	0,353237	**0,034776**	**0,000008**
R V_1 – R V_4	0,109659	0,236109	**0,000004**	**0,000004**
R V_2 – R V_3	**0,002484**	**0,014633**	**0,028775**	0,072683
R V_2 – R V_4	**0,000974**	0,621007	**0,000004**	**0,000451**
R V_3 – R V_4	0,734129	**0,043792**	**0,002169**	0,082573
A V_1 – A V_2	0,055902	0,477643	0,418136	0,180168
A V_1 – A V_3	**0,042747**	0,245503	**0,000225**	**0,000147**
A V_1 – A V_4	**0,009696**	0,346844	**0,000004**	**0,000004**
A V_2 – A V_3	0,844336	0,599208	**0,003238**	**0,013219**
A V_2 – A V_4	0,462660	0,121873	**0,000009**	**0,000004**
A V_3 – A V_4	0,542250	**0,045675**	0,107812	**0,006864**
R V_1 – A V_1	0,710400	**0,039639**	0,836767	0,121483
R V_1 – A V_2	0,105929	0,155617	0,341896	**0,005221**
R V_1 – A V_3	0,086938	0,316046	**0,000117**	**0,000004**
R V_1 – A V_4	**0,024079**	**0,003139**	**0,000004**	**0,000005**
R V_2 – A V_1	0,150034	0,593328	0,753860	0,172977
R V_2 – A V_2	**0,000983**	0,820703	0,302520	0,950196
R V_2 – A V_3	**0,000596**	0,479325	**0,000080**	**0,013628**
R V_2 – A V_4	**0,000056**	0,165195	**0,000005**	**0,000004**
R V_3 – A V_1	0,095500	**0,003270**	**0,047915**	**0,002066**
R V_3 – A V_2	0,749362	**0,023776**	0,203216	**0,066869**
R V_3 – A V_3	0,635824	0,067262	0,075381	0,451061
R V_3– A V_4	0,319294	**0,000104**	**0,000941**	**0,000692**
R V_4 – A V_1	0,056591	0,338991	**0,000005**	**0,000005**
R V_4 – A V_2	0,963943	0,761271	**0,000019**	**0,000472**
R V_4 – A V_3	0,868347	0,794930	0,163500	0,279697
R V_4– A V_4	0,469234	0,073564	0,756838	0,083575

It has been found highly significant differences for all anallysed characters. According to the results recorded the most significant results have been obtain especially for roort increment. Better results in terms of growth of stem and root biometric caracters seedlings were made for experimental variants V3 and V4. It should be noted that experiments will be continued taking into account the fact that the number of analyzed seedlings was not very high (some of the seedling were dry).

Conclusions

1.The 80% of rooting percentage by using Radistim and 71% by using Atonik are not significant difference.
2.The value of coefficient variation are high for all analysed characters. This show an accentuate variability for increment of biometric characters for woody species
3.Better results in terms of growth of stem and root biometric caracters seedlings were made for experimental variants V3 and V4

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