AGRONOMIE ŞI ECOLOGIE

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APPLICATION OF BLACK SEA SAPROPELLES TO IMPROVE THE ROOTING AND GROWTH OF "KAZANLIKA" OIL-BEARING ROSE CUTTINGS

N. NIKOLOV
Plovdiv Agriculture University, Bulgaria

Abstract. A fost realizat un studiu privind efectul aplicării de Sapropel din Marea Neagră asupra înrădăcinării şi creşterii medii a butaşilor de trandafir oleaginos "Kazanlika". Experimentul de doi ani a fost efectuat în sere de plastic neîncălzite în perioada octombrie-aprilie, pe baza a două varietăţi de substraturi, care conţineau sapropel. Rezultatele obţinute au arătat că la adăugarea cantităţii de sapropel de 30,0 g/kg, creşte procentul de butaşi înrădăcinaţi în ambele substraturi de la 5,0% la 15,0%, în comparaţie cu substraturile standard. În primul caz – substratul de turbă/perlit, îmbogăţit cu sapropel, creşterea medie este mai mare decât în substraturile standard şi variază între 3, 6-18, 8 cm.

Cuvinte cheie: Acid a-indolyl acetic, Butaşi, Înrădăcinare, Sapropel din Marea Neagră, Substrat de turbă/perlit, Trandafir oleaginos.

INTRODUCTION

Oil bearing rose "Kazanlika" is the most important oil crop in Bulgaria according to N.Nedkov, (2002). Bulgarian rose oil is world-famous. Besides rose oil, by processing rose petals, we can receive rose water, which is used in perfumery and food industry. Processed fruits and petals of Kazanlika rose are rich in vitamin C and also can be used successfully as animal feed. It is also well known that the implementation of rose planting presents anti erosion features in the area in which they are grown.

In order to produce the necessary quantity of rose oil, rose plantings should be periodically renewed and enlarged, fact which requires an increased production of seedlings. The main method of seedlings production is the rooting of rose cuttings in various substrates in glasshouse conditions. Rooting a rose from cuttings is an easy and comparatively inexpensive way to obtain new rose plants. There are known two technologies of seedlings production: rooting of green cuttings in peat/perlite substrate using water mist irrigation and rooting of ripe cuttings in periodically irrigated substrates. According to N.Nedkov et al, (2005) the first method is more effective, but requires more investments. Excessive substrate moisture is a prerequisite for the development of harmful microflora, which requires reliable plant protection. As for the second technology, the production costs are reduced, but the percentage of rooted cuttings is lower in comparison to the first method.

Recently, the Black Sea Sapropelles are an object of special research, because of their rich organic-mineral composition and possibilities of being used in different aspects of agriculture (P.Dimitrov et al, 1988). An important reason to continue the investigations is the favourable macro and micro elements composition of sapropelles. It was established that they improve the agro-technical properties of soils. (P.Dimitrov et al., 1999). Sapropelles protect the seeds against certain pathogens causing diseases of wheat as *Ustilagonudaf.sp.tritici* and *f.sp.hordei.* (G.Georgiev, 2005) There were created agro-technologies to stimulate plants growth by using sapropelles, certain essential oils and plant extracts (P.Dimitrov et al, 2006).

The aim of present work was to improve the rooting technology of "Kazanlika" oil-bearing rose, using ripe cuttings and introducing Black Sea Sapropelles in the substrate composition.

MATERIAL AND METHODS

1. Elemental analysis. A sample of Sapropelles taken from a depth of 1200 m was analyzed for its content of K, P, Si, Ti, Al, Ca, Na, Fe, Mn, Mg, Cr, Mo, Cu, as well as the heavy metals Pb, Zn, Ni in the form of oxides. An inductively coupled emission spectrometry (Jobni Yvon Emission JY 38 S, France) was used. The quantitative measuring was carried out with the help of apparatus ICP.

2. Rooting of ripe rose cuttings. A study was made in the experimental field of Plovdiv Agriculture University. The two year experiment was carried out in unheated plastic greenhouse. At the 15th of October, in beds with a breadth of 80 cm, 320 fresh cuttings of "Kazanlika" oil-bearing rose, taken in the area of Rakovsli village, Plovdiv district, were set for rooting. The experiment was carried out in four substrates, and two of them were enriched with sapropelles: Variant I, representing perlite + 30,0 g/kg of sapropelles and Variant II, peat/perlite substrate in 1:1 correlation + 30,0 g/kg of sapropelles. For comparison there were used two standard substrates: Standard I - balcanin-zeolite substrate and Standard II - mineral mixture for tomatoes. The number of the examined cuttings, for each variant, was 80. All variants include four replications (4 x 20 cuttings). During the rooting period there were made all necessary agro-technical activities. At the end of February, plant nutrition with nitrogen fertilizer was made, using a dose of 3 g of ammonium nitrate per one cutting. The beds were irrigated regularly with water.

3. Biometrical indicators. After seven months (October-April), before the planting of rooted cuttings at a permanent place, at the beginning of April, for both investigated years, in each experimental variant, the biometric indicators, percentage of rooted rose cuttings and their growth (cm) were determined.

4. Determination of humus content. The humus content determination of a Black Sea sapropelles sample, taken from a depth of 1200 m was determined by the method of Turin (K.Trendafilov et al.,2007).

5. Statistical data processing. For statistical processing of obtained results we used the program "BIOSTAT".

RESULTS AND DISCUSSIONS

The results from the elemental analysis of sapropelles are shown in the Tables 1 and 2. The content of macro and microelements was established and calculated as oxides.

Table 1

Chemical composition. Content of humus and microelements

Sample oxides	Cr g/t	Mo g/t	Zn g/t	Mn g/t	Pb g/t	Cu g/t	Ni g/t	Humus g/kg
Sapropelles	50.00	36.40	65.82	383.42	28.22	36.63	49.75	68,6

Table 2

Chemical composition. Content of macro- and microelements

Sample Oxides	SiO_2 g/kg	TiO_2 g/kg	Al_2O_3 g/kg	FeO g/kg	MпO g/kg	MgO g/kg	CaO g/kg	Na_2O g/kg	K_2O g/kg	Loss by 1273 K, g/kg
Sapro-pelles	397,6	7,0	116,9	45,7	0,4	26,8	154,6	21,3	1.83	199,7

The data show that for some important microelements for crops vegetation, such as Ńr, Mo, Mn, their content in sapropelles exceeds many times the same content in soils. The content of CaO is 154,6 g/kg, which is over the limits in comparison to most soil types. Sapropelles contain K_2O – 1,83 g/kg, MgO – 26,8 g/kg and some other elements which turn them into a natural micro and macro fertilizer. The loss by heating at 1273 K, (table 2) was of 199, 7 g/kg, because of organic matter and carbonates. Humus content is an important factor for soil fertility, because it improves nitrogen assimilation from plants. (5) The used sample of sapropelles contains 68,6 g/kg of humus (table1). The content of heavy metals Zn, Ni, Pb is in admissible limits. The obtained data determine the Black Sea sapropelles as a complex organic-mineral fertilizer.

The influence of sapropelles on the rooting of oil-bearing rose cuttings was established. Two variants of substrates, containing sapropelles were investigated. In the first Variant, representing perlite, enriched by 30,0 g/kg of sapropelles, the average percentage of rooted cuttings for the four replications was as follows: 1 – 95,0%, 2 – 90,0%, 3 – 85,0% and 4 – 90,0%. The average value was of 90,0% which is with 5,0-10,0% more than in the standard substrates (figure 1)

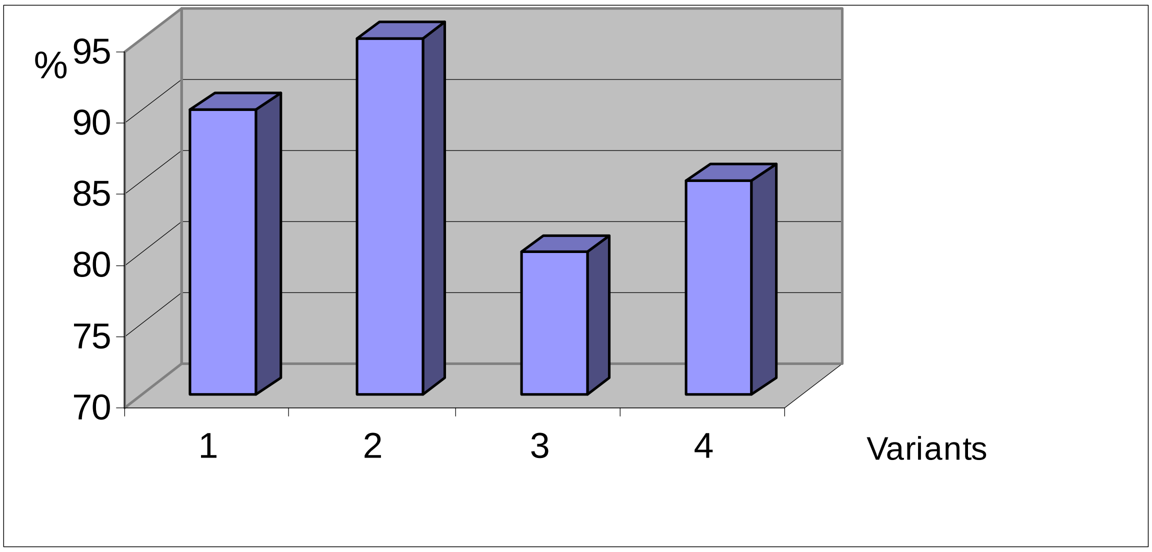

Figure 1. Percentage of rooted cuttings in the 4 variants:
1.Variant I, 2. Variant II, 3. Standard I, 4. Standard II

The average growth was low - 6,04 cm, because of lower nutrient ability of this substrate in comparison to the others. In the second tested substrate containing peat/perlite in correlation 1:1 and enriched with 30,0 g/kg of sapropelles, the average value of rooted cuttings was 95,0%, which is 10,0-15,0% more than in the standard substrates (figure 1)

The average growth of rose plants in the variant II was 21,76 cm, which is 3,58 cm more than in the mineral mixture for tomatoes and 11 cm more than in the balcanin - zeolite substrate (table 3).

Table 3

Average growth of oil-bearing rose cuttings during the two year experiment in nutrient substrates enriched with sapropelles and in standard substrates

№	Variants	Replications	Number of cuttings	Composition of substrates	Average growth of rose cuttings, cm	% compared to Standard I
1	I	1	20	perlite + 30,0 g/kg sapropelles	6,4	57,0
2		2	20		5,9	
3		3	20		6,2	
4		4	20		5,9	
5	Average value				**6,1**	
1	II	1	20	Peat/perlite 1:1 +30,0 g/kg sapropelles	22,1	202,0
2		2	20		20,9	
3		3	20		21,6	
4		4	20		22,6	
5	Average value				**21,8**	
1	Standard I	1	20	Balcanin-zeolite substrate	10,3	100,0
2		2	20		11	
3		3	20		10,7	
4		4	20		11,2	
5				Average value	**10,8**	
1	Standard II	1	20	Mineral mixture for tomatoes	16,7	169,0
2		2	20		18,6	
3		3	20		18,4	
4		4	20		19,1	
5	Average value				**18,2**	
	GD 5,0 %				9,6	

Statistically proven differences were observed according to cuttings growth in the Variant II (peat/ perlite substrate + 30,0g/kg of sapropelles). Unproven was the impact on the rose growth in the Variant I (perlite +30,0g/kg of sapropelles), which was because of the substrate poor in nutrients (table 3).

Grow regulator **a** -IAA (**a**-indole acetic acid) is one of the most important auxins (plant hormones) used for improving the rhizogenesis of plant cuttings. It was applied in all tested variants of rooting. The obtained experimental results showed that the established effect on rooting by using sapropelles cannot be clearly explained only with the impact of **a** -IAA and other substances in the composition of preparation "Rhizostim-N". The dominating influence upon the increased number of rooted cuttings was probably due most of all to the rich content of macro, micro elements and organic substances in sapropelles composition. (Tables 1 and 2). According to E. Sidorovich et al. (1987), the trace elements take an active part in a number of important physiological and biological processes in plants, including rhizogenesis and those related to the growth of plants.

CONCLUSIONS

Being introduced in the peat/perlite substrate, in an amount of 30,0 g/kg, the sapropelles increase the rooting of rose cuttings by 10-15% and their average growth from 3,6% to 11,0%, compared to the standard substrates. Data analysis showed that sapropelles can be used as substrate amendment for the production of ripe rose cuttings.

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