measure profitability (14,11%) is in comparison with an adequate registration of arrangements soil variant in the neighbourhood level. Variant nourishment profitability V1 is 64,92%, V2 61,19 and V3 50,81 %. The Average altitude of the

variable costs, according to variants nourishment following: V1 14925,33, V2 14708,00 and V3 12383,33 67 Sk. ha^{-1}, the economic correspond income with : V1 16004,72, V2 14951,90 and V3 11226,97 Sk. ha^{-1}. Distinctions income intervene between individual nourishment variantsare as following: CA-RA 1052,82 Sk. ha^{-1}, CA-NT 4777,75 and RA-NT 3724,93 Sk. ha^{-1}.
The variational span of expense measure profitability (29,25%) trots in he expressive distinction of profitability, according to the fertilisation variant and also arrangements soil in comparison with the effect of individual inputs. Relations between the costs of attained harvest according the differentiated intensity make orientation possible primer by searching for the optimal production grades.

Table 2 Economical analysis of alfalfa cropping at different tillage and nutrition intensity level (1998-2000)

Tillage variant	CA			RA			*NT*		
Nutrition variant	V1	V2	V3	V1	V2	V3	V1	V2	V3
Yield per hectare (tone)	45,41	43,79	37,01	43,83	42,80	36,20	38,98	37,62	31,88
Costing formula entriens	Sk/ha								
Fertilizers	1982,00	1810,00	0,00	1982,00	1810,00	0,00	1982,00	1810,00	0,00
Pesticides	900,00	900,00	900,00	900,00	900,00	900,00	2100,00	2100,00	2100,00
Fuels	4416,00	4378,00	4224,00	4128,00	4094,00	3936,00	3136,00	3072,00	3040,00
Machine work	8450,00	8450,00	7950,00	7850,00	7850,00	7350,00	6950,00	6950,00	6750,00
Variable costs	15748,00	15538,00	13074,00	14860,00	14654,00	12186,00	14168,00	13932,00	11890,00
Fixed costs	9672,00	9672,00	9672,00	9672,00	9672,00	9672,00	9672,00	9672,00	9672,00
Total costs (TC)	25420,00	25210,00	22746,00	24532,00	24326,00	21858,00	23840,00	23604,00	21562,00
TC of secondary product	2178,00	2178,00	2178,00	2178,00	2178,00	2178,00	2178,00	2178,00	2178,00
TC of main product	23242,00	23032,00	20568,00	22354,00	22148,00	19680,00	21662,00	21426,00	19384,00
Yield per hectare (tone)	45,41	43,79	37,01	43,83	42,80	36,20	38,98	37,62	31,88
TC per tonne	511,81	526,02	555,68	510,02	517,43	543,59	555,78	569,58	607,95
Realization price (Sk / t)	950,00	950,00	950,00	950,00	950,00	950,00	950,00	950,00	950,00
Income	43140,45	41595,75	35163,30	41638,50	40663,80	34393,80	37027,20	35736,15	30289,80
Profit per ha	17720,45	16385,75	12417,30	17106,50	16337,80	12535,80	13187,20	12132,15	8727,80
Profit per tonne	390,22	374,23	335,48	390,29	381,69	346,25	338,34	322,52	273,74
Zero rentability yield	26,76	26,54	23,94	25,82	25,61	23,01	25,09	24,85	22,70
Cost rentability level (%)	69,71	65,00	54,59	69,73	67,16	57,35	55,32	51,40	40,48

MICROPROPAGATION OF *PAEONIA ARBOREA* DONN., SYN. P. *SUFFRUTICOSA* ANDR.

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Summary

Woody peony belongs to the ornamental species with problematic propagation therefore micropropagation in "*in vitro*" conditions should be one of the suitable methods to overcome this problem. In this study, the effect of growth regulators for inducing the axillary buds of woody peony cv. Comtesse de Tuder in culture medium is described. On Murashige & Skoog

(1962) medium supplemented with 1.0 mg.l^{-1} BAP and 0.2 mg.l^{-1} NAA the multiplication coefficient reached the maximum value 4.7 per explant. The BAP concentration significantly increased the number of axillary shoots and the NAA concentration significantly increased in length. The higher concentration of NAA increased the number of vitrified axillary peony shoots in "*in vitro"* culture.

Key words: woody peony, growth regulators, axillary shoots, coefficient of multiplication

Introduction

Many factors e.g. the physiological status of the mother plants, the cutting positions and growth regulators used are limiting for the peonies propagation. Peonies micropropagation described Youlong (1984) and Constantine (1986). Kamenická and Valka (1997) published three possibilities of peonies propagation by using following methods: 1. Generative (the seed dormancy; stratification; the plants from the seeds blossom are later than from vegetative propagation). 2. Vegetative (the mother plant cultures; cuttings taken; limited amount of rare and menaced species; the growth regulator applications). 3. Tissue cultures (the fast clone propagation; the high multiplication coefficient; continuous propagation during the whole year; cultivation of the healthy regenerants; the long term of the storage at the low temperatures). Woody peonies belong to the ornamental shrub plants propagated mostly by the cuttings but this is less effective in the large-scale production. From this point of view using the plant tissue cultures seems to be perspective one.
The objective of our experiments was to study the influence of BAP (6-benzylaminopurine) and NAA (a-naphtaleneacetic acid) in different concentrations and combinations. The number and length of the axillary shoots, formation of the vitrified shoots and the multiplication coefficient of cuttings from 5 years old woody peony cv. Comtesse de Tuder propagated in " *in vitro"* conditions were tested.

Material and methods

Internodal stem segments from 5 years old woody peony cv. Comtesse de Tuder were used during the spring 1996 and 1997 for the axillary shoots induction. The stem segments were sterilised by autoclaving (PS 20-A) 30 minutes at 120 ^{o}C, all laboratory items were sterilised by hot air, 70 % alcohol or using UV lamp. As a control modified Murashige & Skoog (MS) medium was used (MS + 7 g.l-1 agar + 0.5 mg.l-1 nicotine acid + 0.1 mg.l-1 thiamine + 0.5 mg.l-1 pyridoxine + 2 mg.l-1 glycine + 100 mg.l-1 myo-inositol and 30 g.l-1 sucrose). Further experiments were carried by adding 0.5, 1.0 and 2.0 mg.l-1of BAP or by adding 0.1, 0.2 and 0.5 mg.l-1 of NAA, each in the combination with 1.0 mg.l-1 BAP. pH of all media used was adjusted to pH 5.6 -5.8 before autoclaving. Peony stem segments were placed in a large test tubes/ glass jars and cultured in a growth chamber with a photoperiod of 16 h (100 μEm^{-2} s^{-1}) white fluorescent light at 22 ^{0}C. After 5 weeks of cultivation the number of axillary shoots and their length, the number of vitrified shoots and the multiplication coefficients were evaluated, as well as. The obtained experimental data were statistically analysed using the general method of ANOVA (SPSS for Windows, vers. 6.0).

Results

On MS medium without growth regulators usually was formed one axillary shoot with an average length 13.04 mm. The number of axillary shoots increased up to 4.25 (per stem segment) by increasing BAP concentration to 1.0 mg.l-1 but when BAP concentration 2.0 mg.l-1 was used number of the axillary shoots decreased to 3.75 (see Table 1.).
Analysis of variance validated the high significance of differences in the number of shoots between the treatments (see Table 2.). Analysis of variance validated high significance of differences in number of shoots between treatments – table 2. Influence of BAP on the lengths of the axillary shoots became negative, but statistically not significant. Analysis of variance validated also high significance of differences in % of the vitrified axillary shoots. The most of vitrified shoots (61.79 %) was found at the concentration 2.0 mg.l^{-1} BAP, i.e. 528.57 % in comparison with the control MS medium. The highest efficiency of the axillary shoots 34.00 (an average length in

Table 1 Ifluence of BAP Concentration on Multiplication of *P. suffruticosa* cv. Comtesse de Tuder

mg.l^{-1} of BAP	Number of Shoots (pieces)	% to Control	Length of Shoots (mm)	% to Control	Vitrifica-tion (%)	% to Control	Efficiency (pieces x Ø length)	% to Control
0.0	1.00	100.00	13.04	100.00	11.69	100.00	13.04	100.00
0.5	2.75	275.00	10.14	77.76	10.02	85.71	27.89	213.88
1.0	4.25	425.00	8.00	61.35	15.03	128.57	34.00	260.74
2.0	3.75	375.00	7.80	59.82	61.79	528.57	29.25	224.31

Table 2 Analysis of Variance of BAP Effect on the Axillary Sshoot Numbers

Source	Sx^2	N	V	F
Cultivation medium	159.0000	3	32.4375	25.6700**
Repetition	3.1875	3	1.0625	0.2920
Residual	29.3750	9		
Total	191.5625	15		

*** = high significance $F_{0.05} = 3.9$ $F_{0.01} = 7.0$

mm multiplied by number of shoots) was found at the concentration 1.0 mg.l^{-1} BAP that was 160.74 % higher than control treatment. Table 3. shows results from the follow-up experiment in which the best treatment from the first experiment (MS+1.0 mg.l-1BAP) was used as control. The highest number of axillary shoots 4.75 was found at the concentration 0.2 mg.l^{-1} of NAA. In comparison with the control experiment (MS+BAP) these results mean increase by 18.75 % but in comparison with control from the first experiment (MS) by 375 %. However, statistically high significant differences were found between the lengths of axillary shoots (Table 4.).

Table 3 The Influence of NAA Concentration on the Multiplication of *P. suffruticosa* cv.Comtesse de Tuder

mg.l^{-1} of NAA	Number of Shoots (pieces)	% to Control	Length of Shoots (mm)	% to Control	Vitrifica-tion (%)	% to Control	Efficiency (pieces x Ø length)	% to Control
0.0	4.00	100.00	8.20	100.00	18.37	100.00	32.80	100.00
0.1	4.00	100.00	10.92	133.17	15.03	81.82	43.68	133.17
0.2	4.75	118.75	12.47	152.07	16.07	87.48	59.23	180.58
0.5	3.75	93.75	7.90	96.34	50.01	272.24	29.63	90.34

Table 4 Analysis of Variance of NAA Effect on Axillary Shoots Length

Source	Sx^2	N	V	F
Cultivation medium	1620.5384	3	61.0783	88.0345**
Repetition	0.9683	3	0.3228	1.4664
Residual	1.9810	9		
Total	1623.4876	15		

** high significance
F 0.05 = 3.9
F 0.01 = 7.0

The longest axillary shoots (12.47 mm) were obtained on MS-medium supplemented with 0.2 mg.l^{-1} NAA, that means they were longer by 52.07 % in the comparison with the control shoots. The concentration of 0.5 mg.l-1 NAA had negative effect on the length of the axillary shoots. Vitrification reached 272.24 % in comparison with the control after 5 weeks in culture. With increased NAA concentration (up to 0.2 mg.l^{-1}) the efficiency of the axillary shoots induction increased as well. In comparison with the control treatment (MS+BAP) it was higher by 80.58 % and with the other one (MS-hormone free medium) even higher by 354.22 %.

Discussion

The concentration of 1.0 mg.l^{-1} BAP in MS medium can be recommended for the induction of the axillary shoots for *P. suffruticosa* in "*in vitro*" conditions. The low BAP concentrations for multiplication of *P. suffruticosa* were used also by Bouza et al. (1993) and Harris & Mantell (1991). In our experiments where BAP was applied induction of the adventive buds were occurred on the basipetal side of the internodal peony stem segments. These basipetal stem segments became swollen and here calli was produced. Later adventive buds there regenerated in this area of the explants. The similar way of the regeneration published Yulong et al. (1984), Harris & Mantell (1991) and Bouza et al. (1993) after application cytokinins to the culture medium for *P. suffruticosa.* Krejcí & Franc (1997) and Franc (1998) recommend for more woody species to add auxins in the low concentrations to the medium. In our experiments an increased apical dominance effect occurred at the

presence of NAA in medium and it manifested by axillary shoots longer by 52.07 % in comparison with MS+BAP medium. In our experiments the higher number of the vitrified explants was recorded at higher BAP and NAA concentrations. Harris & Mantell (1991) and Buchheim & Meyer (1992) discussed this problem, too. Kyte & Kleyn (1996) recommended to decrease the content of cytokinins and to increase the content of agar in the culture medium at the first appearance of the vitrification fenomena. Franc (1996) published that the multiplication coefficient has to be higher than 2.0 in orders to secure commercial utilisation of the multiplication method. Constantine (1986) reached the multiplication coefficient 2.5 - 3.5 in 4 weeks production cycle. In our experiments the multiplication coefficient of peony axillary shoots was 4.25 on MS medium supplemented with 1.0 $mg.l^{-1}$ BAP and 4.75 on medium supplemented with 1.0 $mg.l^{-1}$ BAP + 0.2 $mg.l^{-1}$ NAA after 5 weeks in culture.

References

Bouza , L. et al. : In: Plant Cell Rep. 12:593-596, 1993; Buchheim, J.A.T.-Meyer, M.M.: In: Bajaj, Y. P. S. (ed.) Biotechnology in Agriculture and forestry, Vol.20:269-285, Springer Verlag, 1992 ; Constantine, D.R.: In: Withers, A.L.-Anderson, P.G. (ed): Plant tissue culture and its agricultural applications.London: Butterworts, 1986, p. 175-186; Franc, P.: In: Zahradnictví, roc. 21, c. 3, 1996, s. 16-18; Franc, P.: In: Zahradnictví-Hort.Sci., roc. 25, 1998, s. 41-46; HarrisR.A.-Mantell, S.H.: In: Journal of Horticultural Science, Vol. 66, No 1, 1991, pp. 95-102; Kamenická, A.-Valka, J. Cultivation and Propagation of Magnolias. Zvolen: Technical University Publishers, 1997. 99p, ISBN 80-967238; Krejcí, P.-Franc, P.: In: Zahradnictví-Hort.Sci., roc. 24, 1994, c. 4, s. 133-137; Kyte, L.-Kleyn, J.: Plants from test tubes: an introduction to micropropagation. 3rd ed. Portland: Timber Press, 1996. 240 p. ISBN 0-88192-361-3; Murashige, T.-Skoog, F.: Physiologia Plantarum, 1962, 15, 473-479; Youlong, L. et al.: *In vitro* propagation of *Paeonia suffruticosa*. Kexue Tongbao, 29, 1984, pp. 1675-1986

THE APPLICATION OF THE INTER -GENERIC HYBRIDS AT AGROECOLOGICAL CONDITIONS OF THE EAST – SLOVAKIAN LOWLAND

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Summary

Productive parameters of the inter-generic hybrids of grasses in the monocultures and clover –grasses mixtures were investigated. The field trial with the grasses monocultures and clover-grass mixtures was carried out on the experimental basis of Research Institute of Agroecology Michalovce at Milhostov. Over the three crop years evaluation of the total dry matter production was confirmed, that the clover-grass mixtures were the most productive. Perspective inter-generic hybrids, marked "HŽ 7DK", was the most productive before the inter-generic hybrids marked "PERUN". So the inter-generic hybrids were confirmed the convenience of it's ones growing at the conditions of the East-Slovakian Lowland.
***Key words*:** inter-generic hybrids, monocultures, clover-grass mixtures, dry matter production, the East-Slovakian Lowland

Introduction

An intensification of the fodder crop production presents a measure at raising of plant production and connected animal production, also. The East-Slovakian Lowland has favourable assumes to effective fodder crops production in monocultures, as well as in mixtures. Apart from generally growing clovers and grasses, the inter-generic hybrids can be taken to reflections, too. According to Knotek et al. (1996), from the fodder point of view, the inter-generic hybrids mean the quality overturn, because they are sufficient productive, they have higher sugar contents and they are good ensilaged. At Nitra region, Volosin et al. (1997) reached upon inter-generic hybrid "FELINA" and HYKOR higher yield like were upon the productive grass – fescue (*Festuca arundinacea Schreb.*) and dew-grass (*Dactylis glomerata L.*). Krajčovič, Knotek et al. (1995) suggest to use inter-generic hybrids to clover grass mixtures at the individual regions of Slovakia. According to Gejguš (1997), Gejguš and Kováč (1998) inter-generic hybrids found out their application at regions of the East-Slovakian Lowland.

Material and methods

Over the years 1997 – 1999, the field trial with the grasses monocultures and clover-grass mixtures was carried out on the experimental basis of Research Institute of Agroecology Michalovce at Milhostov, on Efluvi-Eutric Gleysol with high clay particles content. Average composition of arable layer is following: contents of available phosphorus 60 $mg.kg^{-1}$, contents of available potassium 160 $mg.kg^{-1}$, contents of available magnesium 230 $mg.kg^{-1}$, humus contents 2,9 %, pH $_{(KCL)}$ 7. Average year temperature is 8,9 °C and average year total precipitation is 559 mm at Milhostov.
Table 1 shows twelve variants of grass monocultures and clover-grass mixtures integrated in the field trial. Before seeding mineral fertilizers were applied at the doses N- 30 $kg.ha^{-1}$ p.n., P- 30 $kg.ha^{-1}$ p.n. and K- 80 $kg.ha^{-1}$ p.n.. Nitrogen was applied