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MICROPROPAGATION OF SWEET POTATO (*Ipomoea batatas* (L.) Lam.) FROM NODE EXPLANTS

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Abstract. In the moderate climate, sweet potato plantations are relatively scarce. The plantations are established after spring frosts using well-rooted, hardened cuttings. The cuttings are obtained from the shoots grown from tubers buried in warm, humid soil or from plants growing in greenhouses. However, this method is inefficient with respect to larger plantation. The aim of the study was to estimate the potential for the production of larger numbers of uniform, well-rooted sweet potato plants by means of *in vitro* culturing. The study covered two cultivars – 'Carmen Rubin' and 'White Triumph'. The node explants were placed on two growth media containing the basic components of the MS medium as well as growth regulators. The first medium was supplemented with 1 mg dm^{-3} gibberellin and 0.1 mg dm^{-3} kinetin, while the second one – with 0.5 mg dm^{-3} IAA. The induction of organogenesis and regeneration of the plants took place on the same medium, with no passage. Within 9 weeks, 4 plants were produced from each primary explants in two multiplication cycles. The properties of the plantlets depended on the cultivar, weight of the explants and composition of the medium. The average weight of the 'Carmen Rubin' plants was higher than that of the 'White Triumph' ones. Moreover, the 'Carmen Rubin' plants produced longer shoots and more developed root systems. The sweet potato micro-plants displayed an ability to acclimatize quickly.

Key words: *in vitro* propagation type of medium, properties of plantlets

INTRODUCTION

Sweet potato is one of the earliest known vegetables. In Central America and the tropical areas of South America it was consumed by humans already in the prehistoric times. Today, it is grown in over one hundred countries in the tropical, sub-tropical and moderate climate. The total annual production of sweet potato is 106–110 million tons with the plantation area of approx. 8.1 million hectares [FAO 2008, 2011]. It is a staple food for many people in South-East Asia, Africa and Latin America. The edible parts of

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the plant are root tubers, leaves and young shoots. Sweet potato is regarded as good for human health because of its beneficial protein composition as well as high content of minerals, vitamins and antioxidants [Islam 2006, USDA 2007, Tumwegamire et al. 2011]. The industrial use of sweet potato tubers includes starch extraction and the production of alcohol, acetic acid and yeast [González et al. 1999, Zuraida 2003].

The best yield is achieved in warm, humid tropical zone areas. Favourable conditions for the growing of sweet potato are also found in many higher-latitude regions (up to approx. 40°N and 40°S). In favourable conditions, the plantations are often established from tubers and unrooted cuttings [He-Bin et al.1997, Katayama et al. 1999]. In the moderate climate, sweet potato plantations are relatively scarce. According to numerous authors, areas suitable for sweet potato growing are characterised by a minimum of 4 months free of ground frost and 3 months with temperatures exceeding 15°C. The plantations are established after spring frosts, using well-rooted, hardened cuttings. Traditionally, cuttings are obtained from the shoots grown from tubers buried in warm, humid soil (25–28°C) or from plants grown in greenhouses [Ching 2000, Novac et al. 2007]. However, this method is inefficient with respect to larger plantations. A solution which makes it possible to produce larger numbers of uniform, healthy plants is *in vitro* culture. Sweet potato can be propagated by stimulating the development of apical and axillary buds, by means of adventitious buds and by somatic embryogenesis [Gosukonda et al. 1995, González et al. 1999, Mukherjee 2002]. The techniques which are best suited for the production of plants for commercial plantations are these which use explants with buds. When such techniques are used, the shoots develop from meristems and somaclonal variation is rare [Larkin and Scowcroft 1981].

An increased interest in sweet potato has been recently observed in Poland. Sweet potato dishes are served in some restaurants in larger cities, while tubers are sometimes available in supermarkets. According to FAO Statistical Yearbook [FAO, 2011], 842 tons of tubers were imported into Poland in 2009. It was proved in field tests that sweet potato can be grown in Poland and its production can be economically viable [Krochmal-Marczak and Sawicka 2009, Krochmal-Marczak et al. 2010].

The aim of our study was to investigate the potential for the production of larger numbers of uniform, well-rooted sweet potato plants by means of *in vitro* culturing using node explants.

MATERIAL AND METHOD

Single tubers of two sweet potato cultivars (‘Carmen Rubin’ and ‘White Triumph’) were obtained from the Department of Specific Plant Cultivation, University of Life Sciences in Lublin. Two micropropagation cycles were carried out and two types of medium were used in each cycle. Both of them contained the basic components of the MS medium [Murashige and Skoog 1962], the difference being the content of growth regulators. The first medium was supplemented with 1 mg dm^{-3} gibberellin (GA_3) and 0.1 mg dm^{-3} kinetin (KIN), while the second one – with 0.5 mg dm^{-3} of indole-3-acetic acid (IAA).

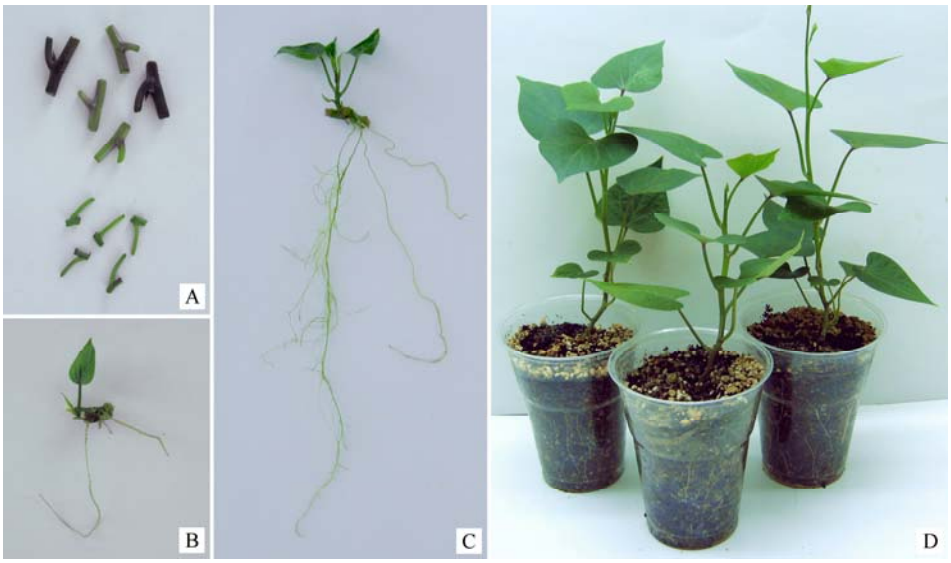

Fig. 1. Micropropagation of sweet potato: A – node eksplants (primary end secondary), B – young plant after 2 wk. culture, C – plant before hardening, D – well-rooted, hardened sweet potato cuttings.

At the beginning of the micropropagation process, explants were extracted from the plants grown in a greenhouse. They were 1–1.5 cm long and consisted of a stem node with an axillary bud, fragments of internodes, and a fragment of petiole (fig. 1A). The explants were disinfected in 0.1% $HgCl_2$ solution for 7 minutes, rinsed in sterile water and inserted in fours into 0.4 dm^3 jars with agar-solidified medium. Each experimental set consisted of 20 jars. The jars were placed in a growth chamber with a temperature of 25°C, photoperiod of 16/8 h, and white light with an intensity of 25–30 µmol m^{-2} s^{-1}. After 4 weeks, for each experimental set alive explants were calculated, plants with one shot and this ones produced two shots. Later on, 40 plants from each set were examined to determine the following features: weight and length of the shoot, number of internodes, and number and weight of the roots. The remaining plants served as a source of explants for the subculture. Those explants were much smaller than the primary; the stem fragments were 2–3 mm long, while the petioles – approx. 1 cm long (fig. 1). Because the induction of organogenesis in the subculture was delayed, the period of plant regeneration was extended to 5 weeks. Then, were counted every living explants, sweet potato plants and alive explants without shoots. 40 plants from each set were examined to measure the same parameters as in the first culture. Forty plants were planted into 0.33 dm^3 cylindrical plastic pots filled with a not-sterile mixture of horticultural soil and sand (3:1) and subjected to hardening. The pots were covered with plastic covers and placed in a greenhouse, where they were exposed to natural light and temperature fluctuations. The covers were removed after two weeks. The plants were kept in an unheated glasshouse for 4 weeks and then planted in the open field. Some of the plants

(12 from each set) were left in jars and kept in a growth chamber. After 7 weeks from the establishment of the culture, the length of their shoots was measured and the internodes were counted.

The results were subjected to statistical analysis according to the completely randomised 2 × 2 factorial experiment design. The significance of differences between the mean values of individual parameters was determined using the Tukey's test.

RESULTS AND DISCUSION

In our research, the induction of organogenesis and the regeneration of the sweet potato plants took place on the same medium, with no passage. The primary explants of 'Carmen Rubin' began to develop organs after 4 days, while the 'White Triumph' ones – about 3 days later. In most cases, shoots and roots developed simultaneously. Within four weeks, all the primary explants grew into plants consisting of one or two shoots, the explant and roots (fig. 1C). It was observed that numerous explants of both cultivars began to develop a number of shoots, but only one of these shoots achieved a larger (normal) size, while the rest usually remained in the form of buds – structures smaller than 0.5 cm, and some reached a length of 2–3 cm. The percentage of plants with 2 shoots depended on the cultivar and the composition of the medium (tab. 1). On the medium contained kinetin and gibberellin, 2 shoots were developed by 13.3% of 'Carmen Rubin' plants and 15.7% of 'White Triumph' plants, while on the medium with auxin – by 16.7% of 'Carmen Rubin' plants and 55.5% of 'White Triumph' plants. Plants produced three or more shoots were not observed. The average weight of 'Carmen Rubin' plants was significantly larger than that of the 'White Triumph' ones (tab. 1). The weight of the plants regenerated on the medium containing 0.1 mg dm^{-3} KIN and 1 mg dm^{-3} GA_3 was larger than that of these regenerated on the medium with 0.5 mg dm^{-3} IAA. The explants retained the green colour, while some of them produced small amounts of dense green callus (about 7%). There were no significant differences in the weight of explants between the two cultivars. The dominant shoots of 'Carmen Rubin' were characterized by longer stems, while the number of nodes was similar in both cultivars. The root systems usually consisted of one long root and several shorter ones. Two roots of similar length or a single long root were observed very rarely. On average, 'Carmen Rubin' plants had more roots than the 'White Triumph' ones. There was no difference in the length of the dominant root between the two cultivars. The plants grown on the cytokinin and gibberellin medium had more roots and longer stems than these regenerated on the auxin medium. The hormonal composition of the media had no effect on the number of nodes (tab. 1).

The number of explants obtained from sterile plants was similar to the number of nodes (tab. 1). The secondary explants were much smaller then the primary ones (fig. 1A). The average weights of secondary and primary explants depended on the cultivars ('Carmen Rubin': 22,5 and 153.1 mg, 'White Triumph': 21,2 and 146.5 mg, respectively).

In the second experiment, the onset of the development of shoots and roots (5% explants) was observed after 10 days in the 'Carmen Rubin' plants and 4 days later

Table 1. Characteristic of plants regenerated from primary explants

Feature	Medium	Cultivar		Means	$LSD_{0.05}$
		'Carmen Rubin'	'White Triumph'		
Living explants number	A	75	70	72.5	–
	B	72	72	72	–
	means	73.5	71	72.25	–
% plants with two shoots	A	13.33	15.71	14.52	–
	B	16.67	55.55	36.11	–
	means	15.00	35.63	25.31	–
Plant weight (mg)	A	611.3	510.9	561.1	44.1 *
	B	430.5	331.2	380.8	44.1 **
	means	520.9	421.1	470.9	62.3 ***
Shoot weight (mg)	A	211.4	162.2	186.8	19.7 *
	B	161.2	88.6	124.9	19.7 **
	means	186.3	125.4	155.8	27.8 ***
Roots weight (mg)	A	208.3	176.0	192.2	17.6 *
	B	93.9	54.3	74.1	17.6 **
	means	151.1	115.1	133.1	24.9 ***
Explant weight (mg)	A	191.7	172.6	182.2	ns *
	B	175.3	188.3	181.8	ns **
	means	183.5	180.4	182.0	ns ***
Stem length (cm)	A	1.65	1.26	1.45	0.14 *
	B	0.99	0.93	0.96	0.14 **
	means	1.32	1.09	1.21	0.20 ***
Nodes number	A	4.12	4.40	4.26	ns *
	B	4.35	3.70	4.02	ns **
	means	4.24	4.05	4.14	0.62 ***
Roots number	A	5.85	4.62	5.23	0.58 *
	B	1.65	1.37	1.51	0.58 **
	means	3.75	3.00	3.37	0.82 ***
Root length (cm)	A	22.6	22.1	22.4	ns *
	B	18.1	15.8	17.0	2.4 **
	means	20.3	18.9	19.7	3.4 ***

A – medium with KIN and GA_3, B – medium with IAA, ns – non significant difference, * – LSD for cultivars, ** – LSD for medium, *** – LSD for interaction cultivar × medium

in the 'White Triumph' ones. This was caused by a rather intense production of callus, which was evidenced by comparing the weight of the explants used for the culturing and the weight of the explants with callus measured after five weeks ('Carmen Rubin': 22.5 and 103 mg, 'White Triumph': 21.2 and 99.3 mg). Even though the regeneration

period was extended by one week, some of the explants did not produce plants. The percentage of the explants with shoots depended on the cultivar and the medium used (tab. 2). On the medium with kinetin and gibberellin, 87,2% of the 'Carmen Rubin' explants and 85% of the 'White Triumph' explants developed shoots. On the medium with IAA, the shoots were observed in 82,9% of the 'Carmen Rubin' explants and in 75,9% of the 'White Triumph' ones. Each of the plant, which developed shoots, produced only one shoot; the explants with no shoots developed a small number of short roots on the callus. The weight of the plants was much smaller than the plants grown earlier from the primary explants ('Carmen Rubin': by 42.1%, 'White Triumph': by 52%). The average weight of the 'Carmen Rubin' plants was significantly larger than that of the 'White Triumph' ones (tab. 2). Regardless of the cultivar, the weight of roots developed by the plants grown on the IAA medium was larger than that of these grown on the KIN and GA_3 medium. The average weight of the 'Carmen Rubin' shoot was similar on both media, while the weight of the 'White Triumph' one was larger on the auxin medium. The callus on the secondary explants of the two cultivars developed more intensely on the medium with kinetin and gibberellin than in the presence of auxin.

Similarly to the plants from the primary culture, the average stems length was larger in the 'Carmen Rubin' plants than in the 'White Triumph' ones (tab. 2). In the majority of the plants, the root systems consisted of one longer root and several shorter ones. Unlike in the first experiment, the number of internodes in the 'Carmen Rubin' plants was higher than in the 'White Triumph' plants; at the same time, the average 'White Triumph' plants produced more roots. The two cultivars also differed in the average length of the largest root, which was longer in 'Carmen Rubin'. The morphological structure of the micro-plants was influenced by the medium used. The average number of roots in the 'Carmen Rubin' plants was similar in both media, while the 'White Triumph' plants developed more roots on the medium with auxin. The dominant root observed for 'Carmen Rubin' plants grown on the medium with KIN and GA_3 and was longer than the one developed on the medium with IAA, considering in the 'White Triumph' plants this difference was insignificant.

The extension of the plants regeneration period by another 2 weeks resulted in a significant increasing in the length of the stem and the number of nodes. The stems of the 'Carmen Rubin' plants produced average 4.93 nodes at an average stem length of 1.33 cm. The 'White Triumph' stems were shorter (0.69 cm) and we could observed fewer number of nodes (3.27).

Little literature is available on the propagation of sweet potato from apical and node explants. Most probably, this is because in the key sweet potato growing areas there are no major problems with the establishment of plantations. In the tropical and sub-tropical regions, the plants can be produced cheaply and in large quantities [Wilson 1988]. In the research conducted on *I. batatas*, the explants with axilary or apical buds placed on the media with a strong predominance of cytokinins over auxins developed a larger number of shoots. The shoots were then isolated and transferred onto rooting media [Litz and Conover 1978, Mukherjee 2002]. In the cases where the induction of organogenesis took place on hormone-free media and with a predominance of the auxins over cytokinins, one-step plant regeneration was observed with a single bud developing a single shoot and roots [Afren-Zobayed et al. 1999, Bressan 2002].

Table 2. Characteristic of plants received from secondary explants

Feature	Medium	Cultivar		Means	$LSD_{0.05}$
		'Carmen Rubin'	'White Trumph'		
Living explants number	A	78	80	79	–
	B	76	78	77	–
	means	77	79	78	–
% explants with shoots	A	87.18	85.00	86.09	–
	B	82.89	75.92	79.40	–
	means	85.03	80.46	82.74	–
Plant weight (mg)	A	314.9	186.5	250.7	41.1 *
	B	288.1	217.3	252.7	ns **
	means	301.5	201.9	251.7	58.0 ***
Shoot weight (mg)	A	105.8	48.9	77.3	19.5 *
	B	113.0	78.5	95.7	ns **
	means	109.4	63.7	86.5	27.6 ***
Roots weight (mg)	A	80.8	29.5	55.1	15.4 *
	B	97.3	48.6	72.9	15.4 **
	means	89.1	39.0	65.7	21.8 ***
Explant weight (mg)	A	128.4	108.4	118.4	ns *
	B	77.6	90.3	83.9	13.0 **
	means	103.0	99.3	101.1	18.4 ***
Stem length (cm)	A	0.63	0.45	0.54	0.08 *
	B	0.56	0.53	0.55	ns **
	means	0.60	0.49	0.54	0.11 ***
Nodes number	A	2.73	1.70	2.22	0.30 *
	B	2.53	2.67	2.60	0.30 **
	means	2.63	2.18	2.41	0.42 ***
Roots number	A	1.53	1.83	1.68	0.28 *
	B	1.73	2.06	1.89	ns **
	means	1.63	1.94	1.78	0.40***
Root length (cm)	A	20.8	11.9	16.4	1.9 *
	B	17.5	11.8	14.6	1.9 **
	means	19.2	11.9	15.5	2.6 ***

A – medium with KIN and GA_3, B – medium with IAA, ns – non significant difference, * – LSD for cultivars, ** – LSD for medium, *** – LSD for interaction cultivar × medium

Litz and Conover [1978] separated 3 mm long explants from the apical and axillary buds of two *I. batatas* cultivars. Then, they placed the explants onto MS medium supplemented with IAA auxin as well as BAP and KIN cytokinins. The growth regulators were used in various concentrations and combinations. The development of shoots was preceded by the formation of callus. Within five weeks, the 'White Star' cultivar produ-

ced the largest number of shoots (8.5) on the medium containing 1 mg dm^{-3} BAP, while the 'PI 315443' clone achieved the highest multiplication rate (5.1) on the medium containing 1 mg dm^{-3} IAA and 1 mg dm^{-3} KIN. On the rooting media, the roots developed at the base of the shoots and in the callus. The apical buds developed into plants after 8 weeks, whereas the axillary buds – 2–3 weeks later.

The research by Mukherjee [2002] demonstrated that the multiplication rate of the sweet potato shoots developed from axillary buds can be increased under sodium chloride stress. Node explants of 4 sweet potato cultivars with a length of 3–5 mm were placed onto 6 induction media containing the basic components of the MS medium. The individual media differed in the presence of growth regulators and NaCl concentrations. NAA was used at the concentration of 0.5 mg dm^{-3}, BAP – at the concentration of 1 mg dm^{-3}, while GA_3 – 0.05 mg dm^{-3}. NaCl was added at the following concentrations: 0.5, 1 and 2 mg dm^{-3}. After 4 weeks of culturing, the shoot multiplication rates varied depending on the cultivar and the composition of the medium. On the medium without hormones, two cultivars produced no shoots at all. In the case of the two remaining cultivars, the percentage of explants which produced shoots was, respectively, 10 and 8%. In all four cultivars, the percentage of explants with shoots was the highest (44–100%) on the medium containing all hormones and 0.5 mg dm^{-3} of NaCl. At the same time, in these conditions the shoots developed most quickly. The highest multiplication rate (3.5–5.2) was achieved on the hormone-supplemented medium with 1 mg dm^{-3} NaCl.

Afren-Zobayed et al. [1999] proved that micropropagation of sweet potato from node explants can be carried out under photoautotrophic conditions. Explants composed of a shoot fragment with a node and a single leaf were placed in special containers with the MS medium with no sucrose or vitamins. The medium was solidified using agar or gelrite, or, alternatively, the explants were planted on vermiculite, cellulose fibres or a mixture of both. The plants developed in sterile conditions, under strong light, with regulated air exchange and increased CO_2 concentration. After 21 days, the best plantlets were obtained from the explants grown on the mixture of vermiculite and cellulose. They had the highest total weight and the most developed root systems.

Bressan [2002] used young sweet potato plants grown from node explants to study the colonisation of roots by the *Glomus etunicatum* fungus. The 0.5 cm long explants were placed on the basic MS medium. Two weeks later, the plants were transferred onto three different media and their roots were inoculated with fungus spores. The White's medium was found to create favourable conditions for the root colonisation. No mycelium grew on the Hoagland medium and on the MS medium without sucrose.

Islam and Kubota [2002] used sweet potato shoot fragments consisting of a stem fragment with a node and a leaf for the cloning of plants in non-sterile conditions. The shoot fragments were planted into multi-cell trays filled with soil mix. In high humidity conditions with artificial lighting, strong, well-rooted plants were obtained after 4–5 weeks.

In the presented study, the sweet potato micro-plants survived the hardening process without any major problems. They easily withstood transplantation to not-sterile soil, temperature fluctuations and the gradual decrease in humidity. No withering was observed during the hardening period.

It was observed in numerous studies that sweet potato is able to acclimatize well to the planting conditions. Various acclimatization techniques were applied. Gosukonda et

al. [1995] placed sweet potato micro-plants and unrooted shoots into plastic containers with a sterile mixture of sand, perlite and vermiculite. A high humidity was maintained for 2 weeks, then it was gradually reduced and the plants were planted into pots with soil mixture and placed in a greenhouse. No plant withering was observed. Mukherjee [2002] researched sweet potato shoots developed from node buds and adventitious buds as well as plants produced from somatic embryos. They were hardened and rooted in a hydroponics set-up with 0.01% solution of the Hoagland's medium. Later, the plants were transplanted into the open field. Afren-Zobayed et al. [2002] transplanted sterile sweet potato plants from photoautotrophic cultures into pots with a mixture of compost and vermiculite, and placed them in a greenhouse. The survival of the plants was assessed after five days and was found to depend on the supporting material used during the plant regeneration. When a mixture of vermiculite and cellulose fibres was used, 97% of the plants survived the hardening process. For the plants regenerated on the agar-solidified medium the percentage was 79%.

The literature shows that in the moderate climate a significant increase in the sweet potato yield can be achieved when the plantations are established using well-developed plantlets with intact root systems. Such plantlets are obtained when plants produced by traditional methods as well as micro-plants produced by *in vitro* culturing are kept in an unheated greenhouse or in a plastic tunnel for 4–5 weeks before being planted in the field [Ching 2000]. Their root systems develop better when the leaves are regularly trimmed over this period, which reduces the assimilation area. As a result, the roots grow faster and produce a dense root ball. Higher tuber yields are also achieved when agrotextile covers are used to cover the plantations, or when the planting soil is covered with polyethylene foil [Krochmal-Marczak and Sawicka 2006, Novac et al. 2006].

The research by Ching [2000] shows that the properties of the sweet potato plants and the future yield of tubers can be strongly influenced by the shape of the pots in which the root systems develop. The plants grown in cylinder-shaped pots developed few long and coiled roots. The improper structure of the root systems had a negative impact on the yield of tubers, some of which had abnormal, coiled shapes. More roots developed in the pots which were shaped like inverted pyramids; the roots were shorter and directed towards the bottom of the pot, which had a positive effect on the number and shape of the tubers.

In our researches hardened sweet potato plants were grown 4 weeks in a little cylindrical plastic pots (0.3 dm^{-3}), placed in unheated glasshouse. During the planting of plants in the field, they had 15–20 cm long shoots consisted from 5–7 nodes, dense root systems composed from few long and coiled roots (fig. 1D). Late autumn, when sweet potato plants were harvested, abnormal coiled tubers were not observed. Many storage roots were grown in a long distance from the place where plants were planting.

CONCLUSIONS

1. The study has shown that sweet potato can be relatively easily propagated from node explants by *in vitro* culturing. The induction of organogenesis and regeneration of the plants took place on the same medium without passage. It took 4–5 weeks to produce micro-plants.

2. The two cultivars of sweet potato differed in their plant regeneration ability. In the axillary buds of the 'Carmen Rubin' plants, the organogenesis was initiated earlier than in the 'White Triumph' buds. The 'Carmen Rubin' plants had a higher total weight, longer shoots and more developed root systems.

3. Evaluated micropropagation process was strongly influenced by the parameters of the explants. The primary explants were much larger than from secondary explants and produced little callus, which resulted in a quicker induction of organogenesis and, consequently, positively influenced the properties of the produced plants. In the secondary explants, the organogenesis was delayed by intensive callus formation.

4. It was observed that the shoots which developed earlier were clearly dominant over these who developed later; very similar dependence was perceived for the roots.

5. A favourable property of the micro-plants obtained was their ability to acclimatize easily.

6. The micropropagation of sweet potato by *in vitro* culturing can be carried out continually. In the cultures aimed at the production of sterile explants, the plant regeneration period can be extended to 7 weeks, which increases the multiplication rate. The subcultures which end the production should be shorter – e.g. 5 weeks.

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MIKROROZMNAŻANIE BATATA (*Ipomoea batatas* (L.) Lam.) Z EKSPLANTATÓW WĘZŁOWYCH

Streszczenie. Słodki ziemniak jest w klimacie umiarkowanym uprawiany stosunkowo rzadko. Nadają się do tego celu rejony, w których przynajmniej przez 3 miesiące temperatury są wyższe niż 15°C. Plantacje są zakładane po wiosennych przymrozkach za pomocą dobrze ukorzenionych sadzonek otrzymywanych z pędów wyrastających z bulw umieszczonych w ciepłym wilgotnym podłożu albo z roślin rosnących w szklarni. Taki sposób rozmnażania ogranicza możliwości zakładania dużych plantacji. Celem badań była ocena możliwości wytwarzania większej ilości wyrównanych, dobrze ukorzenionych sadzonek batata za pomocą kultur *in vitro*. Badano dwie odmiany: 'Carmen Rubin' i 'White Triumph'. Eksplantaty węzłowe wykładano na dwie pożywki, które zawierały podstawowe składniki pożywki MS i regulatory wzrostu. Do jednej dodano 1 mg dm^{-3} gibereliny i 0,1 mg dm^{-3} kinetyny, do drugiej 0,5 mg dm^{-3} IAA. Indukcja organogenezy i regeneracja roślin zachodziły na jednej pożywce, bez pasażowania. W czasie dziewięciu tygodni, w dwóch cyklach mnożenia, z jednego pierwotnego eksplantatu wytworzono 4 rośliny. Właściwości sadzonek zależały od odmiany batata, masy eksplantatów i składu pożywek. Rośliny 'Carmen Rubin' miały średnią masę większą od roślin 'White Triumph', wytworzyły dłuższe pędy i dłuższe korzenie. Korzystną właściwością młodych roślin batata była duża zdolność do szybkiej aklimatyzacji.

Słowa kluczowe: rozmnażanie *in vitro,* rodzaj pożywki, właściwości sadzonek

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