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# Suitability of meristem culture for the propagation of wild and primitive forms of potato

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## Introduction

Tissue culture has been applied for many years to improve potato production by micropropagation, pathogen elimination and germplasm conservation (Roca et al, 1978 and 1979). The preservation of plant resources requires storage and propagation conditions which guarantee that the genotypes remain stable in all their characterstics for many years. Organ and tissue cultures have a high degree of genetic stability and can also avoid the risk of losing valuable material, particularely as a result of diseases. Some investigators have attempted to multiply clones by stem cutting techniques (Westcott et al, 1977) others by regenerating plants from callus tissues (Roest and Bockelmann,1976). However, plants regenerated from callus can differ genetically from the plant of origin (D' Amato, 1977). The wild and primitive Solanum genotypes are usually propagated using tubers or true seeds (Hoekstra, 1990). There is very rare information about the propagation of wild forms of potato using meristem culture in vitro (Arslan et al, 1987). This work is conducted to study the suitability of wild and primitive forms of potato for meristem culture in vitro.

## Material and methods

The plant material used for this study consisted of 53 wild and 5 primitive forms of potato. The seeds were provided by the Collection of Genetic Resources of the Institute of Crop Science, Federal Research Centre for Agriculture, Braunschweig, F.R.Germany. The seeds were raised in a green house. After two monthes young stems were collected from each genotype. The stem cuttings (each with 2 nodes) were surface sterilized using 2 % calcium hypochloride for 15 minutes and then rinsed with sterilized water. Seven cuttings were placed in each flask containing 50 ml solid medium. The medium consisted of Murashige and Skoog salts (1962) to which 20 g sucrose and 7.5 g agar were added. The plants were cultivated in a growth chamber at temperature of 20-23 °C and light intensity of 4000 lux with a day length of 16 h for 6 weeks. The plant growth was evaluated according to shoot and root formation as well as the fresh weight of shoots.

## Results and discussion

All the tested genotypes had formed well developed shoots (Table1 and fig.1a). Fifty four genotypes (93 % of the genotypes) produced shoots on 90-100 % of the cultivated stem cuttings. The rest of the genotypes (7 %) formed shoots on 80-90 % of the cultivated cuttings. Root formation was greately affected in comparison to shoot formation (Table 1 and fig.1b). Not all of the cultivated cuttings could produce roots. Only 47 % of the genotypes formed roots on 90-100 % of the cultivated cuttings, whereas 34 % of genotypes could form roots on 70-90 % of the cuttings. The genotypes No. 10, 28, 36 and 37 (Table 1) showed very poor root formation, although they had shown good shoot formation ( 80-100 % ). Genotype No.28 showed the lowest shoot and root development.

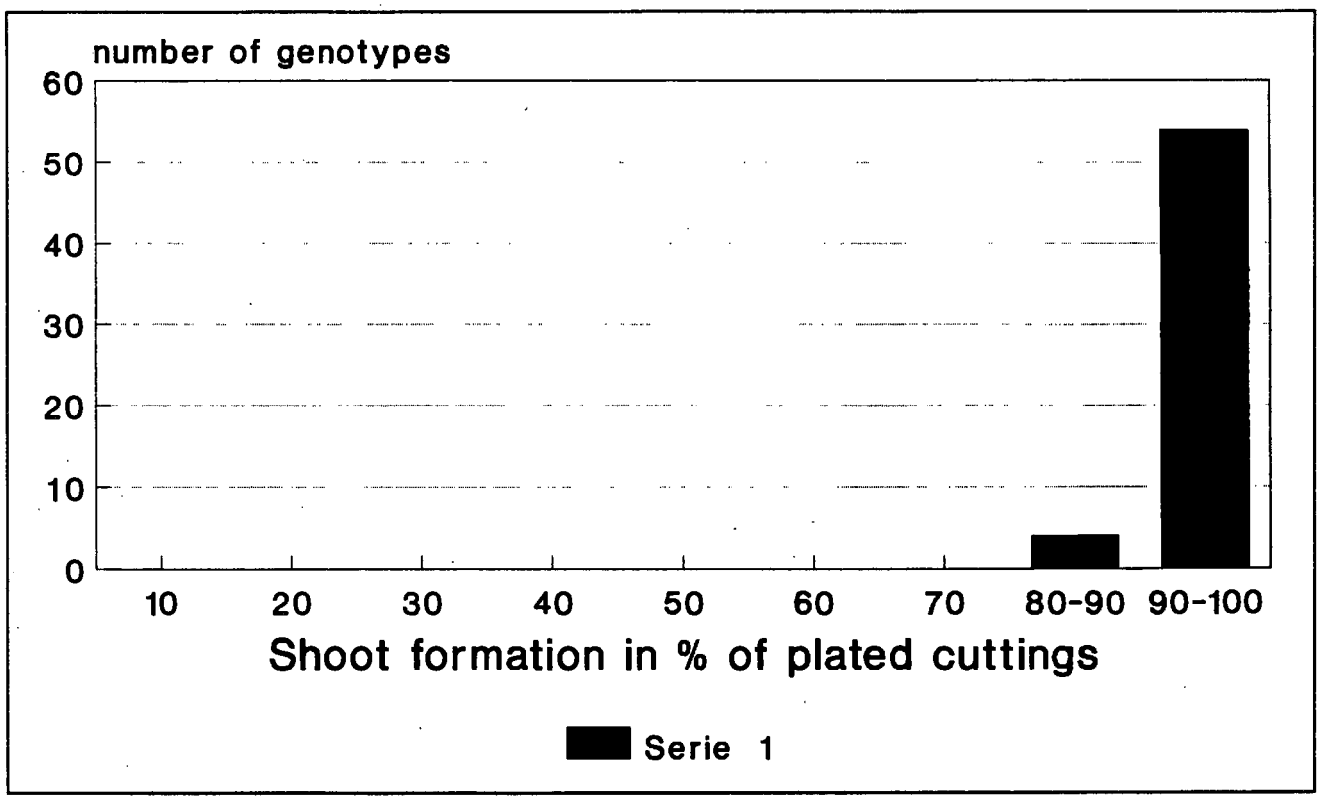
The shoot development was also measured as fresh weight (Table 1). The genotypes No. 7, 9, 10, 16, 17, 23, 24, 43, 52, 56 and 57 (19 %) had the highest fresh weight (70-90 mg/plant), whereas the genotypes No. 3, 4, 32, 33 and 39 (8 %) showed the lowest fresh weight (10-20 mg). There were little differences in fresh weight among the accessions except between accessions of species *S. berthaultii* (No.4-6), *S.leptophyes* (No.31 & 34) and *S. stenotomum* (No.47 & 48). The results showed that the wild and primitve forms of potatoes can be propagated in vitro using meristem cuttings. The low root formation could be improved using growth hormones or other substances which favour root formation (Pennazio and Vecchiati, 1976).. These results confirm the results obtained using meristem culture for the propagation of potato cultivars (Roca et al, 1978 and Mix, 1981). These results were also used as a base for using meristem culture for screening for salinity tolerance of potato genotypes in further studies in vitro (Elhag, 1991 ).

## Summary

Wild and primitive Solanum genotypes are usually propagated using tubers or true seeds. The suitability of fifty eight potato genotypes for propagation using meristem culture was tested in this study. The culture medium was consisted of Murashige and Skoog salts. Almost all tested genotypes gave well developed shoots and high fresh weights as well. Root formation was lower than that of shoots which could be improved using growth hormones. The results showed that wild and primitive forms of potato could be propagated using in vitro meristem culture.

## Eignung der Meristemkultur zur Vermehrung von Wild- und Primitivformen der Kartoffel

Wild- und Primitivformen der Kartoffel werden normalerweise über die Knollen und/oder Samen vermehrt. In der vorliegenden Studie wurde die Eignung der In-VitroVermehrung von 58 Genotypen getestet. Der Kulturnährboden bestand aus Murashige und Skoog Salzen sowie 20 g/l Saccharose. Fast



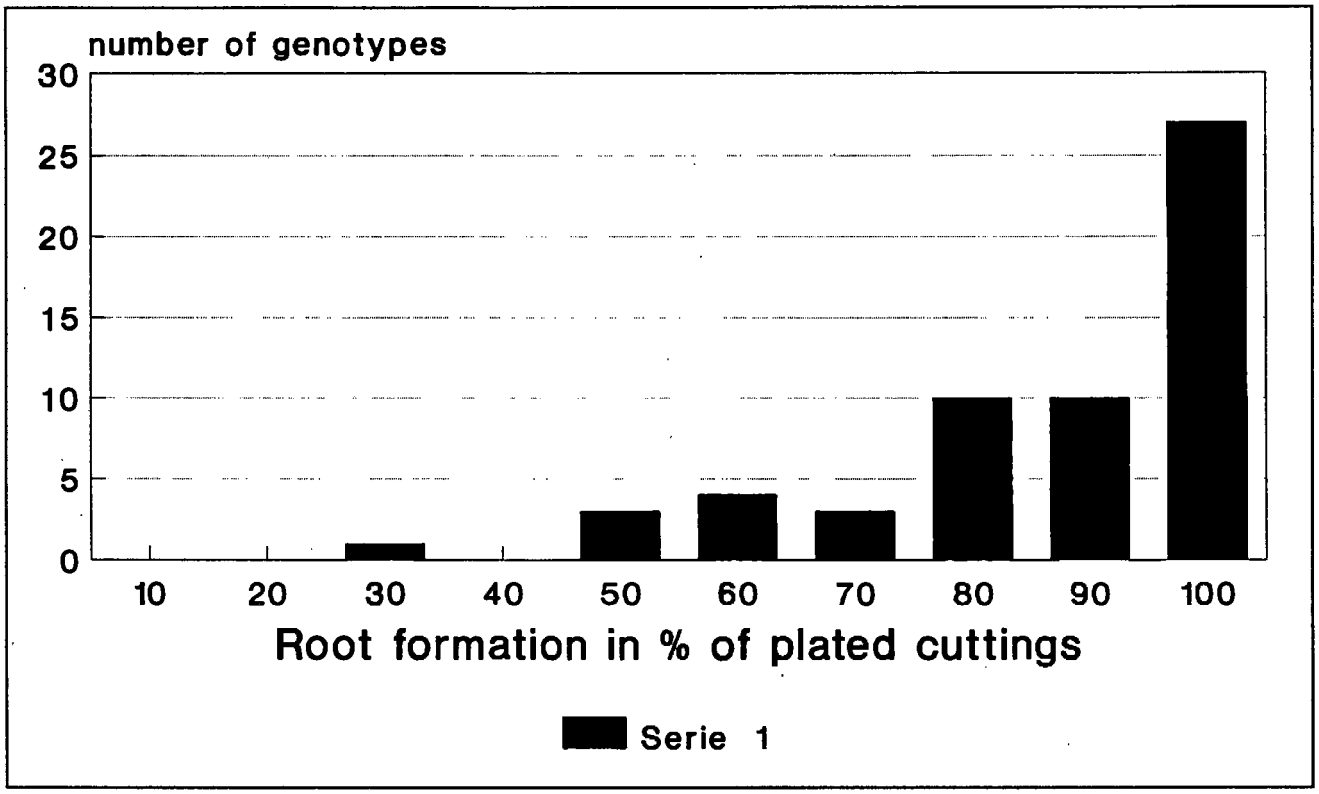




Figure 1a+b: **Frequency distribution of 58 potato genotypes in relation to (a) shoot and (b) root formation in % of cultured cuttings in vitro** - Häufigkeitsverteilung der Genotypen hinsichtlich der Sproß- (a) und Wurzelbildung (b) in % von den angesetzten Nodien bei 58 Kartoffelgenotypen

| index no. | species | accession BGRC | cuttings with shoots | | cuttings with roots | | FW mg |
|---|---|---|---|---|---|---|---|
| | | | abs. | rel. | abs. | rel. | |
| 1 | S.acaule ssp.aemulans | 17180 | 6.0 | 85.7 | 4.0 | 57.1 | 53.4 |
| 2 | S.alandiae | 31187 | 7.0 | 100 | 5.0 | 71.4 | 38.4 |
| 3 | S." | 28491 | 7.0 | 100 | 5.0 | 71.4 | 20.3 |
| 4 | S.berthaultii | 18548 | 7.0 | 100 | 6.0 | 85.7 | 17.0 |
| 5 | S." | 28033 | 7.0 | 100 | 7.0 | 100 | 40.7 |
| 6 | S." | 10063 | 7.0 | 100 | 6.0 | 85.7 | 55.6 |
| 7 | S.boliviense | 7985 | 7.0 | 100 | 6.0 | 85.7 | 75.2 |
| 8 | S.brevicaule | 28023 | 7.0 | 100 | 5.0 | 71.4 | 54.3 |
| 9 | S.canasense | 8012 | 7.0 | 100 | 7.0 | 100 | 73.2 |
| 10 | S.cardiopyllum | 10052 | 7.0 | 100 | 3.0 | 42.8 | 90.3 |
| 11 | S.chacoense | 16979 | 7.0 | 100 | 7.0 | 100 | 40.7 |
| 12 | S." | 24577 | 7.0 | 100 | 7.0 | 100 | 48.3 |
| 13 | S." | 8030 | 7.0 | 100 | 6.5 | 92.8 | 45.0 |
| 14 | S.commersonii | 17655 | 7.0 | 100 | 7.0 | 100 | 57.8 |
| 15 | S." | 17660 | 7.0 | 100 | 7.0 | 100 | 65.3 |
| 16 | S.demissum | 53643 | 7.0 | 100 | 7.0 | 100 | 80.7 |
| 17 | S.fendleri | 8088 | 7.0 | 100 | 5.0 | 71.4 | 75.5 |
| 18 | S.gourlayi | 16837 | 7.0 | 100 | 7.0 | 100 | 45.4 |
| 19 | S." | 7180 | 7.0 | 100 | 7.0 | 100 | 47.3 |
| 20 | S." | 17338 | 7.0 | 100 | 5.0 | 71.4 | 43.0 |
| 21 | S.hannemanii | 16843 | 7.0 | 100 | 7.0 | 100 | 37.2 |
| 22 | S." | 16840 | 7.0 | 100 | 7.0 | 100 | 43.7 |
| 23 | S.hawkesianum | 16955 | 7.0 | 100 | 6.0 | 85.7 | 73.6 |
| 24 | S." | 16951 | 7.0 | 100 | 7.0 | 100 | 75.2 |
| 25 | S.incamayoense | 17350 | 7.0 | 100 | 5.0 | 71.4 | 42.8 |
| 26 | S." | 16903 | 6.5 | 92.8 | 4.0 | 57.1 | 45.1 |
| 27 | S.infundibuliforme | 24623 | 6.0 | 85.7 | 5.0 | 71.4 | 40.0 |
| 28 | S." | 16842 | 6.0 | 85.7 | 1.5 | 21.4 | 43.2 |
| 29 | S.kurtzianum | 17585 | 7.0 | 100 | 7.0 | 100 | 55.8 |
| 30 | S." | 17576 | 7.0 | 100 | 6.0 | 85.7 | 48.3 |
| 31 | S.leptophyes | 7184 | 7.0 | 100 | 6.0 | 85.7 | 47.2 |
| 32 | S." | 27211 | 7.0 | 100 | 5.0 | 85.7 | 18.3 |
| 33 | S.medians | 18554 | 7.0 | 100 | 6.0 | 85.7 | 10.3 |
| 34 | S.megisatcrolobum | 27262 | 7.0 | 100 | 7.0 | 100 | 35.7 |
| 35 | S.microdontum ssp.mic. | 7197 | 7.0 | 100 | 5.5 | 78.5 | 50.3 |
| 36 | S.multidissectum | 8145 | 7.0 | 100 | 3.0 | 42.8 | 22.4 |
| 37 | S.okadae | 24720 | 7.0 | 100 | 3.0 | 42.8 | 25.8 |
| 38 | S." | 24719 | 7.0 | 100 | 5.0 | 71.4 | 23.7 |
| 39 | S.pampasense | 8161 | 7.0 | 100 | 4.0 | 57.1 | 19.8 |
| 40 | S.phureja | 50199 | 7.0 | 100 | 7.0 | 100 | 60.6 |
| 41 | S.raphanifolium | 15446 | 7.0 | 100 | 6.0 | 85.5 | 63.4 |
| 42 | S.sanctae rosae | 15454 | 6.5 | 92.8 | 4.5 | 64.2 | 28.3 |
| 43 | S. " | 17569 | 6.0 | 85.7 | 4.0 | 57.1 | 37.8 |
| 44 | S.sparsipilum | 24687 | 7.0 | 100 | 7.0 | 100 | 64.7 |
| 45 | S.spegazzinii | 18326 | 7.0 | 100 | 7.0 | 100 | 57.4 |
| 46 | S." | 16929 | 7.0 | 100 | 6.0 | 85.7 | 45.3 |
| 47 | S.stenotomum | 27165 | 7.0 | 100 | 7.0 | 100 | 47.8 |
| 48 | S." | 18478 | 7.0 | 100 | 7.0 | 100 | 70.8 |
| 49 | S.stoloniferum | 7229 | 7.0 | 100 | 7.0 | 100 | 60.2 |
| 50 | S.sucrense | 24695 | 7.0 | 100 | 4.5 | 64.2 | 57.8 |
| 51 | S. " | 27290 | 7.0 | 100 | 4.5 | 64.2 | 65.5 |
| 52 | S.tarijense | 24717 | 7.0 | 100 | 7.0 | 100 | 75.4 |
| 53 | S." | 17423 | 7.0 | 100 | 6.0 | 85.7 | 67.9 |
| 54 | S.tuberosum ssp.andg. | 28043 | 7.0 | 100 | 7.0 | 100 | 57.4 |
| 55 | S." | 7463 | 7.0 | 100 | 7.0 | 100 | 46.7 |
| 56 | S.vernei | 15451 | 7.0 | 100 | 7.0 | 100 | 85.3 |
| 57 | S." | 16929 | 7.0 | 100 | 6.5 | 92.8 | 83.6 |
| 58 | S.vidaurrei | 16828 | 7.0 | 100 | 7.0 | 100 | 47.8 |

Table 1: **Number of stem cuttings which have formed shoots and roots (absolute and in % of total cultured cuttings/flask) and fresh weight of shoots of 58 potato genotypes** - Anzahl der sproß- und wurzelbildenden Nodien (abs. und rel.in % der angesetzten Nodien/Gefäß) und die Frischmasse von 58 Kartoffelgenotypen

alle Genotypen zeigten ein gutes Sproßwachstum und ein hohes Frischgewicht. Das Wurzelwachstum, das durch einen Hormoneinsatz verbessert werden könnte, war schwach. Die Ergebnisse machen deutlich, daß für eine Vermehrung der Wild- und Primitivformen die In-Vitro-Techniken eingesetzt werden könnten.

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