POTENTIAL OF POTATO (*SOLANUM TUBEROSUM* L.) MICROTUBERS FOR SEED PRODUCTION

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ABSTRACT

Plant growth, number of shoots, nodes/shoot and shoot height varied with different shoot proliferation media. Shoot proliferation was best in Lama medium (Murashige and Skoog 9 MS) + 2.5 Gibberllic acid (GA_3) + 10% coconut water). Clone 1-1039 gave significantly higher number of shoots. Combination of plant growth regulators (PGR) in Dodds medium (MS + 0.4 ppm GA_3 + 0.5 ppm Benzylamino purine (PAB) + 0.01 ppm Napthalene acetic acid (NAA) was equally effective as Lama medium in proliferating the shoots in *in vitro*. Dodds protocol (MS + 5 ppm BAP, 500 ppm of Cloroclorine chloride (CCC) and 8% sugar) affected higher number and weight of the microtubers. Presence of CCC and BAP in the fiber induction media showed synergistic effect on both tuber induction and bulking.

Additional Key Words: Vegetable, tuber, growth regulators, tissue culture.

INTRODUCTION

Seed multiplication in potato is mainly aimed at producing disease free planting materials. Traditional method of seed production through "clonal selection" is time consuming (Straik and Lommen, 1990) and exposure to many systemic and nonsystemic disease (Hyouk *et al.*, 1991; Potts, 1990) results in rapid seed degeneration. The high cost, unavailability and frequent poor quality (Horton, 1987; Uyen and Ming, 1980) of seed tubers are compelling reasons in developing most effective system of seed multiplication and distribution scheme in developing countries.

Year-round production of microtubers (Allard and Blank, 1990), which are less bulky (Dodds, 1988) and have higher multiplication rate (Levy, 1988) can provide a continuous supply of premium stock to traditional seed-growing areas which will provide tremendous advantages over conventional seed tubers. Using them will ultimately improve ware potato production in low elevations (Beukema *et al.*, 1985). Their use also reduces the subsequent effects on seed tuber quality compared to conventional seed during bulk transportation. Furthermore, untimely delivery of seed in areas with poor road facilities is eliminated.

In view of the above importance regarding the situation in most of the developing countries, the study was conducted with the strategy of systematically evaluating the factors affecting *in vitro* proliferation and microtuber production. Important factors included are media composition and physical environments in *in vitro* production.

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MATERIALS AND METHODS

Experiment No. 1. In vitro Proliferation of potato Clones 1-1039 and 1-1035

Four shoot proliferation media Dodds (MS + 0.5 ppm BAP + 0.4 ppm GA + 0.01 ppm NAA), Wang and Hu (MS + .005 ppm NAA), Kim (MS + 0.1 ppm GA + 0.5 ppm Kinetin) and Lama (MS + 2.5 ppm GA_3 + 10% coconut water) were evaluated in proliferating the shoots of potato clones 1-1039 and 1-1035. Nodal cuttings were used as explants. Two percent of table sugar was added in all the media.

The experiment was laid out in completely randomised Design (CRD) with 8 replications. Four stem segments with 3 nodes each were layered in 200 ml culture bottles containing 9 ml of liquid media under 16 hours photoperiod and ambient room temperature (20-25°C). Total number and percent shoot expression, number of nodes/shoot, root expression (1-3 scale), plant vigor (1-6 scale) and shoot height (cm) were studied.

Experiment No. 2. In vitro microtuber induction of potato Clones 1-1039 and 1-1035

Five tuber induction media such as, Dodds (MS + 5 ppm BAP + 500 ppm CCC + 8% sugar), Wang and Hu (MS + 10 ppm BAP + 8% sugar), Kim (MS + 5 ppm BAP + 6% sugar, Yong and Jun (MS + 5 ppm BAP + 8% sugar) and Hussey and Stacey (MS + 2 ppm BAP + 6% sugar) were evaluated using potato clones 1-1039 and 1-1035 under complete darkness at 18-29°C.

The experiment was laid out as in experiment No. 1. Shoots were multiplied in the Lama medium. Parameters studied were total number of microtubers (MT), percent MT size (mm) distribution (> 5, 5-10 and > 10), total weight (gm) and MT induction days.

RESULTS AND DISCUSSION

Experiment No. 1. Various media tested significantly affected shoot proliferation of potato clones 1-1039 and 1-1035. Dodds and Lama media gave the highest number and percent shoot expression (Table 1). Lower concentration of GA_3 in Kim (0.1 ppm) and Wang and Hu might have contributed to lower number of shoots. It shows that combination of NAA, GA_3 and BAP enhance shoots proliferation than application of GA3 alone in potato (Roca *et al.*, 1978).

Number of nodes per shoot was highest in the Wang and Hu medium, but less number of shoots proliferated per bottle. Plant height ranged from 8.5 to 8.9 cm among Wang and Hu, Lama, and Dodds which did not vary significantly; however, they varied significantly from the Kim medium (7.5 cm).

Table 1. *In vitro* shoot proliferation characteristics of clones 1-1039 and 1-1035.

Medium	Total shoot (#)	Shoot expression (%)	Nodes/ shoot (#)	Total nodes (#)	Root expression (1-3)	Plant vigor (1-6)	Plant height (cm)
Dodds	10.3a	86.0a	7.7ab	79.3	2.00	2.0	8.9a
WH	5.7b	47.5b	8.2a	46.7	2.00	4.5	8.5a
Kim	6.5b	54.2b	6.4c	41.6	1.70	3.4	7.5b
Lama	9.4a	78.3a	6.8bc	64.0	1.20	5.3	8.7a

Means in each column with a common letter are not significantly different at 5% level by Duncan's Multiple Range Test (DMRT)

Table 2. *In vitro* shoot proliferation characteristics of clones 1-1039 and 1-1035.

Clone	Total shoots (#)	Shoot expression (%)	Nodes/ shoot (#)	Root expression (1-3)	Plant vigor (1-6)	Shoot height (cm)
1-1039	8.9a	73.7a	7.2a	2.2b	3.6b	8.2a
1-1035	7.1b	59.3b	7.4a	1.5a	2.8a	8.6a

Means in each column with a common letter are not significantly different at 5% level by DMRT.

Table 3. Effect of various media on MT induction *in vitro* for white potato.

Tuber induction Media	Total MT (#)	% MT distribution			Total weight (gm)	MT induction (days)
		>10	5-10	<5		
Dodds	8.5a	10.8a	41.2ab	47.9c	3.9s	15
WH	5.1b	5.7a	45.1ab	51.2bc	1.6b	17
Kim	3.8c	2.5a	27.3b	67.8b	1.0c	19
Yong	5.6b	3.0a	57.5a	40.4c	1.8b	15
HS	3.4c	0.0a	3.3c	96.6a	0.8c	20

Means in each column with a common letter are not significantly different at 5% level by DMRT.

Plant vigor was best on the Lama medium followed by Wang and Hu, and Kim media. After 3 weeks of incubation period there was a profuse root growth in Lama medium. The rest gave moderate root expression.

The foregoing results indicate that the Lama medium is suitable for *in vitro* shoot proliferation ot potato. As shown in Table 2, clones varied significantly as to number of shoots, percent shoot expression, root expression, plant vigor and shoot height. Such finding could be attributed to inherent genetic characteristics of the clones in relation to their critical photoperiod. Higher number of shoots proliferated in 1-1039 which is an andigena clone (critical photoperiod about 12 hours). This indicated that shoot growth and development of andigena clones proliferate under long day (16 hours) conditions (Ewing, 1981).

No significant interaction effects were found between clones and shoot proliferation media tested.

Experiment No.2. Effect of various media for MT induction *in vitro* for white potato is presented in Table 3. The Dodds (MS + 5 ppm BAP + 500 ppm CCC + 8% sugar) medium produced the highest number of MT, tuber weight and earliest tuber induction. It recounts that a "Hormonal complex" controls stolon growth and tuber initiation in potato (Palmer and Barker, 1973). It can be expected that application of number of growth substances may influence their balance and thus may have a direct or an indirect influence on tuberization (Hammes and Nel, 1975). Apparently, the ability of CCC in stimulating tuberization is due to its anti-gibberellin action. Nevertheless, exactly how the low level of gibberellin is associated with tuber initiation is at present unclear. However, previous findings indicate that sugar is important factor (Gregory, 1956). Result shows that *in vitro* MT production in potato is genotype dependent (Ortiz-montiel and Lozoya-saldapa, 1987; Paet and Zamora, 1991).

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