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SHORT NOTE

Gibberellic acid as a media additive for *in vitro* propagation of potato (*Solanum tuberosum* L.)

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Vegetative multiplication of potato is used routinely to produce disease-free seed tubers and to multiply new potato varieties for trials. The conventional methods of vegetative propagation using virus-tested stem cuttings allow production of 800–900 plants from a single plant in 3 years (Hussey & Stacey, 1981). Use of *in vitro* propagation allows much more rapid rates of multiplication of new varieties of potatoes (Wooster, 1984). Axillary buds taken from a few tubers can be multiplied to 500 plants within 4 months by repeated subculturing of nodal cuttings on artificial media in sterile conditions.

. Gibberellic acid (GA_3) has been suggested to be an effective media additive for potato cultures. Goodwin, Kim & Adisarnanto (1980) found that supplementation of liquid media with kinetin and low concentrations of GA_3 increased multiplication rates of shoot tips in culture. Westcott, Henshaw & Grout (1977) and Heszky, Enyingi & Szaba (1983) suggest the use of GA_3 for increasing multiplication rates of nodal cuttings on solid media but the response to increasing GA_3 concentrations is not described. The experiment described in this note compares growth of nodal cuttings of potato on solid basic medium with growth on medium supplemented with three different concentrations of GA_3.

MATERIALS AND METHODS

Sterile potato plantlet cultures of two varieties, King Edward and Record, were provided from the collection of the National Institute of Agricultural Botany (NIAB). The sterile cultures were established from tubers by surface sterilization of axillary buds as described by Hussey & Stacey (1981).

The basic medium used was the salt mixture of Murashige & Skoog (1962) with (mg/l) 100 inositol, 0·5 thiamine-HCl, 1·0 pyridoxine-HCl, 5·0 nicotinic acid, 2·5 pantothenic acid, and 3% sucrose and 0·5% technical agar. Media were autoclaved at 121 °C for 20 min. Sterile solutions of GA_3 were made up in 70% ethanol (Arditti & Strauss, 1979) and added to cooled media to give final concentrations of 0·01 (G_1), 0·1 (G_2) and 0·5 mg/l (G_3).

Explants consisted of nodal cuttings with 4–8 mm of stem. Five explants were inoculated on 20 ml media in each 90 ml specimen jar at a sterile bench. Metal lids were used to preclude contamination but allow gaseous exchange. Cultures were grown at 23 ± 2 °C and 4000 lux with a 16 h light – 8 h dark photoperiod for 3 weeks.

Plantlets were scored for number of nodes usable for subculture and height of shoots measured. Effects of the concentration of GA_3 added were tested by analysis of variance using jar totals as variates.

RESULTS AND DISCUSSION

Regeneration of explants of both varieties, King Edward and Record, was good on all media (> 90%). On the basic medium, King Edward grew taller than Record and produced more nodes (Table 1). For both varieties supplementation with G_1 increased node production whilst higher concentrations of GA_3 reduced the number of nodes. A significant variety × medium interaction showed that Record was less inhibited by G_2 and G_3 and stimulated more by G_1 than King Edward so that the numbers of nodes produced by the two varieties with G_1 were similar.

The effect of GA_3 on height differed for the two varieties. Height in King Edward was decreased by G_2 and G_3 whilst for Record high concentrations of GA_3 did not decrease plantlet height, and maximum height was attained by G_2. Both varieties did, however, respond in a similar way to G_1.

Plantlets grown on G_2 and G_3 appeared spindly and chlorotic. King Edward showed poor root development on these media. Comparison of the growth of the two varieties at different GA_3 concentrations suggests that Record has a higher

Table 1. *Mean height and number of nodes for jar totals of plantlets of King Edward (KE) and Record (RE) grown for 3 weeks*

Supplement to basic medium	Mean number of nodes per jar		Mean height per jar (mm)	
	KE	RE	KE	RE
None	15·2	11·8	210	137
0·01 mg GA_3/l (G_1)	21·2	22·0	251	176
0·10 mg GA_3/l (G_2)	4·8	11·6	110	185
0·50 mg GA_3/l (G_3)	4·4	7·0	152	178
S.E.	4·65		41·5	

threshold for GA_3 stimulation and inhibition than King Edward. This may reflect lower endogenous levels, different rates of metabolism or different affinities for GA_3. The response of node production to GA_3 concentrations showed significant linear and quadratic effects but deviations from a quadratic relationship suggest that use of orthogonal polynomials does not allow a good description of the response. It may be better to test a range of concentrations around 0·01 mg GA_3/l to investigate how the stimulatory effects of low concentrations of GA_3 differ from the inhibitory effects at higher concentrations. The apparent optimum of about 0·01mg GA_3/l compares with 0·01 mg GA_3/l + 5mg kinetin/l found to be best for growth of potato shoot-tip subcultures by Goodwin *et al.* (1980). Heszky *et al.* (1983) suggest the use of 0·1–0·5 mg GA_3/l for multiplication of nodal cuttings although no results are given.

This experiment indicates that multiplication rates of two-to-threefold over 3 weeks on basic medium can be increased to four-to-fivefold by supplementation with 0·01 mg GA_3/l but that higher concentrations may be strongly inhibitory to varieties like King Edward. Tests with more varieties should establish whether low levels of GA_3 allow most rapid and synchronous multiplication in general.

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