Reviewed Research Paper

Influence of Growth Regulators and Nitrogen Form on Micropropagation of Rabbiteye Blueberries[1]

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In recent years several investigators (5, 6, 8, 11) have reported successful micropropagation of blueberries. It normally proceeds through 4 distinct stages, establishment, multiplication, rooting and reestablishment. Chemical and environmental factors may be altered in order to optimize performance of the explant at each stage. Gibberellic acid (GA_3) has been observed to be both beneficial (2) and detrimental (3, 9, 10) to establishment and initial growth of woody plant cultures. Cytokinins such as 2-isopentyladenine (2iP) promote shoot multiplication (5, 6, 8, 11). Culture media used for other ericaceous plants normally include both ammonium and nitrate forms of nitrogen, although they are balanced heavily toward the latter (1, 6, 7). Three experiments were performed during this study: effect of (1) GA_3 on explant establishment, (2) 2iP on multiplication, and (3) nitrogen ion balance on multiplication of rabbiteye blueberries (*Vaccinium ashei* Reade).

Materials and Methods

The culture medium contained modified McCown and Lloyd's mineral salts (4) supplemented with casein hydrolysate (1 g/l), sucrose (30 g/l), and 2iP (5 mg/l), unless otherwise indicated. For experiment 1, GA_3 was filter sterilized and added after autoclaving the media. Five levels of GA_3 were evaluated (0, 1, 10, 100, 1000 mg/l). Difco Bacto agar (6 g/l) was used to gel media for experiments 2 and 3. The pH of the media was adjusted to 5.7 ± 0.1 prior to dispensing into culture tubes. Tubes were capped with polypropylene closures (Kaputs) and autoclaved at 1.05 kg/cm^2 and 121°C for 15 minutes. A photoperiod of 16 hours, light intensity of 1200 lux at explant height and average temperature of 28°C were maintained for all 3 experiments. Illumination was provided by Sylvania Lifeline fluorescent lights.

In experiment 1 terminal cuttings from new growth flushes of field-grown 'Delite' rabbiteye blueberry plants were used. Leaves were removed and shoots treated with Benomyl (1.56 g/l) and Captan (2.3 g/l) for 30 minutes with constant stirring. They were then soaked in a 1% sodium hypochlorite (20% Clorox) solution plus 0.1% Tween 20 for 10 minutes followed by 3 rinses with sterile deionized water. Prior to explanting, shoots were trimmed to 4 node explants approximately 40 mm in length. In experiment 2, shoots from previously established cultures 'Bluegem' and in experiment 3 of 'Bluebelle' and 'Beckyblue' were used.

Results and Discussion

Experiment 1 (gibberellic acid on culture establishment)

Increasing GA_3 level in the media produced a corresponding decrease in culture survival and axillary bud growth (Table 1). In addition, shoots arising from buds of GA-treated explants were spindly and leaves narrow and chlorotic. These observations

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Table 1. Effect of GA level on establishment and bud growth of 'Delite' blueberry explants.[z]

GA level (mg/l)	% of Cultures	
	Surviving	Vegetatively-active
0	95a[y]	15a
1	88ab	12b
10	82b	8b
100	77b	5bc
1000	26c	2c

[z]Based on 65 replications per treatment.

[y]Values not followed by a common letter are significantly different at the 5% level using chi square analysis.

Table 2. Effect of 2iP on growth of 'Bluegem' blueberry shoot tips in culture.[z]

2iP level (mg/l)	Fresh weight (mg)	Shoots formed (no.)	Shoot length (mm)
0	144a[y]	1.4a	55.1a
1	1130b	4.5b	34.6b
2	1085b	4.3b	32.9b
4	1076b	4.7b	23.9b
8	978b	4.2b	14.5d

[z]Based on 120 replications per treatment.

[y]Means not followed by a common letter are significantly different at the 5% level using the LSD test.

agree with those found with other plants (2, 3, 5, 8, 9, 10).

Experiment 2 (2iP on multiplication)

All levels of 2iP used resulted in a comparable increase in culture fresh weight (Table 2). From the standpoint of rapid clonal increase, these 2 factors are of primary importance. However, increasing 2iP levels in the media resulted in a corresponding decrease in shoot length. This confirms earlier observations with blueberries (11).

Experiment 3 (nitrogen ion balance on multiplication)

Due to similarity of data and identical analysis, fresh weight and shoot formation data for the 2 cultivars were combined in Table 3. Fresh weight of cultures on media lacking the nitrate form of nitrogen was considerably less (Table 3). A greater number of shoots formed on cultures with a high percentage of nitrate in the media. Shoot length of 'Bluebelle' decreased as NO_3 concentration decreased. The trend with 'Beckyblue' however, was less clear.

These experiments reveal the: (1) detrimental influence of GA on survival and growth of buds on multinode shoot explants, (2) promotive influence of 2iP on culture fresh weight and shoot formation and (3) importance of using a medium that includes both the nitrate and ammonium forms of nitrogen. Therefore a medium containing McCown and Llyod's mineral salts, casein hydrolysate (1 g/l), sucrose (30 g/l) and 2iP (1 mg/l) is recommended for rapid clonal propagation of rabbiteye blueberries in vitro.

Table 3. Effect of nitrogen ion balance on the growth of 'Bluebelle' and 'Beckyblue' blueberry shoot tips in culture.[z]

N ion balance (%)		Fresh weight (mg)	Number of shoots	Average shoot length (mm)	
NH_4	NO_3			'Bluebelle'	'Beckyblue'
15	85	591a[x]	4.4a	26.0a	19.9b
68	32	635a	2.7b	19.0b	28.5a
100	0	240b	1.3c	10.0c	13.4b

[z]Based on 40 replications per treatment.

[y]Treatment means averaged across 2 cultivars.

[x]Column means not followed by a common letter are significantly different at the 5% level using the LSD test.

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Reviewed Research Paper

Yield Stability in 10 Cultivars of Strawberry[1]

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Abstract

Ten strawberry cultivars were harvested for a total of 7 years at two sites in Michigan. A regression of individual yields on mean yields of all cultivars was calculated to measure phenotypic stability. 'Scott,' 'Raritan,' 'Redchief' and 'Midway' proved to be the most stable high yielding cultivars, while 'Guardian' had high yields but was much less stable.

Introduction

A well adapted cultivar maintains its productivity regardless of the vagaries of nature. Cultivars with modest yield potentials can be more profitable than those with higher yield ceilings if they are more consistent producers from year to year.

In yield trials of fruit, little attempt has been made to measure consistency of production outside of calculating means or coefficients of variation. These measurements are useful, but they tell us little about genotype-environmental interactions. Finlay and Wilkinson (1) have developed a stability analysis using linear regression which measures a genotype's relative response to environmental variability (2). In this study, I describe and use this analysis to measure and characterize yield stability in 10 cultivars of strawberries grown under Michigan conditions for 7 years.

Materials and Methods

The trials were performed at Sodus, Michigan from 1978-1982 and at Traverse City, Michigan from 1979-1982. Average climatic conditions for these two sites are depicted in Table 1. During the course of this study, a wide

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