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Dikegulac Sodium Influences Shoot Growth of Greenhouse Azaleas[1]

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Abstract. **Foliar sprays of 0.5% dikegulac sodium applied to 4 cultivars of greenhouse-forcing azaleas (*Rhododendron* spp.) 11 days after shearing, decreased shoot length and increased shoot number with more shoots originating along the entire stem at lower node positions than on untreated plants. Five to 6 weeks after treatment shoot length increased normally indicating that dikegulac sodium did not have a long term depressive effect on azalea shoot growth and development.**

Dikegulac sodium, the sodium salt of 2,3:4,5-bis-0-(1-methylethylidene-α-L xylo-2-hexulofuranosonic acid), has been extensively tested as a pinching agent on *Rhododendron* (3,4,6,10,11). Researchers reported that dikegulac sodium sprays destroy apical dominance and induce the production of axillary shoots (1,3). Dikegulac sodium has been found to be translocated to the plant apex (2) and to have an inhibitory effect on RNA (7) and DNA (2) synthesis and internodal expansion (2). Delayed plant growth (4,8,11), as well as retardation (3,8,11), has raised serious questions concerning the use dikegulac sodium in the production of *Rhodendron.*

Heursel (9) has reported that the growth delay might last 6 to 24 weeks depending on the number of applications, plant metabolism and environmental conditions. Cohen (5) noted that dikegulac sodium had no effect on *Rhododendron* shoot length 7 weeks after application. The purpose of the present work was to define the effect of dikegulac sodium on vegetative shoot growth of greenhouse azaleas.

Plants of the azaleas 'Kingfisher', 25 × 25 cm, and 'Alaska', Dorothy Gish', and 'Red Wing', 15 × 20 cm, were planted in 15 × 11 cm clay pots containing Canadian sphagnum peatmoss amended with 1.48 kg/m^3 each of dolomitic limestone and gypsum. About 120–180 ml of a fertilizer solution containing 2.5 g/liter of 25 N–4.4 P–8.2 K soluble fertilizer were applied to the medium of each pot every 2 weeks. Iron sulfate (1.0 g/liter) was added to the fertilizer solution to avoid iron deficiency. Plants were grown in a glass greenhouse with a maximum light intensity of 48.5 klx (measured at noon on a bright day). This photoperiod was supplemented during the night starting 2 weeks after treatment by using constant light from incandescent bulbs (208 lux at the top of plants) from 10 PM to 2 AM. Plants were sheared on December 23, 1978. A 0.5% dikegulac sodium spray was applied by a low pressure, high volume sprayer to runoff on sheared plants on January 3, 1979, for comparison with untreated sheared plants. A randomized complete block design was used with 7 replications, 3 plants per treatment (subsample) on 'Kingfisher' and 3 replications, 4 plants per treatment (subsample) on 'Alaska', 'Dorothy Gish' and 'Red Wing'. Two branches were chosen at random from each plant on which length of emerging shoots was measured at various node positions (counting basipetally) on January 31, February 7 and February 14, 1979. Total shoot number of each plant was determined on February 14.

Three to 4 weeks after treatment, newly developing leaves of dikegulac sodium-treated plants exhibited the necrotic leaf tip and chlorosis reported by other workers (1,4,6,7,11). The chlorosis disappeared in 6 to 8 weeks. It is suggested that this characteristic chlorosis may serve as an activity indicator of dikegulac sodium.

Four weeks after treatment, dikegulac sodium-treated plants produced new shoots at node positions 1 to 6 on 'Alaska', 1 to 8 on 'Kingfisher', and 1 to 9 on 'Dorothy Gish' and 'Red Wing' (Table 1). Untreated plants originated new shoots at node positions 1 to 4 ('Alaska'), 1 to 5 ('Red Wing') and 1 to 6 ('Kingfisher' and 'Dorothy Gish'). The average number of nodes per branch which produced shoots from dikegulac sodium-treated plants was 4.0 ('Alaska'), 5.1 ('Red Wing') and 5.2 ('Kingfisher' and 'Dorothy Gish') (Table 2). However, shoot emergence from the nodes on untreated branches averaged 3.1 ('Alaska'), 3.3 ('Kingfisher'), 3.5 ('Red Wing') and 3.6 ('Dorothy Gish'). The mean number of nodes producing shoots on dikegulac sodium-treated plants exceeded that of check plants for 'Alaska', 'Kingfisher' and 'Red Wing' but not for 'Dorothy Gish'.

New shoots were initially shorter on dikegulac sodium-treated plants than on check plants (Table 2). However, after 4 to 5 weeks, there were no differences in shoot length increases between treated and untreated plants except on 'Kingfisher'. At the 5 to 6 week interval, shoot length increases on all cultivars of dikegulac sodium-treated plants exceeded those of untreated plants. This suggested that dikegulac sodium did not a strong depressive effect on shoot growth 6 weeks after treatment.

New shoot length varied by node position (Table 1). Four weeks after treatment uniform length shoots were produced from nodes 1 to 4 on 'Alaska', 2 to 4 on 'Kingfisher', 1 to 5 on 'Red Wing' and 1, 2, 4, and 5 on 'Dorothy Gish'; while the check plants only produced uniform shoots from nodes 1 to 2 on 'Alaska', 'Kingfisher', and 'Red Wing'. Shoot length increased rapidly on treated 'Alaska' plants at 5 and 6 weeks and it was not as uniform on these plants as at 4 weeks. In contrast, shoot development remained uniform from nodes 1 to 3 on check plants. Six weeks after treatment shoot lengths of 'Dorothy Gish' plants were of uniform length at nodes, 2, 4, and 5 as well as nodes 1, 5, and 6.

However, check plants produced different shoot lengths at every node. Shoots developing from the first node

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Table 1. The influence of dikegulac sodium on sheared 'Alaska', 'Kingfisher' 'Dorothy Gish' and 'Red Wing' azalea plants.

	New shoot length (mm)											
	'Alaska'			'Kingfisher'			'Dorothy Gish'			'Red Wing'		
Node[z]	4 wk	5 wk	6 wk	4 wk	5 wk	6 wk	4 wk	5 wk	6 wk	4 wk	5 wk	6 wk
	Dikegulac sodium 0.50%											
1	11.2a[y]	17.8bc	22.9bc	7.0bcd	9.5b	11.6b	7.8b	10.3bc	12.5cd	8.8ab	12.6ab	15.5b
2	16.4a	27.0ab	34.5ab	13.1a	18.4a	22.5a	9.7b	15.6b	20.8b	11.6a	18.2a	24.6a
3	16.4a	30.9a	40.9a	14.2a	25.9a	14.8a	22.3a	29.3a	10.6ab	18.7a	24.6a	24.6a
4	10.1a	20.7b	26.3b	11.3a	17.7a	24.0a	9.2b	16.1b	20.3b	8.9ab	16.7ab	23.6a
5	3.8b	8.3cd	12.8cd	7.6b	11.3b	14.4b	6.8bc	12.5bc	16.0bc	7.4abc	13.8ab	20.2ab
6	0.8b	2.2d	3.3de	2.4c	4.1c	6.0c	3.7cd	6.9cd	9.3cd	5.4bcd	10.7bc	14.1b
7	0.0b	0.0d	0.0e	1.0c	1.7c	2.2cd	1.8d	6.5cd	8.5d	2.8cde	4.5cd	6.1c
8				0.3c	0.6c	1.0d	0.7d	1.3de	1.9e	0.6de	1.2d	1.8c
9				0.0c	0.0c	0.0d	0.3d	0.7e	1.6e	0.3e	0.8d	1.2c
10							0.0d	0.0e	0.0e	0.0e	0.0d	0.0c
	Check											
1	35.5a	47.7a	54.2a	28.3a	34.7b	38.1b	25.6b	29.8b	33.5b	31.8a	38.7a	42.8ab
2	37.5a	46.0a	52.8a	31.3a	39.6a	44.8a	29.9a	36.6a	42.3a	33.5a	41.8a	47.8a
3	28.8b	38.8a	43.7a	23.0b	32.0b	35.5b	21.3c	22.7c	25.4c	25.3b	31.4b	36.7b
4	12.2c	16.8b	19.3b	8.3c	11.1c	12.2c	9.3d	9.4d	11.2d	17.1c	20.0c	22.0c
5	0.0d	0.0c	0.0c	4.0d	5.4d	6.1d	1.1e	2.0e	2.1e	2.8d	4.3d	5.1d
6				0.1e	0.3e	0.3e	0.4e	1.4e	1.4e	0.0d	0.0d	0.0d
7				0.0e	0.0e	0.0e	0.0e	0.0e	0.0e			

[z]Node position numbering basipetally counting from shoot apex.
[y]Mean separation in columns for treatment and week by Duncan's multiple range test, 5% level.

Table 2. Growth of new shoots on sheared 'Alaska', 'Kingfisher', 'Dorothy Gish', and 'Red Wing' azalea plants after dikegulac sodium 0.5% treatment; study initiated December 1978.

	No. nodes with shoots[z]	Shoot length[z] (mm)			Total shoot no. per plant	New shoot length increase (mm)	
Treatment	4 wk	4 wk	5 wk	6 wk	6 wk	4 to 5 wk	5 to 6 wk
				Alaska			
Dikegulac	4.0*	14.8*	27.0*	35.5*	95.0*	12.2	8.5
Check	3.1	37.0	48.4	55.2	54.0	11.5	6.7
				Kingfisher			
Dikegulac	5.2**	11.0*	16.2*	20.8*	95.8*	5.3*	4.5
Check	3.3	28.9	37.5	41.7	58.0	8.6	4.2
				Dorothy Gish			
Dikegulac	5.2	10.6*	17.7	23.0	126.6*	6.7	5.4
Check	3.6	24.6	32.3	36.7	76.6	7.6	4.4
				Red Wing			
Dikegulac	5.1*	11.5*	19.6*	26.6*	73.3*	8.2	7.0
Check	3.5	32.0	39.4	44.7	38.9	7.4	5.3

[z]Data from 2 randomly selected shoots per plant, 3 replications.
*,**Significantly different from the check at the 5% and 1% level, respectively.

on all cultivars of dikegulac sodium-treated plants were never the longest, and shoots developing from node 5 were as long as those from node 1. Dikegulac sodium initially exerted a strong inhibitory effect on apical shoot development, thus new shoots initiated from lower node positions. Apical dominance was rapidly restored on sheared plants and resulting new shoots initiated near the shearing point confirming Barrick and Sanderson's work (2).

Total number of new shoots produced by the dikegulac sodium-treated plants exceeded the number produced by the check plants (Table 2) which agrees with other findings (3,4,5,6,8,9,10,11).

Our study indicates that a single 0.5% dikegulac sodium spray on sheared azalea plants does not exert a strong depressive effect on shoot growth. This treatment produces a dense, compact, well-shaped plant because a greater number of shoots, and shoots of similar length, are produced at lower node positions.

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