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Effect of benzyladenine on post-harvest berry drop in Anab-e-Shahi grapes (Vitis vinifera L.)

by

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Cytokinins are one of the six general classes of growth regulators, in addition to auxins, gibberellins, inhibitors, abscisic acid, and ethylene that regulate physiological functions of the plant. They are known to influence protein synthesis and/or degradation. They have been observed to act as mobilizing agents or produce 'sinks' for other endogenous compounds which regulate the physiological functions. Among their other properties, their ability to inhibit or retard senescence (8) is interesting. Senescence and deterioration of certain vegetables have been greatly reduced by their application, especially with N 6-benzyladenine (4, 1, 5). In these cases, either the green colour or freshness was retained for a longer period. In the case of cauliflower, addition of 2,4-D to the cytokinin spray resulted not only in the retention of the green colour but even the leaf abscission was prevented during storage (2). Weaver and his co-workers have worked with cytokinins on grapes and their influences on set and development of berries have been reported (11, 12). Some results of the studies made by the author on the influence of a cytokinin application on post-harvest behaviour of grapes are reported in this paper.

Materials and Methods

The studies were carried out in March 1969 at the Agricultural College, Dharwar, on Anab-e-Shahi grapes. Bunches of uniform size and maturity were selected at random in the College vineyard and tagged. These bunches were sprayed thoroughly with two cytokinin formulations by a baby sprayer on March, 3. The sample of cytokinin, benzyladenine (BA)[1]) used in the experiment was in form of white crystalline powder. The formulation was prepared by slowly dissolving 250 mg of the chemical in 125 ml of ethanol and making the volume to 500 ml by distilled water so as to give a concentration of 500 ppm. The second formulation was prepared by dissolving the calculated quantity of the auxin, alpha-naphthaleneacetic acid (NAA) in the residual solution of the first formulation and the volume is made to have a concentration of 100 ppm each of cytokinin and auxin in the mixture. Both the formulations contained 0.1% Tween-20 as wetting agent.

The treated and untreated bunches were harvested a week after treatment (March, 10) at maturity [14—15% total soluble solids (T.S.S.)]. After cleaning and trimming the decayed and loosely-held berries, 9—11 bunches, weighing between 4.6 and 4.8 kg were placed in the experimental wooden crates (38 cm × 25 cm × 15 cm having aeration slits) in double layers in triplicates under each treatment. However, on account of insufficiency of the treated material, only duplicate crates were used in the case of cytokinin — auxin treatment. These fruit crates were kept in a ventilated room for further studies at room temperature (26—29° C). Every day the intact bunches, dropped and decayed berries in each crates were separated, counted and weighed and these observations were taken for a period of six days. At the close

[1]) The gift sample was kindly supplied by Dr. R. J. Weaver, University of California, Davis, USA.

of the experiment, a 'drop test' was conducted to test the strength of attachment of berries in the bunches. In this test which is similar to the one followed by WEAVER (9), the bunch was dropped on the hard ground surface on its side from the top of a wooden stool, 43 cm high and berries seperated due to impact were counted and weighed. For this test, 3—4 bunches were picked up at random from each replicate-crate and totally ten bunches were collected from each lot. The data on number of berries dropped was analysed statistically and mean percentage data (w/w) are presented in the tables 1 and 2.

Results and Discussion

There was no change in the physical structure of bunches or berries after cytokinin treatment nor any change in soluble solids content. WEAVER had observed pedicel thickening and woody cluster parts when treated at shatter stage (12) and

Table 1

Cumulative percentage of post-harvest berry drop in Anab-e-Shahi grapes treated with cytokinin (BA) and cytokinin plus auxin (α-NAA), a week before harvest

Treatment	Cumulative percent post harvest berry drop (w/w)					After 'drop test'[1])	
	Days after harvest					Berry drop	Effect of growth regulators[2])
	1	2	3	4	5		
Control	0.5	0.7	1.6	6.0	19.1	47.9	100.00
BA 500 ppm	0.5	0.6	1.1	2.2*	5.7**	27.9*	41.75
Mixture containing 100 ppm each of BA and α-NAA	0.0	0.1	0.2	0.4+	0.7+	15.3+**	68.05

[1]) The bunches were dropped from a height of 43 cm upon hard surface.
[2]) Effect of growth regulators on percent reduction of berry drop.
* Significant at 5% level over control.
** Significant at 1% level over control.
\+ Significant at 5% level between treatments.

Table 2

Cumulative percentage wastage due to losses in weight (LW) and decay in Anab-e-Shahi grapes treated with cytokinin (BA) and cytokinin plus auxin (α-NAA) a week before harvest. (Total wastage includes wastage due to berry drop also)

Treatment	Cumulative percent wastage after harvest (w/w)														
	1 day			2 days			3 days			4 days			5 days		
	LW	Decay	Total	LW	Decay	Total	LW	Decay	Total	LW	Decay	Total	LW	Decay	Total
Control	2.4	0.7	3.6	4.1	1.2	6.0	5.8	2.1	9.5	7.3	2.6	15.9	8.2	4.0	31.3
BA 500 ppm	3.5	0.5	4.5	5.3	1.3	7.2	6.8	2.5	10.4	8.4	3.5	14.1	10.2	3.8	19.7
Mixture containing 100 ppm each of BA and α-NAA	2.4	0.3	2.7	4.6	0.5	5.2	6.4	0.6	7.2	8.8	1.1	10.3	10.7	2.0	13.4

development of purple anthocyanin pigment in the rachis (10). There is no indication in these reports whether the thickened pedicels improved the berry adherence.

The mean data on cumulative percentage berry drop are presented in Table 1. For the first three days after harvest, there was no difference in berry drop in different lots. Significant difference was observed after four days in treated and untreated lots as well as within the two treatments. After five days, there was greater upsurge in the magnitude of drop in untreated lots (19.1%), followed by cytokinin treated (5.7%) and cytokinin-auxin treated lots (0.7%). The results of the 'drop test' confirms that the berries in the treated lots were more firmly held than in untreated ones. A closer observation of the detached berries in the treated lots after drop test revealed some interesting features. Berries with intact capstems (pedicel) were found in greater numbers in treated lots than in untreated. When the capstem was pulled from the berry, a greater force was required, especially in the lots treated with cytokinin-auxin mixture. While these observations may provide a strong inference of abscission control, anatomical and phyiological investigations are required to confirm it.

Transformation of the untreated portion of partly treated Black Corinth clusters into either dead or stunted form was attributed to the mobilizing actions of the cytokinin treatment (12). Consistent with the mobilizing action of the chemical, the cytokinin treatment is reported to have induced senescence in the untreated leaves of the bean plant (3). Whether the cytokinin 'mobilized' the natural compounds from adjacent parts of leaves and shoots or retarded the degeneration of endogenous auxins of the bunch postponing the abscission in the present case, is not clear. Addition of NAA to cytokinin spray leading to additional strength in pedicel attachments reveals the marked effect of NAA in grape berry abscission, consistent with the earlier reports (6, 7).

The data on cumulative percent wastage due to physiological losses in weight, decay etc., are presented in Table 2. No significant difference was observed in losses in weight or decay. Berry drop alone contributed greately to the total wastage. Its influence on grape senescence is therefore not clear. Trials with different concentrations are necessary to study this aspect. There is also need to try different combinations with NAA and other auxins.

Summary

Experiments conducted at the Agricultural College, Dharwar, showed that a preharvest spray of benzyladenine (a cytokinin) at 500 ppm significantly reduced the post-harvest berry drop in Anab-e-Shahi grapes. A mixture of 100 ppm α-NAA and 100 ppm cytokinin solution resulted in the least berry drop. The 'drop test' confirmed that the berries were more firmly held in the treated lots than in untreated ones. No marked influence of the chemical on the losses in weight and wastage was observed at this concentration.

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