

## HORTICULTURE

### Effect of Pruning Severity on Fruit Bud Formation, Bunch and Berry Characters in *Anab-e-Shahi* Grapes (*Vitis vinifera* L)

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Preliminary investigations on the fruit bud initiation and differentiation in the variety *Anab-e-Shahi* revealed that under Coimbatore conditions, fruit bud initiation takes place about 45 days from pruning and that at the end of 100 days the differentiation of the inflorescence was complete. The differentiation of the floral parts took place only after bud burst in the subsequent season following pruning (Rajaram *et al*, 1964). A second study was taken up to observe the influence of severity of pruning on the initiation of fruit buds, and on certain aspects of growth, flowering, yield and bunch characters. The results of this study are presented in this paper.

**Materials and Methods:** Eight year old vines of *Anab-e-Shahi* raised on overhead arbours and planted 4.6 m × 6.0 m apart were pruned on 27th November, 1963. Three hundred canes of past season of pencil thickness were selected from two vines and divided into five lots of 60 each. The first lot was pruned very severely to spurs containing one node each and the second lot to three node spurs while the others were pruned to canes containing 4, 5 and seven nodes respectively. Canes thinner than a pencil as well as weak canes were pruned to one or two nodes. The vines received normal cultural and manurial treatments. The same treatments were repeated in the second season in July, 27th, 1964.

Axillary buds were collected from the first, third, fifth, seventh and ninth nodes of selected shoots on the 45th, 60th, 75th, 90th and 105th day after pruning. The shoots arising from the terminal node of the previous season's cane were selected. Buds were killed and fixed in Formalin acetic alcohol and stored. At the time of processing, they were washed in tap water and distilled water and passed through increasing concentrations of alcohol upto 70 %. The woody base was removed as far as possible by trimming and dissecting under a stereo-microscope to remove scales, tomentose hairs and accessory buds, leaving the primary bud alone for examination. This was further dehydrated in gradual ethyl alcohol series, infiltrated in chloroform and embedded in paraffin wax (52°-53° F congealing point). Longitudinal sections of 12 microns thickness were taken with a Spencer's rotary microtome. Staining was done with Delafield's Iron Alum Hamatoxylin.

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Data were also recorded on the bud burst, rate of growth of shoots, inflorescence counts, bunch and berry characters with reference to the influence of pruning severity.

*Results: Buds collected on the 45th day:* Buds collected on the 45th day showed only alternating leaf primordia. At this stage no difference was discernible among the pruning treatments.

*Buds collected on the 60th day:* In any given pruning treatment, the different nodal positions showed different stages of development. Basal buds were found to differentiate reproductive parts earlier. Buds from nodes one, three and five from all the pruning treatments showed post-initiation development *viz.*, development of shoulder-like protruberances suggestive of inflorescence or tendril primordia. The 7th and 8th nodes revealed only a flattening of the growing point which is a stage characteristic of the beginning of flower bud initiation.

On the 60th day, flower bud initiation had been completed in all the basal buds from different treatments. Under the most severe pruning treatment, the development was also slightly advanced as could be noticed from the bract formed in a bud from the third node and three growing points in the bud from the fifth node. On the other hand, buds from the same nodal positions in the other treatments at this stage showed only the undifferentiated shoulders or protruberances. This suggests that the most severe pruning might have hastened flower initiation by probably 5 to 10 days.

*Buds collected on the 90th day:* At this stage, all the buds under the different treatments showed similar development. The inflorescence primordia had developed numerous growing apices and were easily distinguishable from the tendril and transitional forms. No difference was noticed between the most severe and least severe forms of pruning.

*Buds collected on the 105th day:* The primordia had attained their full development with numerous growing points projecting considerably beyond the apex of the bud. In all the pruning treatments, the initials of the inflorescence had developed fully by the 105th day. The severity of pruning did not appear to influence the time of initiation of the flower primordia.

*Effect of pruning severity on bud burst, shoot growth, flowering, fruiting etc.:* In both the seasons, the lightest pruning (seven nodes) appears to have reduced the percentage of bud burst while the highest percentage of burst was recorded in the four-bud treatment. A slight delay of 3 to 4 days was noticed in the least severe (7 node) treatment, in comparison to the most severe treatment (one node).

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*Growth rate of shoots:* The less severe pruning (5 & 7 buds) appear to have promoted growth, as revealed by the longer shoots than the severe treatments. While the treatments differed slightly in the rate of growth in the initial stages, they tended to even out as growth progressed. At the end of 105 days, the shoots in the 5 and 7 node treatments, had produced longer shoots than the other treatment (Table).

TABLE. *Length of shoot, number of inflorescences, bunch weight and berry weight in pruning treatments (Mean values)*

i. No. of days from pruning	Average length of shoots (cm)					SE	CD
	Number of nodes per spur						
	One	Three	Four	Five	Seven		
45	84.6	82.1	102.7	110.0	98.0		
60	97.3	89.2	145.4	177.1	180.4		
75	125.1	131.0	165.3	188.0	189.3		
90	163.2	166.0	176.7	196.3	195.0		
105	176.5	181.3	193.0	209.2	203.1		
ii. No. of inflorescences							
I Season	31	27	50	50	71		
% of inflorescence to the total	13.5	11.3	21.8	21.8	31.1		
II Season	2	5	9	17	18		
% of inflorescence to the total	4.2	10.4	18.8	29.1	37.5		
iii. Bunch weight (g)							
I Season	348.4	405.9	585.0	601.5	702.5	37.8	108.5
No. of berries per bunch	48.7	49.3	83.3	119.7	164.6	17.8	52.5
Weight of each berry (g)	7.3	6.4	6.5	6.5	6.5	1.5	4.5

*Number of inflorescences:* In both the seasons, the 7-node treatment had yielded the maximum number of inflorescences followed by the four and five node treatments (Table). Very severe pruning to one and two nodes was found to result in the reduction of flowers to the extent of 8 to 14%. Flowering in the second season (May - September, 1964) was nearly five times less than that in the first season (November 1963 to March, 1964).

*Bunch and berry characters:* The average weight of bunch was found to increase progressively as the pruning severity decreased. (Table). For instance, the average weight of bunch in the one node treatment was 348.4 g while it was 405.9, 585.0, 601.5 and 702.5 g respectively in the 3, 4, 5 and 7 node treatments. The last two did not differ significantly from each other, as also the 4 and 5 node treatments. These two treatments were significantly better than the 3 and one node treatments which between themselves did not differ significantly.

It was also noted that except in one instance the 7-node treatment had yielded heavier bunches than all other treatments. The 5-node treatment yielded heavier bunches in six out of ten cases than the spurs containing less than 5 nodes. The 4-node spurs scored over the 3-node spurs in nine out of 10 cases. Likewise, the 3-node spurs proved better than the 1-node spurs in 7 cases out of ten.

In regard to the weights of the heaviest bunch under each treatment, it was again observed that the heaviest bunch was borne under the 7-node treatment, followed by the 5 and 4-node treatments. Between the 1 and 3-node treatments, however, the former was the better of the two. It was also interesting to note that the smallest bunch under the 7 and 5-node treatments weighed 330 g and 300 g respectively as against 160 g and 200 g in the other treatments. The wide disparity in the average bunch weight between the one-node and the 7-node treatments was also clear. The bunch weight in the latter was more than double that of the former. Similar differences were recorded in the other treatments indicating generally the heavier bunches in the less severe pruning treatments. The less severe pruning thus contributed towards production of heavier bunches.

**Bunch size:** As in the case of bunch weight there was a progressive increase in the size of the bunch with the decrease in pruning severity.

**Number of berries:** The number of berries increased with the decrease in severity of pruning (Table). As in the case of bunch weight, bunches in the 7-node treatment contained significantly large number of berries than the 4, 3 and one node treatments while being on a par with the 5-node treatment. The latter while on a par with the 4-node treatment, was significantly higher than the 3-node and one node treatments. Among the 1, 3 and 4-node treatments, the differences were not significant. It was also noted that the number of berries borne in the 7-node treatment is more than 3 times that of 1 and 3-node treatments and double that of the 4-node treatments and about 1½ times that borne on the 5- node cane.

**Berry weight:** The average weight of individual berry showed a decrease with the decrease in the severity of pruning. Berries in the one node treatment were significantly heavier than those under the other treatments. The difference among the latter was not significant *vide* Table.

**Berry size:** The mean berry size as in the case of weight was found to decrease with the decrease in pruning severity.

**Number of seeds per berry:** Pruning severity did not influence the number of seeds per berry. The average seed content ranged from 2.8 to 2.9 per berry.

**Quality:** The difference in the total solids content was only 0.40% between the most and the least severe pruning treatments.

**Discussion:** The present study has shown that the level of pruning does not influence fruit bud initiation although there were indications of earlier initiation in the hard pruned vines (one-node treatment). May and Antcliff (1964) have also reported that pruning severity exerted no influence on fruit bud formation in the Sultana. Micklem and Wiggans cited by Gardner *et al* (1952) have likewise found that pruning did not influence the time of initiation.

If fruit bud initiation is a process unaffected by pruning severity, the difference in yields can only be ascribed to other factors such as the amount of bud burst and the ability of some nodes to give rise to multiple shoots, some of these shoots in turn producing more than one cluster *etc.* The current season's spur or cane, though capable of producing a bunch or two from each node has certain definite nodal positions which are relatively more fruitful. The production of an adequate number of shoots from these fruitful positions is a necessary prerequisite for satisfactory cropping.

In the grape, each bud has been found in this study to enter the reproductive phase between 45 and 60 days after pruning. At this time, if the leaf subtending the bud is healthy, possessing the optimum C/N balance plus the necessary 'flowering stimulus', the flower bud is encouraged. On the other hand, if the balance is disturbed, say, due to an overabundance of nitrogen there is possible tendency to vegetativeness. The work of Magness on young apple trees cited by Gardner *et al* (1952) indicates that accumulation of carbohydrate in the immediate vicinity of the buds is favourable for fruit bud differentiation. It is also suggested that this accumulation takes place where there is greater effective leaf area, *i. e.*, within limits, those spurs which have the largest and best lighted leaves accumulate the largest reserves of carbohydrates and differentiate the most fruit buds. The barrenness of lower buds is attributed to the poorly lighted condition and smaller amounts of elaborated food.

Barnard and Thomas (1933) stated that early cessation of elongation of growth in the shoots was favourable for the accumulation of starch in the wood and consequently conducive to the differentiation of inflorescence primordia. They suggest that any pruning method practised should allow for the cessation of growth during this critical period. This suggestion serves to emphasise the need for limiting growth activity to the minimum at the time of fruit bud initiation. In this study, the less severe treatment of four to seven nodes resulted in a rapid growth initially followed by a slowing down of the growth rate until the 90th day. In the severe pruning treatment, the growth rate was slow to begin with and very rapid between the 60th and 90th day *i. e.*, at the

time of fruit bud initiation. This is undesirable and is probably the reason why fewer of inflorescences were initiated under the severe treatments. Under South Indian conditions, no definite dormant period exists and growers could at best withhold irrigations, refrain from fertilizer applications and other growth inducing treatments at this crucial time. Pinching of the terminals may also help.

The role of flower inducing endogenous hormones, phytochrome, histo-chemical changes connected with nucleic acid metabolism, auxins, anti-auxins, inhibitors, gibberellins *etc.*, in influencing the change-over from the vegetative to the reproductive phase has yet to be studied and the switch over from the vegetative to the reproductive phase cannot be sought to be attributed to any single factor.

The least severe pruning treatment (7 nodes) appeared desirable from the point of view of flower production, yield, size and weight of bunches, and number of berries *etc.* The size of the berries has, however, suffered somewhat in this treatment but it was not serious enough to affect the marketability of the bunches. These observations are in agreement with those of Colby and Tucker (1933). The quality of the berries was also not influenced appreciably by the pruning severity.

**Summary :** The influence of pruning vines of *Anab-e-Shahi* to four levels of pruning severity (with past season's canes pruned to one, three, four, five and seven nodes) was studied with particular reference to the fruit bud initiation. It was found that fruit bud initiation was not influenced by the degree of severity of pruning. The size of the spur or cane seemed to have no bearing on the course of fruit bud formation. Flowering, yield, bunch weight and size, and number of berries per bunch were higher in the less severely pruned vines (7-node). Berry size was the highest in the 1-node treatment. There was no appreciable difference in the quality of the berries under the different pruning treatments.

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