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EFFECT OF DEFOLIATION ON MATURITY AND RIPENING IN GRAPES

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The influence of leaves on fruit set in grapes was known as early as 1883. Numerous workers studied the influence of leaf area on fruit set in grapes (Shrader 1932, Branas and Levodoux 1946, Rai 1950, Coobbe 1959, 1962, Mohanakumaran 1963). Translocation of photosynthates from the leaves in grapes were found to depend upon the stage of development of the leaves (Hale and Weaver 1962). Total defoliation of shoots and removal of leaves below the clusters resulted in the production of large number of seedless berries in seeded varieties of grapes (Aravindakshan 1968). Besides yield, the leaf area influenced the colouration of the berries (Winkler 1930, Shrader 1932, Cross and Webster 1934, Oinoue 1940, Winkler 1958). Further, excessive reduction of leaf area resulted in the failure of berries to ripen and in the reduction of berry size (Masahib-ud-din 1941 and De'Freitas 1947).

In defoliation experiments aimed at ascertaining the influence of leaves on the development of grape berries, the leaves retained on the shoots are generally fixed in terms of number of leaves and leaf area. Nikiforova (1957) observed retardation in the growth and ripening of berries, due to removal of leaves above the clusters. This suggests the positional effect of leaves on grapes. No objective studies have been made to ascertain the influence of leaves on the grape berries in relation to their position on the shoots. The present studies were therefore carried out to find out the effect of removal of leaves from the different portions of the shoots in relation to the cluster position and at different stages of development of berries, on the maturity and ripening of the bunches.

Material and Methods

Five varieties of grapes viz. Anab-e-Shahi, Bangalore Blue, Black Prince, Muscat and Habshi grown in the College Orchard, Agricultural College and Research Institute, Coimbatore, were selected for the studies. The different treatments given to the shoots were as given in Table 1.

The treatments were given at three stages viz., at pre-bloom (4 to 5 days before bloom), at fruit-set (immediately after calyptra fall) and at *veraison* (beginning of the ripening of the berries).

Thirty shoots of uniform size and age were selected from the current season shoots in each treatment under each variety. In each of the selected shoots, only one cluster was retained. In all the treatments involving defoliation, leaves other than

those required were removed as and when they emerged. The axillary buds which were activated due to the treatments also were nipped off. The spurs from which the shoots arose were girdled just at the origin of the shoots as suggested by Nikiforova (1957).

The bunches were considered ripe, when they recorded the minimum total soluble solids fixed for that variety by earlier trials. The duration from pruning to maturity was recorded in each case and the mean duration calculated for each treatment. In cases of irregular ripening of berries, harvest was done when the majority of berries in a bunch were ripe, and just before the earlier ripened berries started shrivelling or rotting.

Results

The data presented in Table I show that removal of leaves from the shoots at all the stages significantly delayed the maturity of bunches, the influence being more pronounced when defoliation was done at pre-bloom. When shoots were completely defoliated, the berries remained unripe for a longer period than in any other treatment. In Anab-e-Shahi, total defoliation of shoots at pre-bloom resulted in a delay in ripening by 20 days while the same treatment at fruit-set caused a delay by 16 days. Defoliation at *veraison* in this variety delayed the ripening by four days. The treatment which had the maximum influence in delaying the maturity next to total defoliation was removal of leaves below the cluster. Here again the treatment had the maximum effect when given at pre-bloom. The removal of leaves above the cluster had little influence even when done at pre-bloom. At fruit-set and *veraison* this treatment had only negligible influence in delaying the fruit maturity. Similar trends were noticed in all the other varieties. Among the different varieties the maximum influence due to removal of leaves was manifested in Anab-e-Shahi, followed by Habshi and Bangalore Blue; it was least in Muscat and Black Prince.

It was interesting to note that as different from the other treatments, shoot tipping induced earliness in ripening, when done at pre-bloom and fruit-set; it had very little effect when done at *veraison.*

Table 2 gives the results of the treatments repeated at the pre-bloom stage. It will be seen that the data confirmed the earlier observation.

The results presented above show that removal of leaves from the shoots resulted in delaying the maturity of the grape bunches irrespective of whether the defoliation was done at pre-bloom, set or *veraison.* The maximum effect was observed when the shoots were totally defoliated, followed by the removal of leaves below the cluster. The delaying effect on the maturity was less pronounced when the defoliation was done at a later stage of berry development as at *veraison.* These observations are in general agreement with those of De Freitas (1947) that if the leaf area was excessively reduced, the berries failed to ripen and became undersized and those of Musahib-ud-din (1941) that the berries ingrapes remained green for alonger period when leaves were removed from the shoots.

The 'position effect' of leaves on berry development observed in earlier trials (Aravindakshan 1968) has been confirmed in the present studies. Thus removal of

leaves below the cluster was inhibitory to berry growth and maturity and this inhibition was as bad as total defoliation. On the other hand removal of leaves above the cluster was only slightly inhibitory and in many cases even negligible in effect. The results thus indicate that the influence of leaves, especially those below the clusters in grapes is not restricted to the early stages of development of fruits alone, but extended even upto the period of maturity and ripening. It is possible that leaves especially the mature ones act as donor tissues for sugars and acceptor tissues for organic acids to a considerable extent. Peynaud and Maurie (1958) followed the synthesis of tartaric and maleic acids in grapes and found that while the leaves maintained acidity, the fruit was

Table 1

Effect of defoliation and shoot tipping at different stages of development of berries on the duration for maturity in different grape varieties

Treatments	Mean duration from pruning to harvest (days)				
	Anab-e-Shahi	Bangalore Blue	Black Prince	Muscat	Habshi
at pre-bloom					
Complete defoliation	150	140	140	136	140
Defoliation below cluster	146	140	136	128	138
Defoliatian above cluster	134	130	124	126	136
Shoots tipped	124	124	110	120	130
Control-No treatment	130	128	116	125	130
at set					
Complete defoliation	146	138	138	130	136
Defoliation below cluster	134	138	118	126	130
Defoliation above cluster	132	130	118	126	330
Shoots tipped	128	126	112	120	128
Control-No treatment	130	128	116	125	130
at **veraison**					
Complete defoliation	134	134	118	128	134
Defoliation below cluster	130	330	116	128	134
Defoliation above culster	130	130	116	125	130
Shoots tipped	128	128	112	125	130
Control-No treatment	130	128	116	125	130

	S. E.	C. D.
Between varieties	1.0	2.0**
Between stages	0.7	1.4**
Varieties X stages	2.2	4.5*
Treatments X stages	1.7	3.5**

** Significant at 1% level
* Significant at 5% level

Table 2

Effect of defoliation and shoot tipping at pre-bloom on the duration for maturity in different varieties of grapes

Treatments	Mean duration from pruning to maturity (days)				
	Anab-e-Shahi	Bangalore Blue	Black Prince	Muscat	Habshi
Complete defoliation	128	128	130	112	112
Defoliation below cluster	126	124	129	112	112
Defoliation above cluster	120	112	108	110	110
Shoots tipped	110	110	100	100	100
Control—No treatment	114	110	106	105	105

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deacidified. They also found that tne organic acids accumulated in the leaves as the fruits matured. The leaves below the clusters in grapes are thus established as efficient sources of metabolites to the developing berries.

Summary

The number of leaves present on the shoots and their position in relation to the cluster influenced the maturity and ripening in grapes. Removal of leaves from the shoots retarded the maturity of bunches, this effect being pronounced if the treatment was done at pre-bloom and less effective if done at the advanced stages of maturity of bunches. Total defoliation retarded the maturity of the bunches to the maximum closely followed by defoliation below the clusters. Defoliation above the clusters did not have any significant effect. The leaves below the cluster seemed to play an important role in controlling the biochemical changes taking place in the berries during their development and maturity.

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