

Annual radial growth cycle of grapevine trunk in the tropics¹⁾

by

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Der jährliche Wachstumszyklus der Stammdicke von Reben in den Tropen

Zusammenfassung. — Die Rebensorte Anab-e-Shahi (*Vitis vinifera*) wird in den Tropen jährlich zweimal geschnitten. Der jährliche Wachstumszyklus der Stammdicke unter diesen Bedingungen wurde untersucht. Obgleich die Reben kontinuierlich — ohne jede Ruheperiode — wachsen, wurde durchweg von April bis September ein maximaler Zuwachs des Stammumfanges und von Oktober bis März nur ein unbedeutendes Dickenwachstum festgestellt. Die jährliche Zuwachsrate des Stammumfanges war beim jungen Weinstock hoch; später nahm sie ständig ab. Weitere Untersuchungen zur Physiologie des Wachstums und der Fruchtentwicklung von Reben unter tropischen Bedingungen, d. h. ohne Zwischenschaltung einer Ruheperiode und modifiziert durch zweimaligen Rebschnitt, sind erforderlich.

Introduction

In contrast to subtropical and temperate grape-growing areas of the world, the grapevines in western and southern India grow continuously the year round and do not exhibit any distinct dormancy. The vines are pruned twice a year, once in October for fruiting and once in April for development of fruiting canes for the next season. BAMMI and RANDHAWA (1968) reported that by pruning twice a year the two basic functions of the vine viz. (1) the maturity of the fruit and (2) the differentiation of the fruit buds and maturity of the wood for the next crop have been separated and are performed independently of each other. This is in contrast to the growth conditions in the temperate zones where the maturity of both fruit and wood for next year's crop must be achieved at the same time. Although grape culture is of commercial importance in south India, very little information is available on the annual growth cycle of shoot, trunk and root as modified by continuous growing conditions and two prunings in a year. This paper presents results of annual radial growth cycle of grapevine trunk in the tropics.

Materials and methods

The experiment was conducted on 96 own-rooted vines of *Vitis vinifera* var. Anab-e-Shahi planted on 1st April, 1970, at the Horticultural Experiment Station, Hessaraghatta, Bangalore. Bangalore is situated on 12.58° N and its mean monthly

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weather attributes are summarized in Table 1. As per the commercial practice of the region, the vines were pruned twice a year. In October the matured fruiting canes were spur-pruned to 5 buds. The crop was harvested in the second and third week of March. The fruited canes with their growths were pruned back to a single bud in the first week of April. The vines were irrigated at weekly intervals during the dry period. The trunk circumference was measured on 1st April and 1st October each year for four years (1971—75) on a fixed colour band marked 30 cm above the ground level. The mean girth increments from April to September and October to March were compared by Student's "t" test.

Results

It is clear from Table 2 that in all the years the maximum radial growth of trunk took place from April to September, while negligible growth was recorded from October to March. Secondly, the rate of girth increment showed rapid increase up to September, 1972, (2½ year of vine age) followed by steady decrease. Except for the difference between girth increments from October, 1972, to March, 1973, and from October, 1973, to March, 1974, all other differences were highly significant ($P = 0.01$) as tested by Student's 't' test.

T a b l e 1

Mean monthly temperature, relative humidity and rainfall at Bangalore (1971-75)
Monatsmittelwerte der Temperatur, der relativen Luftfeuchtigkeit und der Niederschläge in Bangalore (1971-75)

Month	Temperature (°C)		Rel. humidity (%)		Rainfall (mm)
	Max.	Min.	Max.	Min.	
April	34.6	21.9	71.6	28.0	12
May	32.9	21.1	77.3	46.3	95
June	29.1	19.9	83.3	60.3	64
July	27.7	19.5	90.0	66.3	159
August	26.6	19.3	91.3	70.4	126
September	27.3	19.2	90.6	68.0	302
Mean	29.7	20.9	84.0	56.5	758 ¹⁾
October	26.9	19.0	87.6	69.0	164
November	26.9	16.5	74.6	55.0	59
December	26.0	14.7	78.0	48.0	11
January	27.6	14.7	78.0	34.3	0
February	31.1	16.7	72.6	29.3	3
March	32.9	19.2	58.3	23.0	0
Mean	28.5	16.8	74.8	43.1	237 ¹⁾

¹⁾ Total rainfall during 6 months.

T a b l e 2

Mean girth increment in the tropical grapevine var. Anab-e-Shahi during non-fruiting (April to September) and fruiting season (October to March)

Mittlerer Stammzuwachs der tropischen Rebensorte Anab-e-Shahi von April bis September (keine Trauben) und von Oktober bis März (Zeit der Fruchtbildung)

No.	Period	Girth increment (cm)
1	1st April to 30th September, 1971	3.90
2	1st October, 1971, to 31st March, 1972	0.33
3	1st April to 30th September, 1972	5.07
4	1st October, 1972, to 31st March, 1973	0.64
5	1st April to 30th September, 1973	4.24
6	1st October, 1973, to 31st March, 1974	0.68
7	1st April to 30th September, 1974	2.64
8	1st October, 1974, to 31st March, 1975	0.37

The Student "t" values (calculated) for comparison of above means are:

$t_{1,2} = 40.49^{**}$	$t_{4,6} = 0.56$ NS
$t_{1,3} = 9.30^{**}$	$t_{5,6} = 49.27^{**}$
$t_{2,3} = 69.72^{**}$	$t_{5,7} = 17.57^{**}$
$t_{2,4} = 5.95^{**}$	$t_{6,7} = 22.23^{**}$
$t_{3,4} = 50.25^{**}$	$t_{6,8} = 4.66^{**}$
$t_{3,5} = 9.26^{**}$	$t_{7,8} = 26.62^{**}$
$t_{4,5} = 48.84^{**}$	

** : Significant ($P = 0.01$).
NS: Not significant.

Discussion

Although vegetative growth in tropical grapevines is continuous throughout the year, the present study showed that there is a consistent pattern of maximum radial trunk growth from April to September (non-fruiting season) alternating with negligible growth from October to March (fruiting season). In the northern areas of grape production the grapevines begin growth at 8 °C (POENARU and LAZARESCU 1959). In the present study the maximum and minimum mean monthly temperatures for the period April to September (Table 1) were favourable for growth and well above the limits suggested by BUTTROSE (1969), who reported that in controlled environment growth cabinet no grape variety grew well below 20 °C and most of them reached optimum growth at about 25 °C. Also, 76 % of annual precipitation was received in this period and the mean relative humidity was 70 %. Thus, the climatic factors were very favourable for maximum trunk growth from April to September. Secondly, since no crop was borne in this period, the photosynthates and food reserves were utilized mainly for growth.

The negligible girth increment from October to March was due to lower minimum temperatures from November to February (Table 1) and also due to diversion of food reserves mainly for flowering and maturation of fruit. About 24 % of annual rainfall was received during this period and the mean relative humidity was 58.9 %. Thus, climate was less favourable for growth. The pattern of radial trunk growth in this study was influenced by the management (pruning, cropping) and climate.

The data also revealed that the rate of girth increment depends on age and juvenility of vine. The rate of girth increment showed rapid increase up to 2½ years (September, 1972) followed by steady decrease because the permanent framework of the vine on bower was completed by that time and the vines started yielding commercial crops from third year.

Summary

The annual radial trunk growth cycle in *V. vinifera* var. Anab-e-Shahi was studied in the tropics where the vines are pruned twice a year. Although vines grow continuously without any period of dormancy, a consistent pattern of maximum girth increment from April to September alternating with negligible increment from October to March was observed. The rate of annual girth increment was high during juvenile period and steadily decreased later. There is further need to study the physiology of growth and fruiting of tropical grapevines under conditions of non-dormancy as modified by two prunings in a year.

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