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Effect of Different Rootstocks on Fruitfulness in Thompson Seedless (*Vitis vinifera* L.) Grapes

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Abstract: In recent years, many grape gardens have been raised on rootstocks particularly in peninsular India due to the shortage of irrigation water and salinity in the soil. There is still apprehension in the grape growers mind that which rootstock has more beneficial effects with respect to sustainable yield and quality and also the longevity of the vine. Thompson seedless was grafted on Dog Ridge, 110R, 99R, 1613C, St. George and Salt Creek and was compared with own rooted Thompson seedless for bud fruitfulness. The results revealed the significant differences with respect to rootstock and bud position. Among the different rootstocks, general performance of the and also the microscopic studies showed that the rootstock 110R can be the alternative to the present Dog Ridge rootstock which is popular among the grape growers of Maharashtra.

Key words: Thompson seedless, own root, rootstocks, bud fruitfulness, shoot length, cane diameter

INTRODUCTION

Grape is one of the major important commercial fruit crop grown in the country for table, raisin, wine and juice purpose. Yield is directly dependent on the fruitfulness of the variety. Fruitfulness of any variety is of considerable importance in viticulture as it has direct bearing on productivity of vines[1]. Fruitfulness is the quantitative measure of the potential of a vine to produce fruit. Fruitfulness is the consequence of the transformation of vegetative primordial into reproductive primordial[2]. The fruit in the form of inflorescence primordial estimated before or after bud burst. After the bud burst estimation of fruitfulness is often expressed as percent fruitful shoots and is defined as the percentage of nodes producing shoots at which at least one shoot is fruitful[3]. A shoot is considered to be fruitful when it carries one or more inflorescence[4]. Early steps in the reproductive cycle of grapevine include induction and subsequence initiation of inflorescence in the season proceeding flowering and development of fruit[3]. The induction appears to be a pre-requisite for successful inflorescence initiation[5,6].

Different varieties behave differently for fruitfulness depending on environment, training system and position of shoot, pruning time etc. Newer cultural practices such as use of rootstock leading to dense canopy may inhibit the successful induction and initiation of inflorescence and cause a decline in fruiting potential[3]. Rootstock vary in their root characters in terms of root density, root length etc. As cytokinin is known to synthesize in root tips and has a role fruit bud differentiation, different rootstocks are known to influence fruit bud differentiation through their endogenous cytokinin synthesis capacity. Since the use of rootstock in grape cultivation is of recent origin, the information on Thompson seedless grafted on different rootstock for bud fruitfulness is scanty. The present investigation was therefore, carried out to study the effect of different rootstocks on fruitfulness in Thomson seedless grapes.

MATERIALS AND METHODS

The experiment was conducted at the Research and Developmental farm of National Research Center for Grapes, Manjri farm, Pune during the year 2002- 2003 with an objective of generating the information on fruitfulness with respect to different rootstock. Four year old vines of Thompson seedless grafted on different rootstock viz., Dog Ridge, 110R and 99R and 1613C, St. George, Salt Creek and Thompson seedless as a scion on its own root were selected for study. The vines were spaced at 10' ×6' distance and trained on flat roof gable system of training. All the vines received uniform cultural practices during both the pruning time in a year. The experiment consisted of rootstock treatments and 7 bud positions (4-10 bud testing) starting from 4th to 10th bud on a cane. After April pruning the shoot thinning was done at 4-5 leaf stage and vigorous shoots were retained. At maturity stage the cane diameter was recorded at 4th to 5th inter nodal distance position with the help of vernier caliper.

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The data on number of canes per vine was recorded at cane maturity stage, while number of fruitful canes and bunches/vines were recorded under field condition after bunch emergence during October. To study the bud fruitfulness of cane under microscope, the matured and uniform canes from each rootstock were selected. The bud at each position was dissected by cutting at half position with sharp blade and examined under stereo binocular microscope. The primordial visible under microscope were categorized into flower primordial and vegetative buds. The data was analyzed statistically by Panse and Sukhatme[7].

RESULTS AND DISCUSSION

Shoot characters of different rootstocks: Among all the rootstock studied, significant differences were recorded for growth characters (Table 1). The cane diameter ranged from 7.04 to 8.18 mm on different rootstock as compared to 6.44 mm in own rooted Thompson seedless. Maximum cane diameter was recorded in Dog Ridge rootstock 8.18 mm followed by 7.74 mm in 110R rootstock. Maximum cane thickness generally results in enough reserve of food material stored in the cane to nourish the bunch after forward pruning. Significant differences were recorded for inter nodal length among the rootstocks. The inter nodal length ranged from 5.15 to 7.03 cm. Minimum inter nodal distance of 4.46 cm was recorded in own rooted Thompson seedless as compared to 7.03 cm in Thompson seedless grafted on Salt Creek. Among the rootstock, minimum inter nodal distance was recorded on Thompson seedless on 110R rootstock. Maximum shoot length 105.80 cm was also recorded on Thompson seedless grafted on Salt Creek as compared to minimum shoot length of 60.50 cm on 1613 C rootstock. However, Thompson seedless on its own root imparted less shoot length of 47.88 cm. This has also got minimum inter nodal length of 4.46 cm.

Table 1: Growth performance of Thompson seedless grafted on different rootstocks

Rootstock	Cane diameter (mm)	Shoot length (cm)	Inter nodal length (cm)
Dog Ridge	8.18	94.21	5.50
99 R	7.29	62.27	5.69
110R	7.74	74.57	5.15
613-C	7.04	60.50	5.69
St. George	7.39	73.97	5.50
Salt creek	7.09	105.80	7.03
Own root	6.4	47.88	4.46
SEM±	0.17	4.03	0.16
CD at 5%	0.53	12.44	0.51

Fruitfulness and different rootstock: Among the different rootstocks, the fruitfulness was minimum in basal bud (4th bud) studied. However, maximum fruitfulness was recorded in own rooted Thompson seedless grapes at 5th bud position (Table 2). These results are in confirmation with Reddy and Prakash[1]. Maximum bud fruitfulness was recorded at 10th bud position than the lower basal buds. In Thompson seedless grafted on Dog Ridge rootstocks, maximum bud fruitfulness of 97.93% was recorded at 11th bud followed by those on 110R (86.45%). Fruitfulness per node along the cane followed a well-established trend (Table 2). Bud fruitfulness was close to zero in basal nodes but increased steeply thereafter reaching a maximum between node 8 and 10[8]. Low fertility of basal bud is common in many varieties in vigorous situation[9].

The trends in fruitfulness along canes followed a well-established pattern that was first described by Ant cliff and Webster[4]. In the present study, the bud fruitfulness declined steeply beyond the 10th node position among all the different rootstocks. The bud fruitfulness declined steeply beyond the 15th node position. In 1613C and St. George rootstock, maximum bud fruitfulness was recorded at 6th node position followed by 10th bud position beyond which the fruitfulness reduced steeply[4]. These results are in accordance with the findings of Reddy and Prakash[1].

Table 2: Effect of bud position on fruitfulness in Thompson seedless grafted on different rootstocks

	Bud position								
Rootstock	4th	5th	6th	7th	8th	9th	10th	11th	Mean
Dog Ridge	26.83	53.74	46.47	60.33	33.24	26.47	80.09	97.93	53.14
99R	40.13	46.81	80.68	33.31	26.69	33.80	73.82	40.75	47.00
110R	40.23	40.33	60.52	73.11	60.36	60.42	73.59	86.45	61.88
1613C	20.36	33.55	60.39	40.70	46.68	26.57	53.09	40.33	40.22
St. George	20.10	40.33	80.33	46.75	40.36	46.58	73.43	40.49	48.54
Salt creek	26.65	40.16	73.47	53.74	39.99	33.24	66.26	40.01	46.69
Own root	73.73	81.00	73.77	46.51	53.81	40.79	66.57	40.01	59.52
Mean	35.43	47.99	67.95	50.65	43.02	38.26	69.55	55.14	

	Rootstock	Bud position	Rootstock X Bud position
SEM±	0.40	0.42	1.13
CD at 5%	1.12	1.20	3.17

The means of the bud fruitfulness of Thompson seedless on all the rootstock (except on 110R) had lower value as compared to own rooted Thompson Seedless. Regardless of trellis and node position, fruitfulness of Ramsey grafted vines was always lower than that of own rooted vines[10]. In the situation when the scion was grown on its own root, the fruitfulness was maximum in all the bud position starting from 4th to 11th bud compared to the scion on different rootstocks. As most of the rootstocks are known to induce more vigorness in grafted scion varieties, it may lead to reduced bud fruitfulness. But, own rooted varieties were known to have less vigor, thus recording maximum fruitfulness. The present study is in confirmation with earlier findings of Sommer *et al.*[8]) who reported on the circumstantial evidence that vine vigor is inversely proportional to vine fruitfulness.

Fruitfulness and bud position: The means of the bud position starting from 4th to 11th from the base of the cane of Thompson seedless grafted on different rootstocks revealed that highest bud fruitfulness was recorded at 10th bud position followed by 6th bud position. These results are in conformity with the results of Stayanarayana[11] who reported the most fruitful buds in the middle portion of the canes (5 to 7 bud position). The proportion of fruitful buds towards the middle cane increases progressively and falls of towards distal end[4]. Minimum bud fruitfulness was recorded at basal bud (4th bud). The bud fruitfulness was progressed in the subsequent bud and was recorded maximum at 6th bud position (67.95). However, the reduction of bud fruitfulness was recorded at 8th and 9th bud position and again maximum bud fruitfulness was recorded at 10th bud position. Favorable effect of rootstock on bud fruitfulness have also been observed in different grape varieties i.e., 99 R for Souvignon Blanc[12], 1613C for Greenache[13], Salt Creek for Sultana[14].

Some of the rootstocks are known for imparting the vigor in the vine as compared to the own roots. Higher vigor in the rootstock may results into excessive vegetative growth, which ultimately leads into shading effect of the shoots. Such canopy may become hindrance for receiving uniform sunlight on every bud on that cane. Among the different rootstocks, the general performance of vine and also microscopic studies, the preliminary studies shows that the rootstock 110R can be an alternative to the present Dog Ridge rootstock which is popular among the grape growers of Maharashtra.

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