

**RESEARCH ARTICLE :**

## Effect of different rootstocks on raisin recovery and acceptability of commercial grape varieties

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**SUMMARY :** An experiment was conducted during 2013-14 in the experimental vineyard of Grape Research Station, Rajendranagar, Hyderabad to study the effect of different rootstocks (1103 P, SO<sub>4</sub>, Dog ridge) and own root as a control on raisin recovery and acceptability of raisins with the parameters viz., recovery of raisins, average weight of raisins, moisture and organoleptic evaluation (colour and appearance, flavour, taste, texture and overall acceptability) of raisins. Among the rootstocks, Dog ridge performed well with respect to recovery of raisins and taste, whereas 1103 P performed well with respect to colour and overall acceptability of raisins. Among the varieties, Thompson Seedless showed more percentage of raisin recovery with best score for colour, taste and overall acceptability.

**KEY WORDS :**

Grape, Rootstocks, Varieties, Raisin recovery, Organoleptic evaluation

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### **BACKGROUND AND OBJECTIVES**

Raisin, which is a dry seedless grape, is the second most important product of grape vine. In India, though grapes are primarily used for fresh consumption, in recent years. Production of wine and raisins are becoming popular. Quality of raisins are determined to a greater extent by the raw material or the variety used, its composition and maturity or stage of harvest since grape is a non-climacteric fruit. Therefore, apart from seedless, the variety should have very high TSS, preferably greater than 20-22°Brix, moderate to low acidity, thin skin, crispy pulp,

small sized and round to oval shaped berries.

With increased awareness about the use of rootstocks in overcoming the adverse effects of drought and salinity, growers started using rootstock for the cultivation of grapes. Large quantities of fresh seedless grapes being dumped in the markets during peak season can be used in processing such as raisin making. Telangana state is a semi-arid tropical region, wherein the major grape cultivation is confined since decades and as the harvesting period is summer it is the best period for raisin making. Keeping in view of above, the present experiment was proposed to study the effect of different rootstocks on

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raisin recovery and acceptability of commercial grape varieties.

## RESOURCES AND METHODS

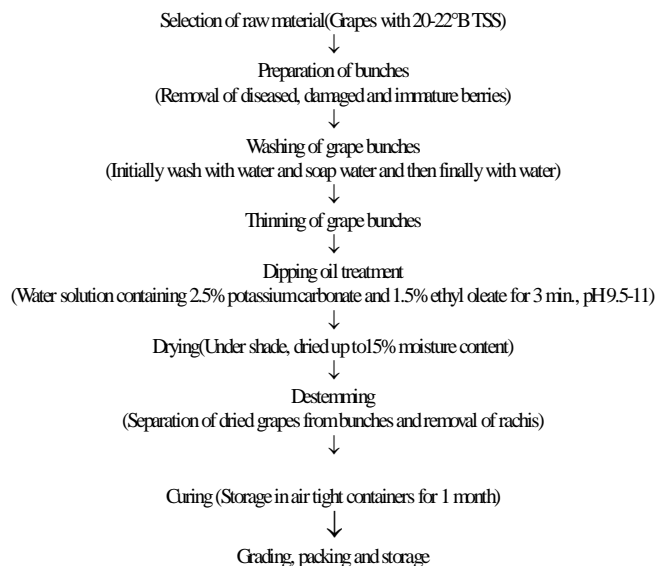
The study was conducted during 2013-14 in the experimental vineyard of Grape Research Station, Rajendranagar, Hyderabad which falls in semi arid climatic zone. The Research Station is located at 77° 85' E longitude and 18° 45' N latitude and at an altitude of 542.6 m above mean sea level, with the average annual rainfall of 800mm. The meteorological data was taken from days from pruning on different parameters like rainfall (0.9mm), minimum and maximum temperatures (16.1°C and 31.3°C, respectively) and sunshine hours (8.0hrs) were obtained from records of meteorological observatory of Acharya N. G. Ranga Agricultural University. The composite sample was analysed for its physical and chemical properties. On average, the soil had a pH of 6.2, an EC of 0.16 dS/m and with red sandy loam soils.

The experiment was conducted on a six-year-old orchard, planted at spacing of 10 x 6 ft and trained on "Y trellis system". The backward pruning was done on 1st May 2013 and forward pruning on 12<sup>th</sup> November 2013. The first pruning is done immediately after fruit harvest during the summer months to develop fruitful canes, popularly called "back pruning", and another pruning is done at about five to six months after back pruning on the fruitful canes to encourage cluster development. This is popularly known as "forward pruning". Within 24 to 48 hours after forward pruning, two to three apical buds on the pruned canes were swabbed with a bud-breaking chemical, hydrogen cyanamide (at 1.5% a.i.), commercially known as "Dormex", to facilitate quick and uniform bud burst.

There were twelve treatments and replicated four times, in a Completely Randomized Factorial Design. One of the factor includes three different varieties of grape (Thompson Seedless, Flame Seedless, Kishmish Chorni) and the other factor includes three different rootstocks (1103 P, SO<sub>4</sub>, Dog ridge) and own rooted vine as a control.

The influence of rootstocks on raisin recovery and acceptability includes the following parameters, *i.e.*, recovery of raisins, average weight of raisins, moisture, organoleptic evaluation of raisins.

### Raisin making (Doreyappa, 1998) :



### Recover of Raisins :

Before pre-treatment, the weight of bunch in each replication for different varieties was recorded using electronic balance. After the completion of dehydration and drying, the actual weight of raisins from each replication was noted. The per cent weight of raisins obtained was determined as the recovery of raisins per replication under each variety (Adsule *et al.*, 2008).

### Average weight of raisins :

After the preparation of raisins, the weight of raisins of each replication was taken and calculated to obtain average weight of raisin (Adsule *et al.*, 2008).

### Organoleptic evaluation :

Sensory evaluation was done by panel of 15 professionals of both at college of Horticulture and Grape Research Station, Rajendranagar, Hyderabad for standard organoleptic attributes using the 5 point hedonic scale (Adsule and Banerjee, 2003). Score card contains various raisin quality attributes (Mane *et al.*, 1998) like colour and appearance, flavour, texture, taste and overall acceptability (Appendix-A). The data on sensory score was analyzed using completely randomized design.

### Statistical analysis :

The data was analysed according to procedure of analysis for Factorial Randomized Block Design given by Panse and Sukhatme (1985). The significant variation among the treatments was observed by applying F-test and critical difference (CD) was worked out at 5% level

of probability to judge the differences between means of two levels of a factor.

## OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads :

### Recovery of raisins :

Among the varieties highest percentage of raisin recovery was recorded in Thompson Seedless (23.88 %). The data presented in table 1, reveals that significant difference was observed on raisin recovery and more percentage recovery was recorded by the varieties grafted on Dogridge rootstock (25.14 %)

The interaction effect was found to be significant. Thompson Seedless on Dogridge rootstock recorded (26.67 %) highest percentage which was found to be on par with Kishmish Chorni on Dogridge rootstock (25.56 %)

Among the varieties, Thompson Seedless which is having best qualities proved to be having more raisin recovery. Flame Seedless is having least recovery of raisins; it might be due the loss of moisture as it contains more moisture percentage than other varieties whereas the highest raisin recovery might be due to high total soluble solids and sugars recorded in fresh berries of Thompson Seedless. Similar observation was made by Doreyappa (1998).

The stage of harvest with particular reference to the TSS content can also influence the quality of raisins in addition to increasing raisin recovery (Miller, 1964; Kasimates and Lynn, 1967).

### Average weight of raisins :

Among the varieties maximum weight of raisin was recorded with Flame Seedless (1.00 g) which was on par with Thompson Seedless (0.95 g). As shown in table 2, it is obvious that average weight of raisins was significantly affected by the kind of rootstock. Varieties grafted on own root (1.06 g) was having more weight Interaction effect was found to be significant. The maximum weight was recorded with Flame Seedless on own root (1.21 g).

Difference in the weight of raisin may be due to size of berry and sugar content of their fresh berries. This is in contravarsity with the findings of Winkler (1962) and Adsule *et al.* (2008). The difference in raisin moisture level and the skin thickness, among the varieties may be other factors that influence the weight of the raisins.

### Organoleptic evaluation :

The organoleptic scoring of raisins varied significantly in varieties grafted on rootstocks and those raised on their own roots. Optimum stage of maturity of fruits is an important factor that influences the quality of raisins.

**Table 1 : Recovery of raisins (%)**

| Varieties          | Rootstocks |       |          |         | Mean of varieties |
|--------------------|------------|-------|----------|---------|-------------------|
|                    | 1103P      | SO4   | Dogridge | Ownroot |                   |
| Thompson seedless  | 24.52      | 22.20 | 26.67    | 22.11   | 23.88             |
| Flame seedless     | 22.28      | 19.25 | 23.18    | 22.13   | 21.96             |
| Kishmish Chorni    | 24.38      | 22.17 | 25.56    | 22.05   | 23.54             |
| Mean of rootstocks | 23.73      | 21.21 | 25.14    | 22.43   |                   |

**Table 2 : Average weight of raisins (g)**

| Varieties                 | Rootstocks |      |          |         | Mean of Varieties |
|---------------------------|------------|------|----------|---------|-------------------|
|                           | 1103P      | SO4  | Dogridge | Ownroot |                   |
| Thompson Seedless         | 0.95       | 0.84 | 0.87     | 1.13    | 0.95              |
| Flame Seedless            | 1.02       | 0.84 | 0.91     | 1.21    | 1.00              |
| Kishmish Chorni           | 0.85       | 0.65 | 0.73     | 0.88    | 0.77              |
| Mean of Rootstocks        | 0.94       | 0.78 | 0.84     | 1.06    |                   |
| CD of Rootstocks at 5%    | 0.007      |      |          | SEm±    | 0.003             |
| CD of Varieties at 5%     | 0.006      |      |          |         | 0.002             |
| Rootstock x variety at 5% | 0.012      |      |          |         | 0.004             |

**Table 3a : Colour and appearance**

| Varieties                 | Rootstocks |      |          |         | Mean of Varieties |
|---------------------------|------------|------|----------|---------|-------------------|
|                           | 1103P      | SO4  | Dogridge | Ownroot |                   |
| Thompson Seedless         | 4.36       | 3.94 | 4.01     | 4.22    | 4.13              |
| Flame Seedless            | 3.95       | 3.77 | 3.80     | 3.90    | 3.86              |
| Kishmish Chorni           | 3.87       | 3.68 | 3.75     | 3.85    | 3.79              |
| Mean of Rootstocks        | 4.06       | 3.80 | 3.85     | 3.99    |                   |
| CD of Rootstocks at 5%    | 0.03       |      |          | Sem±    | 0.01              |
| CD of Varieties at 5%     | 0.04       |      |          |         | 0.01              |
| Rootstock x variety at 5% | 0.07       |      |          |         | 0.02              |

**Table 3b : Flavour**

| Varieties                 | Rootstocks |      |          |         | Mean of Varieties |
|---------------------------|------------|------|----------|---------|-------------------|
|                           | 1103P      | SO4  | Dogridge | Ownroot |                   |
| Thompson Seedless         | 4.13       | 3.73 | 3.88     | 3.96    | 3.92              |
| Flame Seedless            | 4.29       | 3.91 | 4.12     | 4.25    | 4.14              |
| Kishmish Chorni           | 4.10       | 3.65 | 3.80     | 3.91    | 3.86              |
| Mean of Rootstocks        | 4.17       | 3.76 | 3.93     | 4.04    |                   |
| CD of Rootstocks at 5%    | 0.23       |      |          | Sem±    | 0.08              |
| CD of Varieties at 5%     | 0.20       |      |          |         | 0.07              |
| Rootstock x variety at 5% | N.S        |      |          |         | 0.14              |

**Table 3c : Taste**

| Varieties                 | Rootstocks |      |          |         | Mean of Varieties |
|---------------------------|------------|------|----------|---------|-------------------|
|                           | 1103P      | SO4  | Dogridge | Ownroot |                   |
| Thompson Seedless         | 4.12       | 3.82 | 4.26     | 3.91    | 4.03              |
| Flame Seedless            | 3.96       | 3.58 | 3.84     | 3.74    | 3.78              |
| Kishmish Chorni           | 4.05       | 3.80 | 4.20     | 3.98    | 4.01              |
| Mean of Rootstocks        | 4.04       | 3.73 | 4.10     | 3.88    |                   |
| CD of Rootstocks at 5%    | 0.03       |      |          | Sem±    | 0.01              |
| CD of Varieties at 5%     | 0.04       |      |          |         | 0.01              |
| Rootstock x variety at 5% | 0.07       |      |          |         | 0.02              |

**Table 3d : Texture**

| Varieties                 | Rootstocks |      |          |         | Mean of Varieties |
|---------------------------|------------|------|----------|---------|-------------------|
|                           | 1103P      | SO4  | Dogridge | Ownroot |                   |
| Thompson Seedless         | 4.37       | 4.05 | 4.50     | 4.20    | 4.28              |
| Flame Seedless            | 4.15       | 3.85 | 4.27     | 3.97    | 4.06              |
| Kishmish Chorni           | 4.25       | 3.87 | 4.35     | 4.20    | 4.17              |
| Mean of Rootstocks        | 4.26       | 3.92 | 4.37     | 4.13    |                   |
| CD of Rootstocks at 5%    | 0.16       |      |          | Sem±    | 0.05              |
| CD of Varieties at 5%     | 0.14       |      |          |         | 0.05              |
| Rootstock x variety at 5% | N.S        |      |          |         | 0.10              |

**Table 3e : Overall acceptability**

| Varieties                 | Rootstocks |      |          |         | Mean of Varieties |
|---------------------------|------------|------|----------|---------|-------------------|
|                           | 1103P      | SO4  | Dogridge | Ownroot |                   |
| Thompson Seedless         | 4.32       | 3.69 | 4.33     | 4.30    | 4.16              |
| Flame Seedless            | 4.11       | 3.93 | 3.73     | 3.60    | 3.84              |
| Kishmish Chorni           | 4.32       | 3.75 | 4.17     | 3.78    | 4.01              |
| Mean of Rootstocks        | 4.25       | 3.79 | 4.08     | 3.90    |                   |
| CD of Rootstocks at 5%    | 0.17       |      |          | Sem±    | 0.06              |
| CD of Varieties at 5%     | 0.15       |      |          |         | 0.05              |
| Rootstock x variety at 5% | 0.29       |      |          |         | 0.10              |

**Colour and appearance :**

There was significant influence of rootstocks on colour and appearance of raisins (table 3a). Among the varieties significantly highest score for colour and appearance of raisins was recorded with Thompson Seedless (4.13) followed by Flame Seedless (3.86). Significantly lowest score for colour and appearance was recorded with Kishmish Chorni (3.79).

Varieties on 1103 P (4.06) recorded more score and was on par with own root (3.99). The fewer score was recorded by SO 4 rootstock (3.80).

Interaction effect was found to be significant and Thompson Seedless on 1103 P rootstock recorded more score for colour and appearance of raisins (4.36 %) and least with Kishmish Chorni on SO 4 (3.68 %)

Colour and appearance depends upon the individual who are evaluating the raisins. The score on different rootstocks were on par with each other; this may be due to genotypic variation.

Among the varieties, raisins prepared from Thompson Seedless is more appealing than pinkish red coloured Flame Seedless variety. Kishmish Chorni,

**Appendix- A**

Organoleptic evaluation of raisins

Experiment: II Date:

Name of the Evaluator:

Place:

Please evaluate the following samples according to the attributes given below in five hedonic scales

|                       | T <sub>1</sub>                    | T <sub>2</sub> | T <sub>3</sub> | T <sub>4</sub> | T <sub>5</sub> | T <sub>6</sub> | T <sub>7</sub> | T <sub>8</sub> | T <sub>9</sub> | T <sub>10</sub> | T <sub>11</sub> | T <sub>12</sub> |
|-----------------------|-----------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|
| Colour & appearance   |                                   |                |                |                |                |                |                |                |                |                 |                 |                 |
| 5                     | Like very much                    |                |                |                |                |                |                |                |                |                 |                 |                 |
| 4                     | Like                              |                |                |                |                |                |                |                |                |                 |                 |                 |
| 3                     | Neither like nor dislike          |                |                |                |                |                |                |                |                |                 |                 |                 |
| 2                     | Dislike                           |                |                |                |                |                |                |                |                |                 |                 |                 |
| 1                     | Dislike very much                 |                |                |                |                |                |                |                |                |                 |                 |                 |
| Flavour               |                                   |                |                |                |                |                |                |                |                |                 |                 |                 |
| 5                     | Like very much                    |                |                |                |                |                |                |                |                |                 |                 |                 |
| 4                     | Like                              |                |                |                |                |                |                |                |                |                 |                 |                 |
| 3                     | Neither like nor dislike          |                |                |                |                |                |                |                |                |                 |                 |                 |
| 2                     | Dislike                           |                |                |                |                |                |                |                |                |                 |                 |                 |
| 1                     | Dislike very much                 |                |                |                |                |                |                |                |                |                 |                 |                 |
| Taste                 |                                   |                |                |                |                |                |                |                |                |                 |                 |                 |
| 5                     | Like very much                    |                |                |                |                |                |                |                |                |                 |                 |                 |
| 4                     | Like                              |                |                |                |                |                |                |                |                |                 |                 |                 |
| 3                     | Neither like nor dislike          |                |                |                |                |                |                |                |                |                 |                 |                 |
| 2                     | Dislike                           |                |                |                |                |                |                |                |                |                 |                 |                 |
| 1                     | Dislike very much                 |                |                |                |                |                |                |                |                |                 |                 |                 |
| Texture               |                                   |                |                |                |                |                |                |                |                |                 |                 |                 |
| 5                     | Soft - Like very much             |                |                |                |                |                |                |                |                |                 |                 |                 |
| 4                     | Crispy - Like                     |                |                |                |                |                |                |                |                |                 |                 |                 |
| 3                     | Sticky - Neither like nor dislike |                |                |                |                |                |                |                |                |                 |                 |                 |
| 2                     | Puffed - Dislike                  |                |                |                |                |                |                |                |                |                 |                 |                 |
| 1                     | Burnt/ hard - Dislike very much   |                |                |                |                |                |                |                |                |                 |                 |                 |
| Overall acceptability |                                   |                |                |                |                |                |                |                |                |                 |                 |                 |
| 5                     | Like very much                    |                |                |                |                |                |                |                |                |                 |                 |                 |
| 4                     | Like                              |                |                |                |                |                |                |                |                |                 |                 |                 |
| 3                     | Neither like nor dislike          |                |                |                |                |                |                |                |                |                 |                 |                 |
| 2                     | Dislike                           |                |                |                |                |                |                |                |                |                 |                 |                 |
| 1                     | Dislike very much                 |                |                |                |                |                |                |                |                |                 |                 |                 |

**Comments/suggestions:****Signature**

due to blackish colour, it might be least accepted.

#### Flavour :

The data recorded in the table 3b shows that the rootstock influence is significant. Among the varieties, raisins prepared from Flame seedless recorded more score for flavor (4.14) followed by Thompson Seedless (3.92) and minimum score was recorded for Kishmish Chorni (3.86)

Among the rootstocks, the maximum score was observed in the varieties grafted on 1103 P rootstock (4.17) and minimum points to SO 4 (3.76)

There is no significant difference between rootstocks and varieties.

#### Taste :

The Organoleptic scoring for the parameter is presented in the table 3c. Among the varieties, the highest score for taste was recorded in raisins of Thompson Seedless (4.03) and Kishmish Chorni (4.01) and was found to be on par with each other. Among the rootstocks and raised on own roots, the highest score for taste was recorded with varieties grafted on Dogridge (4.10) and 1103 P (4.04) which were on par with each other. Interaction effect was found to be significant. Highest score was recorded with Thompson Seedless on Dogridge rootstock (4.26).

Raisins of all scions on 1103 P and Dogridge scored more for taste, this could be due to higher potassium content which resulted in higher TSS, which is an important content for raisins.

#### Texture :

The data pertaining to texture of raisins was presented in the table 3d. Among the varieties, Thompson Seedless raisins (4.28) gained the maximum score for texture, and among the rootstocks, varieties on Dogridge were given maximum score (4.37). Interaction effect was found to be non-significant.

Thompson Seedless variety score for texture of raisins was high due to its soft nature than crisp nature of Flame Seedless.

#### Overall acceptability :

The data pertaining overall acceptability was significant with respect to rootstocks and varieties (table 3e). Among the varieties, highest score was recorded by the raisins of Thompson Seedless (4.16)

For varieties grafted on rootstocks and on own roots, highest score for overall acceptability of raisins was recorded with varieties grafted on 1103 P rootstock (4.25).

Interaction effect was found to be significant and Thompson Seedless on Dogridge rootstock (4.33) scored more

Raisins of all scions on 1103 P and Dogridge scored more for taste and over all acceptability. According to Manjuvani (2012), this could be due to higher potassium content which resulted in higher TSS, Brix-acid ratio and subsequently improved the taste and over all acceptability.

According to Bhat *et al.* (2006), both physical (berry size, berry shape, berry colour, the nature of waxy cuticle) and chemical fruit properties (moisture content, sugar content and acidity) at harvest affect raisin quality. These properties are influenced by several factors, some of which cannot be manipulated by grower (variety and rootstock; the age of the vine, soil and climatic conditions) and others such as soil improvement, irrigation management, nitrogen and potassium nutrition, growth regulator application, pruning and crop load, which can be altered by growers.

#### Conclusion :

With respect to recovery of raisins and quality, Dogridge was best among rootstocks and Thompson Seedless on Dogridge performed well. With respect to quality, based on the organoleptic evaluation, Thompson Seedless showed best quality and among the rootstocks, 1103 P performed well followed by Dogridge.

Among rootstocks, with respect to colour, flavour, overall acceptability was good irrespective on their varieties whereas taste and texture was observed to be better on Dogridge rootstock.

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