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# Management of Grapevine Orchard under Heavy Rainfall Conditions in Maharashtra

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Uniform implementation of cultural practices after April pruning was carried out across all grape vineyards in Maharashtra. However, following this pruning, particularly during the critical phase of bud differentiation, the necessary inputs could not be adequately provided. As a result, there is a higher likelihood of disturbances in bud differentiation this year. Compared to previous years, unseasonal and excessive rainfall began early this year (May) and has continued persistently until now, coinciding with the bud differentiation period. This prolonged rainfall is likely to have negative impact on the physiological processes essential for proper bud formation. The following are the key requirements for successful bud differentiation:

1 **Temperature:** For optimal bud differentiation in vineyards, a temperature range of 20°C to 35°C is considered ideal. Under higher temperature conditions, there is increase in cytokinin levels within the grapevines, which promotes floral bud initiation. In contrast, lower temperature conditions tend to enhance the synthesis of gibberellins, which may hinder the process of bud differentiation.

2 **Sunlight:** Adequate sunlight is crucial for successful bud differentiation in grapevines. Uniform exposure of sunlight to each bud along the cane enhances the initiation of floral buds. In addition to promoting bud differentiation, sunlight significantly improves photosynthetic activity, leading to better accumulation of food material and nutrients in the developing canes. Optimal photosynthesis occurs within the temperature range of 20°C to 35°C. For effective bud differentiation, grapevines should receive 4 to 5 hours of sunlight daily at least for 15 to 20 days**.** A light intensity in the range of 2,500 to 5,000 lux is considered favorable for the process. In conditions of low temperature, moisture percentage increases in root zone, which may lead to an increased upward movement of endogenous growth regulators synthesized by the roots. This can result in excessive vegetative growth, which in turn can negatively affect bud differentiation.

3 **Bioregulators:** For effective bud differentiation, it is essential to apply cytokinin-based plant growth regulators during new shoot emergence (3 to 4 leaves after foundation pruning**)**, and to be continued for the next 10 days**.** Foliar spray of bioregulators such as 6-Benzyladenine (6-BA), Uracil, and Chlormequat Chloride (CCC) are recommended during this period (fig. 1). These applications stimulate the process of floral bud differentiation by promoting cell division and meristematic activity in developing buds.

**Figure 1. Application of 6- BA on 3rd to 4th leaf beyond to sub-cane**

4 **Nutrient Management:** Prior to the onset of bud differentiation, it is essential to ensure vigorous vegetative growth of the vine. For this purpose, adequate application of nitrogen and water is necessary. However, during the bud differentiation phase, vine

growth must be carefully regulated. This is achieved by completely withdrawing nitrogen and supplying phosphorus instead. Phosphorus is made available both through soil application and foliar sprays**.** Sufficient phosphorus availability enhances the concentration of nucleic acids in the bud meristems, thereby supporting the initiation and development of floral primordia.

5 **Canopy Management**: To maintain microclimate condition, the canopy in the orchard should be kept open to ensure uniform and intense sunlight exposure on each bud of the cane (fig. 2). This facilitates the development of favorable microclimate. Therefore, shoot thinning plays a critical role in achieving this. Considering the above factors, it becomes evident that during the critical period of bud initiation (anlagen formation) in the orchard, persistent cloudy weather prevailed across the cultivated area due to continuous and excessive rainfall. This likely hindered optimal conditions for micro-primordia formation. In high rainfall conditions, substantial leaching of water and nutrients occurred through the root zone. Consequently, dormant roots between the plant rows were activated and transformed into functional white roots. This led to enhanced vine vigor, resulting in increased apical shoot growth (fig. 3a), proliferation of lateral shoots (fig. 3b), and an increase in both the size and number of leaves. As a result, light penetration to the buds on the shoots was reduced, adversely affecting the process of bud development.

**Figure 2. Open canopy**

**Figure 3a. Increased apical shoot**

**Figure 3b. Excessive growth of lateral shoot**

## Cane maturity is crucial for fruit pruning

For effective fruit pruning, it is essential that each cane on the trellis reaches full maturity. When a cross-section of a mature cane is taken, the pith should exhibit brown coloration, indicating physiological ripeness (fig. 4b). During this season, due to prolonged waterlogging condition in the soil, endogenous gibberellin levels in the vine increased, resulting in continuous apical growth. Consequently, cane maturation was delayed. Absence of yellowish brown colour of pith indicates that there is insufficient nutrient reserve present in the cane (fig 4a) and developing bunch are physiologically immature. In many orchards, the persistent rainy and humid conditions also led to an increased incidence of diseases, resulting in premature leaf fall. Under such circumstances, pruning often becomes unavoidable. However, pruning immature canes offers little to no benefit. In such cases, it is advisable to allow the apical 8–9 leaves of the cane to continue growing. This will prevent premature bud break from the basal nodes. On the newly emerged apical shoots, foliar sprays of Potassium-rich fertilizers such as: 0:0:50 @ 1.5 to 2 g/L or 0:40:37 @ 1 to 1.5 g/L or 0:9:46 @ 1 to 1.5 g/L or other suitable commercially available fertilizer mixture can be applied to support cane maturity. In addition, spraying 1% Bordeaux mixture will induce mild leaf scorching, which helps in stopping leaf activity without causing total leaf loss. This strategy supports cane maturation by redirecting assimilates and terminating unnecessary vegetative growth.

**Figure 4a. Pith colour in immature cane**

**Figure 4b. Pith colour in mature cane**

## Management measures before fruit pruning in grape

Before initiating pruning operations, the orchard should undergone complete defoliation. Defoliation can be achieved either manually or by the application of *ethephon*. In many orchards, partial defoliation (approximately 30–40%) may occur naturally. In such cases, ethephon can be applied approximately 8–10 days prior to pruning. However, in orchards where leaves are still physiologically active and intact, ethephon application should be carried out at least 15 days before the planned pruning. The pH of the ethephon solution should be maintained between 2.5 to 3.0 for optimal efficacy. For preparation of the spray solution use 0:52:34 @ of 5 g/L along with ethephon at the rate of 2.5 to 3 ml/L. The nutrients and acidifying agent help maintaining the desired pH and enhance absorption and efficacy of ethephon, ensuring uniform and effective defoliation.