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ICAR-NATIONAL RESEARCH CENTRE FOR GRAPES  
P.B. NO. 3, MANJARI FARM POST, SOLAPUR ROAD, PUNE - 412 307, INDIA  
Tel: +91-20-2695-6000(EPABX), 2695-6002(Director's Office), Fax: +91-20-2695-6099  
E-Mail: [director.nrcg@icar.gov.in](mailto:director.nrcg@icar.gov.in) Website: <https://nrcgrapes.icar.gov.in>

## Advisory for fruit bud differentiation during foundation pruning (April to Sept., 2020)

### 1. Nutrient and water management

Dr. A. K. Upadhyay, Pr. Sci (Soil Science)

#### Rest period:

After the harvest of grapes during February – March, vine reserves are exhausted. After foundation pruning, till photosynthetically active leaves are formed, it is the vine reserves that contribute to the growth and development of the vines. Hence, following is advised:

1. Provide only need based irrigation to protect the existing leaves from drying and also contribute towards increasing the reserves of the vines through photosynthetic activity. The quantum of irrigation water applied should be approx. 5000 – 6000 L/ acre, once in a week. Care should be taken to reduce/stop the water in case new growth is observed on the shoot.
2. Apply 10-15 kg urea, 25-30 kg SSP and 10-15 kg Sulphate of Potash per acre every 15-20 days till foundation pruning is not done.
3. Flooding the vineyard is not advised as it will lead to wastage of water. Concentrate irrigation water application in the root zone only.

#### Pre-pruning operations:

Pre-pruning operation should always be decided in advance probably 20-25 days. This is required to plan for labour, materials like fertilizers, pesticides etc. and availability of water. The input requirement especially fertilizers and water is based upon the soil and water tests report. It is always advisable to draw soil and water samples and get it analysed. Following operations need to be carried out:

1. Analyse soil and water samples. The soil samples should be drawn from the fertilized area i.e. between the vines 15-20 cm away from the drippers. In case the soil is uniform, around 10-12 samples from different parts in an acre should be drawn and thoroughly mixed and around 1kg of the sample should be sent for analysis.
2. Majority of the soils are calcareous in nature and also have alkaline pH. Apply 50 kg sulphur per acre mixed with FYM/compost between the vines in the soil. The sulphur should be properly mixed in the soil for improving its efficacy in taking care of calcium carbonates. Mixing of sulphur in organics further improves its efficacy.

3. The vineyards where sodicity problems are there, apply gypsum to the soil for removal of sodium from the soil exchange complex. In case, the sodic soils are calcareous also, use sulphur for similar purpose.
4. Apply FYM/ compost/other organic sources @ 10t/acre atleast 12-15 days before foundation pruning. Application of organics improves the nutrient and water retention in the root zone and reduces nutrient losses from the profile.
5. In clayey soil compaction and poor aeration and in light soils (stony soils) poor nutrient and water holding capacity leading to restricted active root zone is the major reason of poor utilization of nutrients. Soil compaction causes low K, P and micronutrient uptake. Because of soil compaction the nutrient accumulate below the dripper point and cause nutrient imbalance. Hence one month before fruit pruning the bund (bod) should be loosened by disc or power tiller. This helps in mixing of soil and reduces nutrient imbalance. Addition of organic matter will benefit in light as well as heavy soils.
6. In case Single super phosphate needs to be applied as basal, then mix 100 kg Single super phosphate in the FYM and apply in the soil. This improves the phosphorus utilization by vines.
7. Never apply water soluble fertilisers like urea, ammonium sulphate etc. as basal, as they will leached and contaminate the ground water. They should be applied only from sprouting onwards.

**Note:**

1. **Application of fertilizers should be strictly based upon soil testing report. If the soil is low in nutrients, then apply 1.25 times of the recommended dose. If optimum, then 75% of the recommended dose, and if high, then 50% of the recommended dose.**
2. **The irrigation schedule mentioned is for guidance purpose. The quantity of water applied may change based upon vigour of the crop, leaf symptom and climatic conditions. Also note that if soil is at wapsa condition, then irrigation should not be applied.**
3. **For fruit bud differentiation stage, stress needs to be given. In clayey soil as the water holding capacity is higher, please note that stress needs to be imposed early.**

**Shoot growth stage:**

**Irrigation**

1. Irrigation water < 1dS/m: Apply irrigation through surface drip @ 10,880 to 14,960 L/acre per day.
2. Saline irrigation water (1.1 – 2.0 dS/m): Apply irrigation through surface drip @ 13,600 to 16,150 L/acre per day.
3. In case the shoot growth is vigorous, reduce irrigation water application till growth is controlled.
4. In case there are rains, withhold irrigation water application if the soil is at field capacity (wapsa condition).

5. Mulching the vineyards during this period will reduce the salinity build up in the root zone due to upward movement of saline water from lower soil layer. This will also reduce the irrigation water requirement by another 10%.
6. Cover the cordons of the pruned vines with shadenet, if available, for uniform sprouting as well as reducing the irrigation water needs by 20-25 %. Shadenet coverage will reduce the temperature impact on the cordons. However, remove shadenet after 3-5 leaf stage. If shadenet is not available, spray the cordons with water during the peak heat period i.e. 2-3 pm to reduce the heat effect on the buds.
7. In case there is **probability of less irrigation water availability**, then flood the bund (not whole vineyard) at pruning and mulch the bunds. Flooding the bund will reduce the accumulated salt load in the root zone and mulching will reduce the evaporation of water from soil surface. Thus, this will reduce the salt load in the soil and at the same time saturate the soil leading to proper sprouting. Further, in case less irrigation water is available still the newly emerging shoots will not be damaged due to salinity.

**Nutrition:**

1. Apply 50 kg urea/ acre in 5-6 splits after sprouting. In calcareous soils, donot apply urea, instead use Ammonium sulphate @ 85 kg/acre in atleast 7-8 splits from sprouting onwards.
2. In case of vigorous growth of shoots, stop nitrogen application and wait for the growth to stabilize before resuming nitrogen application. If still the growth continues, then reduce irrigation. Then resume when growth is maintained at desired level.
3. Based upon soil test value, apply Zinc sulphate @10 kg/acre along with Ferrous sulphate @10kg/acre followed by Magnesium sulphate @15kg/acre in atleast 2 splits during 5-7 leaf stage. Boron application should be strictly based upon soil and petiole test.
4. In calcareous soils, spray magnesium sulphate and potassium sulphate @2 gm each/ L during active growing stage.

**Fruit bud differentiation stage:**

1. Apply irrigation through surface drip @ 5000 to 6000 L/acre per day.
2. Mulching the vineyards during this period will reduce the salinity build up in the root zone due to upward movement of saline water from lower soil layer. This will also reduce the irrigation water requirement by another 10%.
3. Based upon soil test values, apply 30 kg phosphoric acid or 150 kg SSP in case the soils are deficient in phosphorus. Phosphoric acid application is desirable in calcareous soils.
4. At 45 DAP, perform petiole test to know the nutrient content of the vines. The petioles should be collected from 5th leaf from the base of the shoot counting the leaves even if they have been removed.
5. Apply magnesium sulphate @ 15kg/acre in 2-3 splits.
6. Keep a close watch on the development of leaf blackening symptoms from the margin in case irrigation water contains sodium more than 100ppm.

7. In calcareous soils, spray magnesium sulphate and potassium sulphate @3 gm each/ L

#### **Cane maturity stage:**

1. Apply irrigation through surface drip @ 5000 to 6000 L/acre per day.
2. Depending upon cloudy conditions and rains, the irrigation water application can be planned. If the soil is at wapsa condition, donot apply irrigation.
3. Apply based upon soil and petiole test, sulphate of potash. In genral apply 60 kg SOP per acre. 30kg SOP should be applied between 60-90 days and other 30 kg from 91-110 days. Donot avoid potassium application as this will affect the bunch development after fruit pruning.
4. Apply magnesium sulphate @ 15kg/acre in 2-3 splits.
5. Foliar sprays atleast twice of magnesium sulphate and potassium sulphate @5 gm each/L should be done.
6. Once the rains start, remove the mulch, so that rain water can penetrate deep in the soil and reduce the salt load.

#### **Canopy management practices to ensure fruit bud differentiation**

**Dr. R. G. Somkuwar, Pr. Sci. (Hort.)**

The following practices are suggested for the production of fruitful canes.

#### **Practices before foundation pruning:**

##### **Rest to the vine:**

As the vine is already exhausted by producing a bunch on a cane, it needs to recuperate before the foundation pruning. Hence, instead of putting the vine under stress, a small quantity of fertilizers (nitrogen and phosphorous) and irrigation may be given to the vines.

##### **Trench opening and filling:**

After the foundation pruning, the bud sprouting starts and subsequently it gets converted into the shoot growth. For proper shoot development, the roots should be active in the root zone. Production of white root becomes the necessity of the hour during this period. Hence, opening of light trench (3 to 4 inch depth, 2 feet wide leaving from 8-9 inch from the trunk) 15 days before the foundation pruning should be done. Exposure of trench for longer time under high temperature (above 40°C) will damage the root cells. This condition will lead to cordon drying (dead arm) and delay the production of new roots.

##### **Foundation pruning:**

Foundation pruning is done retaining single bud on the cane. Immediately after the back pruning, the buds left on the cane should be swabbed with hydrogen cyanamide @ 20 to 25 ml/litre water or can be sprayed on the cordon using same concentration. Under high temperature condition, spraying of water on cordon twice in a day (11.0 am to 12.0 pm and 2.0 pm to 4.0 pm) from 5<sup>th</sup> to 15<sup>th</sup> day after foundation pruning will help to increase relative humidity near the buds.

Covering the vine with shade net will also help in reducing the temperature and increasing relative humidity thereby helping early bud sprout in the vineyard.

### **Growth stages after foundation pruning:**

#### **1. Vegetative growth stage (1-30 days)**

##### **Shoot thinning:**

On each vine there will be at least 80-90 bud sprouts. Those sprouts will be converted into shoot. Hence, shoot thinning based on the area allotted to each vine should be done. For every square feet area allotted to each vine, 0.5 to 0.6 shoots are retained, while the excess shoots are removed. Shoot thinning is done during 6-7 leaf stage. At this stage, all the healthy shoots are visible.

##### **Development of sub cane:**

The sub cane can be developed under the condition of high vigor. New growth is pinched at 7-leaf stage when it is at 9 leaf stage. This will help in the development of one or two laterals depending upon the vigour of the main shoot. The lateral shoots are again pinched or topped retaining only 5 leaves. This is called single sub cane. The bud at the base of each axillary shoot, arising as a result of shoot pinching, will be fruitful. Thus, sub-cane development through shoot pinching not only improves the fruitfulness of buds but also clearly indicates the position of fruitful buds. This helps in minimizing the error in forward pruning and the uncertainty of getting flower clusters from the sprouting buds.

However, sometimes, the vine do not put forth vigor due to non-availability of irrigation water and shortage of nutrient and high temperature in the vineyard during the vegetative growth phase. Under such situation, instead of developing the sub cane, only straight cane can be developed. The main growing shoot is tipped at 10-11 leaf.

#### **2. Fruit bud differentiation stage (31-60 days)**

At this stage, the vigor of vine needs to be kept under control. Hence, application of phosphorus and complete withdrawal of nitrogenous fertilizer is followed during this stage. The vine is given stress by reducing approximately 50% irrigation water as compared to the water applied during vegetative growth.

##### **Application of plant growth regulators:**

After 30-35 days from foundation pruning, the main shoot is pinched for making sub cane. At around 40 to 45 days, the lateral shoot grows to 3-4 leaf. During this stage, 6-BA @ 10 ppm should be sprayed. After the first spray of 6BA another plant growth regulator i.e., uracil @ 25ppm should be sprayed. This will help in increasing the RNA: DNA ratio in the growing bud.

##### **Maintenance of shoots:**

After the sub cane development, the side shoots will also grows with the same vigor. Hence to control the vigor, the pinching of side shoots at 5<sup>th</sup> leaf is followed. When the side

shoot grows to 7-leaf, pinching of the same is done at 5<sup>th</sup> leaf. At this stage, the shoot from the base starts changing the green color to milky white. This is also an indication of initiation of cane maturity. In case of delay in removal of side shoots on the main cane, the light requirement on main bud will be reduced thereby leaf becomes yellow. This condition will also encourage the development of powdery mildew incidence.

### **3. Cane maturity stage (61-90 days):**

For advancement of cane maturity, the growth needs to be kept under control. During this stage, reduction of irrigation and application of potassic fertilizer will help the vine to control the growth. In addition, the shoots are to be tied on foliage wire. This will avoid the build-up of microclimate in the canopy thereby reducing the chances of downy mildew incidence. During this stage, spray of Bordeaux mixture @ 1.0% may help to control the disease and also advancing the cane maturity. In the continuous rainfall condition, anthracnose disease becomes active. The fungus infects the leaves making pin pricks on the new tender leaf and shoot. In severe cases, the organism enters into the growing shoot. Hence, removal of new shoots should be given the priority.

### **Insect and mite pest management during foundation pruning season Dr. D. S. Yadav, Sr. Sci. (Entomology)**

#### **Vegetative growth (0-30 days)**

The newly emerging shoots are relatively more sensitive to damage by thrips, mealybugs and flea beetles. The period of foundation/back pruning normally coincides with hotter and drier summer month of April in majority of the grape growing areas. This type of weather is generally highly congenial for population built up of thrips and mealybugs. Hence, timely and appropriate measures need to be undertaken against these pests in order to avoid serious damage. During sprouting, application of imidacloprid 17.8 SL @ 0.4 ml/L water (water volume 750 liters per hectare) is helpful to prevent damage by flea beetle and mealybugs. Under the condition of shoot malformation, foliar application of imidacloprid 17.8 SL @ 0.4 ml/L water may be repeated again. During active shoot growth, thrips may cause serious damage to tender leaves and stem. To control the damage, fipronil 80 WG @ 0.06 g/L or cyantraniliprole 10 OD @ 0.7 ml/L water or emamectin benzoate 5 SG @ 0.22 g /L water (water volume 1000 L/Ha) spray will be helpful.

#### **Fruit bud differentiation (31- 60 days)**

Weather condition before the beginning of monsoon rainfall may favour thrips population build up which may cause damage to new leaves and tender shoot. With the arrival of monsoon, incidence of leaf eating caterpillars, especially *Spodoptera litura* may increase leading to severe defoliation. Installation of 'Spodlure' sex pheromone traps @ 8-10/ ha may be helpful in judging the onset of caterpillar infestation and aid in undertaking timely control measures accordingly. Fipronil 80 WG @ 0.06 or emamectin benzoate 5 SG @ 0.22 gm /L water (water volume 1000 L/Ha) can help in controlling both thrips and caterpillars. Alternatively, application of *SINPV* @ 250 LE/ha can effectively control the larvae of *S. litura*. If mealybug infestation is observed, spot application of buprofezin 25 SC @ 1.25 ml/L (water volume: 1.5 L/vine) may be given. Sighting of web formation at underside of leaves may be noticed on older leaves due to mite infestation.

Sulphur 80 WDG @ 1.5-2.0 g/L or abamectin 1.9 EC @ 0.75 ml/L or bifenazate 22.5 SC @ 0.5 ml/L water may be sprayed to manage mites.

### **Cane maturity stage (61-90 days)**

The cane maturity stage generally coincides with the active monsoon period. During this period, prevalence of high relative humidity coupled with drizzling rains and cloudy conditions the risk for infestation of leaf eating caterpillar (*Spodoptera litura*) may increase. *Spodoptera litura* Nuclear Polyhedrosis Virus (S/NPV) @ 250 LE/ha may be helpful in controlling the caterpillars. Need based spraying of emamectin benzoate 5 SG @ 0.22 g/L water can effectively control the caterpillars. The high relative humidity conditions are congenial for population built up of natural enemies like predatory coccinellids and parasitoids that help to check the infestations of mealybug in vineyards. Hence, use of broad spectrum insecticides such as methomyl, fipronil, lambda cyhalothrin, etc. that adversely affect the NEs of insect pests should necessarily be avoided. Alternatively, use of entomogenous fungi, *Metarhizium anisopliae* @  $10^6$  cfu/ml will be helpful. The prevailing high humidity will help in establishing this entomogenous fungi and managing infestations of both mealybugs and ants associated with them. For the management of mites if required, Sulphur 80 WDG @ 1.5-2.0 g/L or abamectin 1.9 EC @ 0.75 ml/L or bifenazate 22.5 SC @ 0.5 ml/L water is effective. Excess shoot growth due to high humidity conditions may lead to build up thrips population and reduce coverage during insecticide spray. Thus, excess shoot growth should be removed during this period.

### **Disease advisory after foundation pruning**

#### **Dr. Sujoy Saha, Principal Scientist (Plant Pathology)**

Future strategies are based on previous experiences. Disease scenario during the last season was harsh due to adverse weather conditions. Downy mildew, anthracnose and bacterial leaf spot took a heavy toll of the crops and farmers incurred a considerable financial loss. Excessive rains, resulting in flood conditions in many areas further aggravated the disease, especially downy mildew. There is every chance that the spores of downy mildew pathogen can overwinter in the cordon, bark, old leaves and soil. Hence “clean cultivation” should be the treatment strategy to reduce the primary infection. The following strategies may be adopted post foundation pruning for effective disease management.

1. The pruned material like the twigs and leaves should be collected and dumped in a pit away from the vines. Then a spray of Mancozeb 75 WP @ 2.5g/Litre should be made in the pit and covered. The pruned material should not be burnt.
2. While pruning, there should not be any old lesions of anthracnose on the canes. It should be neatly removed with a secateur and about 2-3 cm extra healthy portion should be removed along with the disease portion to avoid systemic infection.
3. Wherever there is a “Y” shaped canes, care should be taken to have a close check for old anthracnose infection.
4. The cordons should be washed alternatively with Mancozeb 75 WP @2-3 g/Litre and Sulphur @ 2g/Litre at an interval of 7-10 days, twice. This will control the spores of the

fungus causing downy and powdery mildews respectively, overwintering in the bark and reduce the primary inoculum.

5. While pasting with Hydrogen cyanamide, Mancozeb 75 WP @2-3 g/Litre should be mixed with pasting mixture. Propineb / Metiram may also be used instead of Mancozeb, depending on the availability.
6. Uniform sprouting is preferred. If 1-2 erratic, early sprouting of shoots are observed, it should be manually removed.
7. There should not be any contact with the vines and the ground as the growth increases in the later stages. Many-a-times, the tip of the vine, lodges from the “Y” angles and touch the ground, leading to primary infection by the overwintering spores in the soil.
8. At 3-5 leaf stage, application potassium salt of phosphoric acid @ 4g/litre + Mancozeb 75 WP@ 2.5g/litre of water should be applied as tank-mix.
9. 7-10 days, after this spray, one application of Dimethomorph 50 WP @ 1g/litre or Mandipropamid @ 0.75g/litre or Iprovalicarb + Propineb @ 1.5 g/litre may be applied. Usually, this round is avoided in other years but this year, it may be adopted to check the overwintering pathogen, if any.
10. During spray application, use of silicon- based adjuvant should be done @ 1g/litre in a tank mix as it will help in proper distribution of the fungicide within the leaf tissues.
11. Copper based fungicides like 0.5% Bordeaux mixture/ Copper oxychloride @ 2g/litre /Copper hydroxide @ 1.5g/litre may be given between July and August , 3-4 times and 10-12 days interval for control of Downy mildew.
12. Copper application will slow down maturity but when applied at mature leaf stage, absorption will be less and there will not be any problem.
13. One round of spray with triazoles may be given during subcaning which helps in fruit-based differentiation. Triazoles like Hexaconazole @ 1 ml/L or Difenoconazole @ 0.7ml/ L or Tetraconazole @ 0.7 ml/L may be used. This will also take care of powdery mildew infection, if any.
14. Drizzles or moderate rainfall in certain areas will predispose the vines to both anthracnose and bacterial leaf spot diseases. The symptoms of both the diseases are very similar and hence correct diagnosis is extremely important.
  - a) **Anthracnose:** Circular brown spots on leaf with yellow halo; when held against light, small holes are seen on the surface. It can be controlled by the application of Thiophenate methyl @ 1g/L.
  - b) **Bacterial leaf spot:** Angular brown spots on leaf with no yellow halo. No holes are observed on the leaf surface. The spots are mostly seen between the networks of vein lets discretely. It can be controlled by the application of Mancozeb @ 3g/L. Antibiotics like

Streptocyclin should not be used. However, to control both the diseases, a new fungicide, Kasugamycin + Copper oxychloride @ 2.5 g/Litre may be applied.

15. If there is a light to medium drizzle in some areas, 1-2 soil drenching with *Trichoderma sp.* @ 4-5 g/Litre may be given. *Trichoderma* may be applied through drip as well.

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