

MANAGEMENT & REJUVENATION OF SENILE ORCHARDS

The decline of productivity has been attributed to various factors. The most of the problems are due to faulty management i.e. unsuitable site and climate, cultivation of intercrops, inadequate nutrition's, improper planting, undesirable planting materials, incidence of insect-pest and disease and other biotic and a biotic stresses. The decline of trees starts with sparse appearance, yellowing and different type foliage symptoms, undergrowth and sickly appearance, dried-up top growth with small and less number of fruits. The branches of trees start to die from the top to downwards, ultimately resulted poor quality fruits (rough surface, thick skin and less juice). Such type of decline may be seen in whole orchards, on in a single tree or patches. It is a rare site to get any plantation free of this malady even intensity varies from plant to plant and from month to month in the same plant. The growers do not adopt the proper management practices in terms of plant protection; manuring, irrigation; mulching, pruning etc. and the orchards become sick. In general, canopy of fruit crops has irregular shape. Trees of irregular shape and size are difficult to deal with and even culminate into poor yield in the subsequent years as the lower branches of canopy gradually turns inert and infertile as well.

Rejuvenation Strategies:

- Providing technical know-how including plant health coverage and nutritional management programme.
- Re-plantation of old & uneconomical orchards.
- Gap filling by providing disease free quality seedlings.
- The development agencies may prepare comprehensive orchards management Programme providing all the necessary inputs like, plant nutrient, plant protection chemical, horticultural equipment and periodical training's.
- Training is an important component, which improves over all efficiency of the knowledge and skill of field functionaries.
- Complete technological information on management of decline orchard may be packaged and same may be disseminated in farmer's field.

Calendar of activities for first year

December –January

- Marking of trees and their undesired branches for pruning.
- Pruning of marked branches in December.
- Pruning to be followed in alternate row.
- Pruning to be initiated from lower surface of the branch and alter from upper surface to avoid cracking of branch and bark splitting.
- Application of copper oxychloride paste or biodynamic tree paste on the trunk, branches as well as cut surfaces to check microbial infection.
- Ploughing and weeding in orchards in January.
- Preparation of basins and irrigation channels.

February - March

- Application of recommended full dose of single super phosphate (3.00 kg/ tree and half dose of urea (1.25 kg per tree) in basins in the end of February.
- Careful observation for infestation of stem borer insect pest in pruned trees. Upon identification of infestation, placing cotton wick soaked with or dichlorvos or kerosene oil or inject water emulsion of 0.05% monocrotophos or chlorpyriphose.
- Irrigation as per requirement during March.

April – May

- Irrigation as per requirement.
- Mulching in basins around trees.
- Hoeing and weeding in basins.
- Care for new emerging shoots.
- Observation for incidence of stem-borer and its management.

June – July

- Thinning out undesired shoots while retaining about 8-10 healthy shoots with outwardly growth per pruned branch during June followed by spray of copper oxychlorid, 3 gm/liter.
- Irrigation at an interval of 10-15 days.
- Application of remaining half dose of urea. i.e. 1.25 kg per tree during June.
- Application of FYM(120 kg per tree) in basins during July.
- Management of stem borer as described before.
- Spray of Copper oxychloride (3 g/litre water) twice at an interval of 15 days ;if there is infestation of anthracnose and other leaf spot diseases on new leaves.
- If there is serious incidence of leaf cutting weevil, two sprays of 2% carbarly (Sevin) @ 2 g per litre water at an interval of 15 days may be done.

August - September

- Thinning out undesired shoots.
- Observation of incidence of stem-borer insect pest and anthracnose and other leaf spot diseases and their management.

October-November

- Cultural operations of ploughing, hoeing, weeding etc.
- Removal of dried and diseased twigs.
- Management of insect pests and diseases.
- Foliar spray of 2 per cent urea during October for healthy vegetative growth.
- Marking of trees for pruning.

REJUVENATION OF AONLA AND MANGO ORCHARDS

- The rejuvenation technology involves various steps depends on condition of orchard and age of the fruit plants.

Canopy Management

- Older plantations of seedling origin which have become senile can be adopted for top worked by grafting (budding) with scion of superior varieties to upgrade seedling plantation with superior commercial varieties
- There is a tendency of over lapping of canopy between 10 and 12 years of age depending on the nature of variety unless the canopy is maintained by trimming and thinning. Plantations which have overlapping branches.
- This is possible by hedging of branches followed by shoot management to modify the tree structure and maintain canopy size.

Irrigation and Fertigation

- **Aonla:-** During the phase of heading back 50 kg FYM along with 8 kg neem cake / plant is made. Six months after heading back manures and fertilizers may be given as 50 kg FYM + 4 kg neem cake + 1000 g Nitrogen + 500 g potash and 750 g Phosphorus/ year. Fifty per cent of Nitrogen and entire dose of potash and single Phosphorus need to be applied in January-February and rest dose of nitrogen is applied in June.
- During rainy and winter season no irrigation is required but is required at an interval of 10-15 days during dry summer (April-June). In headed back tress, irrigation is done just after rejuvenation.
- **Mango:-** Application of 2.5 kg Urea, 3 kg Single Super Phosphate (SSP) and 1.5 kg Muriate of Potash besides 120 kg well decomposed FYM is recommended. Half dose of urea with full dose of Single Super Phosphate (SSP) AND Muriate of Potash is applied during the end of February. The remaining half dose of urea is applied during the end of June. Full dose of FYM (120 kg/tree) should be applied in the first week of July. Manures and fertilizers should be applied in the basins prepared around the trees.
- Adequate watering is sine-qua-non for the optimum development of novel shoots in rejuvenated trees. Therefore, depending upon temperature and soil moisture status, pruned trees must be irrigated at an interval of 15-20 days form March till the onset of monsoon.

Mulching

- Mulching at the base of pruned trees is done by using black polythene sheet (400 gauge) or heavy mulching with organic material, such as, straw, dried grass, banana leaves, immediately surrounding the main trunk drastically reduces weed growth. After emergence of new shoots on pruned trees, optimum soil moisture should be maintained otherwise, new shoots may dry up.

Thinning of shoots

- During three to four months after pruning there is profuse mergence of shoots on pruned branches.
- Selective and regular thinning of shoots is essential for facilitating development of open and spreading canopy of healthy shoots. Outwardly growing 8-10 healthy shoots are retained per branch and the rest are removed so that they get proper nourishment and develop into ideal canopy.
- Thinning operations are undertaken during the monsoon season. Copper oxychloride fungicide (3 g / litre water) should be sprayed immediately after thinning operations.

Pest and disease management

- Intensive care for prudent management of insect pests and diseases is highly essential for ensuring survival of pruned trees as well as healthy growth of shoots.
- Infestation of stem-borer can be easily identified by wooden frass fallen on ground from the affected branches. Holes and oozing of gum in affected branches are the other indicators of its infestation.
- Larvae can be pulled out from the hole by using thin wire or cycle spoke or they can be traced along the tunnel in the branch made by them from gum oozing spot.
- Larvae hidden inside the branch and trunk can be effectively controlled b y placing cotton wick, soaked in insecticide, inside the hole and sealing it with mud.
- Leaf cutting weevil damages shoot by cutting the leaf across the lamina like scissors. It can be managed by two sprays of 0.2 percent carbaryl (Sevin) insecticide (@ 3 g per litre water) at an interval of 15 days.
- Brown spots on young leaves are the characteristic symptom of anthracnose disease. Copper oxychloride (3 g per litre water) should be sprayed twice at an interval of 15 days for its management.

REJUVENATION OF GUAVA

- In case of totally declined plants it is advised that they should be headed back to the extent of 1.0 to 1.5 meters above the ground level during May to allow the development of fresh canopy of healthy shoots.
- These newly emerged shoots were allowed to grow up to a length of about 40 to 50 cm. These shoots were further pruned to about 50 percent of its total length in October for emergence of multiple shoots.
- The farmers interested to take rainy season crop can allow the shoots to bear flower buds and fruits.
- It is desired to promote fruit load in winter season. Hence, to check the onset of rainy season crop, shoot pruning (50%) was done again in May. emergence of new shoots was facilitated. These new shoots emerging after May pruning were found to have high flowering and fruiting potential for winter crop.
- This procedure of sequential and periodic pruning was continued every year for proper shaping of tree canopy and to ensure enhanced production of quality fruits during winter season.
- Irrigation is done just after rejuvenation. Adequate watering is a sine qua non for the optimum development of novel shoots in rejuvenated trees.
- During the phase of heading back, 50 kg FYM along with 6 kg neem cake / plant is made. Six month after rejuvenation, manures 40 kg FYM + 4 kg neem cake + 1300 g urea +500 g muriate of potash and 1800 g single super phosphate / plant /year to be given.
- Adopt management practices control of pests and diseases as recommended by the research organizations for their respective areas.

Management practices to be followed for rejuvenation of Mango, Anola and Guava

- Cutting should be done from lower surface of the branch and later from upper surface to avoid cracking as well as bark splitting.
- Application of cow dung or copper oxy choride on cut surface of pruned branches to check the microbial infection.
- Application of FYM @ 40-50 kg/plant soon after pruning.
- Insure irrigation soon after for shoot sprouting and proper development of tree canopies.
- Mulching around trees with black polythene film.
- Thinning of shoots and retaining 4 to 6 outward growing, well spaced and healthy shoot per pruned branch.
- Good phyto-sanitary procedures are to be adopted to manage the rejuvenated plants.
- Regular observation for incidence of stem borer. If the infestation is observed then immediately control measures, comprising pulling out the grubs from the holes with help of iron spoke and plugging the holes with monocrotophos or 0.05 per cent dichlorvos or chlorpyrifos soaked cotton swabs following by mud plaster to be taken up.
- If infestation still continues sprays carbaryl1 (0.2 per cent) or monocrotophus (0.004 per cent).
- Adopt management practices control of pests and diseases as recommended by the research organizations for their respective areas.
- The interspaced are used to grow suitable inter crops, which not only provide nutrition to the main crop of aonla, but also generate additional income.
Mango

REJUVENATION OF LITCHI

1. Spacing and Planting system: Planting in square systems at a distance of 9- 10 m within and between the rows has been practiced. Planting in a double hedgerow system at a distance of 4.5 x 4.5x9 m accommodating 329 plants/ha has been found to be the best and gave higher yield of equally good quality fruits.

2. Training and Pruning: Non-Fruiting unproductive branches inside the canopy should be pruned. Dried, diseased and scissors-shaped branches should also be periodically removed. Light pruning after harvest has been found congenial for better growth, fruiting and yield. While harvesting the fruit the panicle is plucked along with 8-10 cm of twig to promote new flush and better bearing for the succeeding year.

3. Manure and Fertilizer

- Application of 600-800 g N, 200-300 g P₂ O₅ and 400-600 g K₂ O per plant is recommended for 12-15 year old trees. Nitrogen and potassium should be applied in 2-3 splits and P₂ O₅ in two Splits. Phosphorus application at the time of flower bud differentiation improves flowering and fruiting. Application of cakes and manure is generally practiced to get better quality fruits.
- Zn is applied in the form of 0.5 percent zinc sulphate hydrated with lime, which helps in reducing fruit drop and enhancing fruits yield and quality. Boron in the form of borax (600 ppm) enhances fruit setting and reduces fruit cracking.
- In acidic soil application of 10-15 Kg lime / tree once in 3 years has been found to increase the yield.
- Foliar application of zinc sulphate (0.1 percent) is done twice, 10-15 days before flowering for improving sex ratio and to reduce fruit drop. If a deficiency of zinc and magnesium is observed, application of 150-200 g ZNSO₄, respectively per plant during September has been found to be beneficial.

4. Irrigation, mulching and water conservation: To achieve faster growth of the plant no water stress should be permitted, while in the reproductive phase water stress is beneficial at the time of fruit bud differentiation. Light irrigation during summer and winter months and cleaning of the basin is advocated. The young plants should be irrigated during dry periods and winter months at intervals of 3-5 days.

Control of pests /diseases /physiological disorders:

Mite: Prune the affected twigs/branches just after harvesting in June and in October and February and burn to avoid spread. Two sprays of Kelthane (0.05) or Dicofol@ 3 ml/lit. or Propargite 3.5 ml/lit or wettable sulphur 0.29 m/lit. at 7-10 days interval during the attack of the insect has been found to effectively control the pest. Application of neem cake has also been found to reduce the incidence of this pest.

Shoot borer: The caterpillar bore inside the newly growing shoot and feed on inner parts resulting in drying of the twigs. In the case pruning and burning of affected twigs minimize the infestation.

Fruit borer: Removal of fallen fruits, leaves, seeds, peel etc. just after the harvest and destroying with pruning of affected twigs.

- Setting of pheromone traps and tricho card @ 50000 eggs/ha at panicle emergence stage.
- Spraying of fruits by Nimbicidine @ 4 ml/litre or Endosulphan 2.0 ml/litre water at lentil size stage and prior to colour break stage twice at 7 days interval.

Leaf roller: Spray phosphamidon (0.05%) or methyl-o-demeton(0.5)

Bark eating caterpillar and trunk borer: The caterpillar bore inside the trunk/ main stem. Cleaning of the infested area and plugging holes with Monocrotophos 0.05% or dichlorvos or chlorpyriphos soaked material is advocated.

Fruit cracking: Light irrigation to maintain soil moisture and to improve humidity has been found to minimize this problem through maintenance of a better micro- climate. Mulching with farm residue and 3 irrigations significantly reduced the cracking.

Attention:

- The development of nutrition management to maintain tree health and encourage successful flowering, fruiting and quality in sustainable manner, requires attention.
- Integrated management of nutrient and water with efficient monitoring mechanisms would improve input use efficiency.
- Integrated management of insect pests and disease is required to improve productivity and reduce the cost of production.
- Infrastructure for post-harvest management requires emphasis to reduce risk.

REJUVENATION OF CITRUS

- Pruning of dried branches, after the harvest of fruits immediately followed by application of carbendazim spraying @ 1 gm/liter of water.
- Control of bark eating caterpillar (Inderbela) by application of Dichlorovas @ 0.1% (3-5 ml) in each larval tunnel or inserting in tunnel cotton swab soaked with insecticide.
- Scrapping of oozing out gum and application of Metalaxyl paste on the wound.
- Spraying of Metalaxyl MZ 72 @ 2.75 gm/liter of water for the control of Phytophthora.
- Irrigation by double ring method/drip and providing proper drainage.
- Application of recommended dose of fertilizer and micro-nutirents.
- Spraying of Imidacloprid @ 0.3 ml or monocrotophos @ 0.5 ml/liter of water for the control of citrus psylla.
- Spraying of Dicofol @ 1.5 ml/liter for the control of mites.
- Application of Bordeaux paste on the tree trunk twice a year before monsoon and after monsoon.

REJUVENATION OF POMEGRANATE

Canopy Management: Planting distances are generally 6X4m or 6X5m, except for the semi dwarf cultivars where planting distances could be somewhat closer like 5x3m. The trees are trained to grow as an open vase. In such a way that light penetrates the trees from between the rows as well as from the inside of the trees. Trees height should not exceed 3.0-3.5m.

Pruning: Broken, bent, and interfering branches are removed. In order to keep the interior of the tree open during growing season, summer pruning is carried out according to needs.

Fertigation: All orchards are irrigated by drip irrigation by one or two lines of drippers per row. Irrigation once a week is widespread .bout 200-300Kg/hectare nitrogen are given annually with about the same amount of potassium (k₂ O). Some growers clean their drip systems by phosphoric acid. By this treatment phosphoric is given too.

Orchard Health Management Schedule (Upto 1 year age):

Training and Pruning:

- Train the plants to 2-4 stem preferably to 3 stem system for proper canopy development and to alleviate favourable microclimate for disease and insect-pest build-up.
- Prune the lateral branches particularly those in contact with ground soil.
- Diseased twigs/branches, particularly, bacterial blight infected are to be pruned 2" below the infected portion and Bordeaux paste be applied to cut ends of pruned branches. During pruning secateurs should be sterilized with sodium or calcium hypochlorite solution (1.0%)/dettol (1.0%) after every cut.

Fertilizer Management

- Apply Organic manures like Farm Yard Manure(20Kg/plant). Application of fertilizers, N(625g/Plant), P₂O₅(250g/Plant) and K₂O(250g/Plant) is done below the tree canopy in shallow circular trenches 30-45cm away from the trunk upto 8-10cm depth.
- Nitrogen is applied in two split doses with half dose at the time of planting along with full doses of P and K and remaining half dose one after month in September.
- Application of biofertilizers like *Trichoderma viride*, Phosphate Solubilizing Bacteria and *Azotobacter* alongwith fertilizers as mentioned under Planting may be effective in better plant growth and yields.

Irrigation:

- Irrigate the crop immediately after 1-2 days of fertilizer application with light irrigation initially and then irrigate at regular intervals.
- It is advisable to use drip irrigation system.

Management of diseases / Insect-pests/ disorders

- All fallen leaves and twigs be collected and burnt. Drenching the orchard particularly plant basin below the tree canopy with bleaching powder (2.5%) could reduce the bacterial inoculums.
- Spray the crop with copper oxychloride (0.2%)/copper hydroxide (0.2%) at 15 days interval.
- For Control of Bacterial blight Disease spray the crop with Streptocycline (500ppm) + Copper oxychloride (0.25%)/carbendazim (0.15%) as soon as the new leaves appear and repeat the sprays at 15 days interval. Another antibiotic Bactronol (0.1%) may also be used in place of Streptocycline
- Dusting the orchard with bleaching powder (20kg/ha) or copper dust (cuprous oxide 4%) @ 20Kg/ha) should be practiced 2-3 times in a year to reduce the bacterial and other fungal pathogens' inoculum.
- For Control of Wilt disease, drenching the affected and adjoining healthy plants with carbendazim (0.2%)/propiconazole (0.2%) + chlorpyrifos (0.2%) at 20 days interval.
- Application of Bordeaux paste (10%) + chlorpyrifos (0.2%) on collar portion of main stem is effective method for wilt management specially when shot hole borer and stem borer infestations are also observed
- Insect infestation due to stem borer, fruit borer and leaf eating caterpillars, spray the crop with chlorpyrifos (0.1%)/deltamethrin (0.1%).
- Aphids, thrips and white flies can be managed by sprays of imidacloprid (0.05%)/ dimethoate (0.1%). Preventive sprays of Neem seed kernel extract (NSKE 5%) are helpful in avoiding diseases and insect-pests.
- Application of phorate (25g/plant)/carbofuran (40g/plant) and Neem cake (250g/plant) in circular trenches around the plant.
- Incorporation of Bioagent preparations consisting of *Trichoderma viride* (2.5kg/ha)/ *Pseudomonas fluorescens* (@ 2.5kg/ha) along with FYM.
- **For fruit cracking:** Regular irrigation of plants during fruit development stage should be done.
- Boron deficiency may also lead to cracking and thus Boron sprays (0.2%) may minimize the disorder.

- **Internal break down of arils:-** Delay in harvesting often result in internal break down of arils, harvest the fruit as soon as they reach maturity to avoid internal break down of arils

Sun scald: -Maintain suitable crop canopy through proper pruning to ensure that fruits facing the noon sun are not directly exposed to rays. Spray anti-transparent like Kaolin (5.0%) one or two times during the fruit development stage and covering the fruits, particularly those receiving direct sun light, with paper bags also reduces sunburn.

Weed Management: Mulching with dry leaves, sugarcane trash and polythene sheet as mentioned under irrigation is also effective method of keeping orchard weed free.

Micronutrient sprays: In general, however, sprays of mixture of Micronutrient formulation (0.1%) containing Fe, Zn, Cu, Mn, Mo, and B at fruit initiation stage and 2nd spray after 45 days at fruit development stage are beneficial.

Fruit Thinning: Thinning is done to ensure that there should not be more than 2-3 fruits per spur/cluster to have about 80-100 fruits per tree. After 80-90% fruit set, new flowers are also removed.

Rest Period

- After harvest orchard is provided 3-4 months rest period from April to July during which normal irrigation is withheld and plants are irrigated weekly or fortnightly for just plant survival.
- Severe pruning is done in May – June and all diseased and insect-pest infested /old twigs/branches are removed and Bordeaux paste (10%) applied to cut ends of the pruned stems.
- Secateurs are sterilized in calcium hypochlorite (1.0%)/Sodium hypochlorite (1.0%)/dettol solutions (1.0%).
- Blight lesions on main stem are removed with sharp razor and Bordeaux paste applied to them. Sanitation measures are followed and diseased leaves, fruits and twigs are collected and burnt.
- The orchard is dusted with bleaching powder (20kg/ha) or copper dust 4% (20kg/ha) to reduce pathogens' inoculums.