

# Rejuvenation of Senile Horticultural Plantations for Improved Productivity and Quality

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**Abstract**— India is a vast country gifted with varied horticultural crops. There is a tremendous increase in the production of horticultural crops especially fruits which is due to specialized new interventions and use of latest research technological tools the country is now among the top fruit producing country ranking second next to china. Despite congenial agro-climatic conditions prevailing in the country the productivity of quality fruits is substantially low in recent years. The old and senile orchards are now reverting towards a declining trend of production because of age factor, non-compatible varieties, poor orchard management practices and incidence of pest and diseases. To increase the production of fruit crops through area expansion is almost impossible due to unavailability of vacant land for new plantations. In the present scenario, the only strategy could be improving the management of existing plantations for sustainable fruit production and to optimize the fruit potential of our country.

**Keywords**— Senile orchard, pruning, rejuvenation, top-working.

## I. INTRODUCTION

Most of the orchard often encounter decline in productivity and poor fruit quality after certain years of plantation. The decline of productivity has been attributed to various factors. Senile orchards with poor efficiency are now a common phenomenon in temperate (apple, pear, peach), subtropical (mango, guava, aonla, ber, litchi) and tropical (cashew) fruits including plantation (coconut, arecanut) crops. 25-30 percent orchards are senile and have become uneconomical. They are characterized by intermingling and overcrowding of shoots with poor photosynthetic efficiency. 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. 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.

As most of the fruit crops have long juvenile phase, instead of planting new plantations, it is advisable to rejuvenate these trees for better and quality production. The decline in yield is due to following reason. Fruit trees require constant care and attention throughout their lives for successful fruit production and as tree grow old their care and attention has to be increased. The decline in yield is due to several causes:

- Inadequate tree spacing
- Injudicious manuring
- Defective methods of irrigation
- Faulty cultural practices
- Pest and diseases.

### **Inadequate tree spacing**

- In most of the old orchards the fruit tree are too closely planted.

- This has resulted upright growth, congestion, severe competition for nutrients, crossing over of branches, inter tree shading, lack of light penetration and spread of diseases and insect pest etc.
- judicious thinning of trees, removal of dry and diseased wood from those should be done on regular interval
- Proper orchard management practices can bring such trees back to normal performance.

#### **Injudicious manuring**

- Most of the orchards are neither adequately nor judiciously fertilized.
- In appropriate and injudicious application of nitrogenous fertilizer is as harmful as its non application.
- Excessive doses and application to near the trunk have often caused tree decline.
- The rejuvenation of such trees would depend on the type of symptoms experienced, kind and varieties of fruit trees and other factors.

#### **Defective methods of irrigation**

- Irrigation is essential for the production of fruits.
- Water can be applied with different methods. Basin irrigation is an excellent way to irrigate fruit trees.
- The key to successful irrigation is the application of the right amount of water at the right time.
- Excessive as well as insufficient Irrigation also causes tree decline. Excessive irrigation causes bark injuries, root rots, leaching of nutrients, whereas insufficient irrigation interferes with availability of nutrients. Both extremes need to be avoided.

#### **Faulty cultural practices**

- Damage to the bark and roots caused by mechanical injuries result in early decline of trees.
- The injured parts if not dressed immediately are attacked by pathogens. Such injuries sometimes prove serious and hamper the continued growth and yield of trees.
- Care in cultural operations and immediate dressing-up of such injuries when they occur help avoid these losses. Each wound needs to be painted either with Bordeaux paint or coal-tar.

#### **Pest and diseases**

Fruit orchards in general and the existing old orchards are attacked by various pest and diseases. The old orchards are more adversely affected due to the comparatively low vigor of the trees. The damage is of several types. Some of the insects and diseases attack the leaves, affecting adversely the production and supply of photosynthesis to the tree. Other attacks the twigs; branches, roots etc, and upset the general physiological functioning of the tree. The preventive and curative measures in such cases would depend upon the kind of tree and the nature of attack. The growers are therefore, advised to follow standard practices for the control of insect and diseases.

#### **Rejuvenation strategies:**

- Full package of rejuvenation technology for the major fruit crops need to be worked out.
- Massive rejuvenation will require lot of mechanization. Therefore, machineries and tools need to be developed.
- Large scale demonstration on rejuvenation technology in the major fruit belts in the country need to be established.
- Demand for organic produce is increasing rapidly, hence package for rejuvenation and organic production of such trees need to be attempted.
- Forest law with respect to rejuvenation need to be revised and wood available from heavy pruning need to be allowed for disposal.

#### **Technique for rejuvenating the senile orchards**

The rejuvenation technology involves various steps which depend on condition of orchard, age of the fruit plant and canopy management. Older plantations of seedling origin which have become senile can be adopted for top working by grafting (budding) with scion of superior varieties to upgrade seedling plantation with superior commercial varieties. There is a tendency of overlapping 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 have poor photosynthetic efficiency should be removed. This is possible by heading of branches followed by shoot management to modify the tree structure and maintain canopy size. The newly emerging shoots are allowed to grow up to 40-50 cm length and then further pruned for emergence of multiple shoots below the pruning point to modify the tree structure and maintain canopy size. The multiple

shoots developed as a result of second pruning are capable of producing flower buds.

#### **Methodology of rejuvenating the existing orchards**

- ❖ Identification of old orchards
- ❖ Top and framing by petrol operated Saw
- ❖ Procurement of bud wood and scion from genuine source
- ❖ Frame working with latest available varieties
- ❖ Operations under expert guidance.

#### **Rejuvenation of Mango Orchard**

The rejuvenation technology involves various steps which depend on condition of orchard, age of the fruit plant and canopy management. It is possible by heading of branches followed by shoot management to modify the tree structure and maintain canopy size. Rejuvenation carried out at Mohanpur (W.B) indicates that, 40-60 years of old plantation can be further given a productive life of 20-25 years by adopting rejuvenation practices. It consists of heading back and removal of selected branches 4 to 5m above ground during winter month (Lal *et al.*, 2000).

Experiment was carried out on 45-year-old Dashehari trees, Rajput, *et al.*, 1999 where yield had declined due to low light penetration and non-availability of productive shoots. Pruning was done in the month of December with five pruning severities. The effect of various pruning severities revealed that the growth of emerging shoots was significantly influenced by the severity of pruning. Length and girth of emerging shoot were more in the first, second and third order pruned trees, whereas less emerging was found in the fourth and fifth order pruning treatments. While the highest length (182 cm) and girth (15.26 cm) of shoots were recorded in the first order, the lowest length (83 cm) and girth (8.75 cm) were observed in the fifth order pruned trees. However, fruit yield was higher in the fourth order pruned trees than the other treatments. No fruit yield was obtained in first and second order pruned trees during the first and second year of fruiting. Cumulative fruit yield of the first five years has indicated that the fourth order pruned trees gave the highest yield 284.64 kg/plant as compared to control trees (113.52).

Proper orchard management which includes pasting of cow dung, thinning of unwanted shoots, nutrient and water management practices in integrated fashion need to be scientifically practiced. In case the original varieties are of poor quality, or there is no provision of pollinizers, top working with elite clone need to be adopted. These rejuvenated trees start bearing from third year onwards

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.

#### **Aonla Rejuvenation**

The rejuvenation technology involves heading back (topping) of branches during Dec-Jan at the height of 2.5 to 3.0 m from the ground level depending on the structure of individual trees in the orchard. Before rejuvenation pruning, branches are marked with white chalk by making a ring around the branches. The selected branches should initially be cut from the underside on the lower side by giving at least 10 cm deep cut. Thereafter, the cutting should be done from the upper surface of the branch. The cut portion of the branches is pasted with cow dung or copper oxichloride. Shoots developing in outer directions on main limbs should be allowed to develop.

#### **Manipulation of vegetative growth**

The new shoots arise on pruned branches of heading back and a few shoots are retained at proper spacing and growing towards periphery of trees. Successive removal of unwanted shoots, considering the vigor and growing direction is important. In this technique, only 4 to 6 shoots developing in outer directions on main limbs should be allowed to develop. The rejuvenation technology involves various steps depends on condition of orchard and age of the fruit plants and 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.

Headed back tree with black polythene mulch



Tree growth after five months of heading back.



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. Gangwar *et al.*, (1975) and Pathak *et al.*, (1996) have revealed that a new productive life can be given through adaptation of rejuvenation technology.

**Treatments of laterals and water sprouts:** Some laterals near the branch tips would have been removed or shortened to strengthen the leaders. From the remaining laterals, those which are growing downwards would be marked for removal. As a first step extension growth on these can be removed and in following year, the entire lateral can be cut away. The vertical and upright laterals should be removed to prevent them from competing with the leaders. It is necessary to remove all water shoots except those which may be required to fill up a vacant place, or those which have developed fruit buds and do not come in the way to other shoots and branches.

**Repairing damaged trees** - Some trees remains unproductive because they are damaged .Any cavities that are found in old tree formed either by careless removal of limbs or by breakage, which must be properly filled with Bordeaux mixture. If the cavities are not repaired diseases can further damage the tree.

**Stabilizing the tree-** In neglected orchard, trees die due to rocking by the wind or by root damage. In order to strengthen tree, pruning should be done in such a way as to make the tree assume an upright position in due course of time. Bridge grafting should be done if the roots of trees are damaged to root rot. In first season, seedlings are planted in basin of plant and in next season grafting is done to provide extra root system to plants.

### 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. Therefore, depending upon temperature and soil moisture status, pruned trees must be irrigated at an interval of 15-20 days from March till the onset of monsoon.

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 emergence 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 develop into ideal canopy.

Thinning operations are undertaken during the monsoon season. Copper oxychloride fungicide (3 g / litre water) should be sprayed 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 grass fallen on ground from the affected branches. Holes and oozing of gum in affected branches are the other indicators of its infestation. Water logging condition is caused by *phytophthora* and *Fusarium*. The 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. 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 oxychloride 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-sanitation 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 carbaryl (0.2 per cent) or monocrotophos (0.004 percent). 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, but also generate additional income.

### Guava rejuvenation

- An experiment was conducted to study the response of pruning on rejuvenation of an old guava orchard (cv. L-49) at the Horticultural Research Station, Mondouri of Bidhan Chandra Krishi Viswavidyalaya during the years 2003 and 2004.
- Eleven- year old guava plants were pruned drastically leaving only four scaffold branches per tree at monthly interval from March 2003 to July 2003.
- The height and spread of plants increased significantly after pruning as compared to control. Only rainy season crop was obtained one year after pruning and pruned plants flowered one month ahead of unpruned (control) plants.
- Time of pruning had significant effect on fruit set. Fruit yield and physicochemical characters of mature fruits were found to be best in fruits obtained from plants pruned in April. Pruning proved to be successful in rejuvenating an old guava orchard of cv. L-49 (Sardar). Source :Basu *et al*,

### Rejuvenation of Litchi

Old and poorly managed litchi trees can be rejuvenated through severe pruning followed by proper management practices including pasting of cut ends with fresh cow dung and pasting of the limbs with Bordeaux paste. (Zhang *et al*, 1999; Nainwal *et al*, 2004)

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.

#### **Manure and Fertilizer.**

- Application of 600-800 g N, 200-300 g P<sub>2</sub> O<sub>5</sub> and 400-600 g K<sub>2</sub> O per plant is recommended for 12-15 year old trees. Nitrogen and potassium should be applied in 2-3 splits and P<sub>2</sub> O<sub>5</sub> 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 ZNSO<sub>4</sub>, respectively per plant during September has been found to be beneficial.

**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 wettable sulphur 0.29 ml/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 Nimbecidine @ 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 chlorpyrifos soaked material is advocated. 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.

#### **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-nutrients.

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. Upadhyaya (2001) reported that 40 to 50 per cent. Khasi mandarin orchards are unproductive and uneconomical in North- Eastern Himalayan state.

#### **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. About 200-300Kg/hectare nitrogen are given

annually with about the same amount of potassium ( $K_2O$ ). Some growers clean their drip systems by phosphoric acid. By this treatment phosphoric is given too.

*Flowering in pruned tree*



*Heavy Fruiting in pruned tree*



### **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.

#### **June-July**

Observation for incidence of stem-borer and its management. 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.

### **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 favorable 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 hypochloride 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), P<sub>2</sub>O<sub>5</sub>(250g/Plant) and K<sub>2</sub>O(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* along with 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 @ 20Kg/ha should be

practiced 2-3 times in a year to reduce the bacterial and other funga pathogens' inoculums.

- For Control of Wilt disease, drenching the affected and adjoining healthy plants with carbendazim (0.2%)/propiconazole (0.2%) + chlorpyriphos (0.2%) at 20 days interval.
- Application of Bordeaux paste (10%) + chlorpyriphos (0.2%) on collar portion of main stem is effective method for wilt management. Insect infestation due to stem borer, fruit borer and leaf eating caterpillars, spray the crop with chlorpyriphos (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.

## II. CONCLUSION

Since the orchard establishment is a long term process and cannot be done in days but once the yield is reduced to such an extent that orchard harding becomes un-economical, rejuvenation is said to be essential. For overcoming the problem of unproductive and uneconomic orchards existing in abundance, large scale uprooting and replacement with new plantations will be a long term and expensive strategy. The development of rejuvenation technology through topping and hedging of the old dense and uneconomical orchard has been found to be cost effective and is beneficial to the farmers as the old orchard gets new lease of life for many years. On the other hand replacing the other hand replacing the orchard is not desirable as it is cumbersome, involves a longer gestation period and entails loss of revenue to the farmers. Therefore, the technique of rejuvenation is a better alternative in this strategy; the farmer is adequately compensated by the wood obtained



after the pruning. Rejuvenation helps in restoring the production potential of old unproductive and diseased orchards in shortest possible duration than any other technique. Helps in maintaining the manageable tree height and canopy with open architecture. Sustaining the life of farmer without affecting his economy to a great extent.

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