Year of Achievement 2008-09

1. Integrated Disease and Insect Pest Management Schedule to Mitigate Pomegranate Bacterial Blight

The bacterial blight caused by a bacterium *Xanthomonasaxonopodis*pv. *punicae*, may result in 25-100% loss of produce. It is prevalent in all major pomegranate growing states in India. In general bacterial blight was prevalent in 78.81% orchards of Maharashtra, 58.33% in Karnataka and 100% in Andhra Pradesh during 2007-2010 surveys. The schedule was initially formulated as 'Orchard Health Management (OHM)' schedule later with modifications based on research and experience, it was named '**Integrated Disease and Insect Pest Management Schedule** (IDIPM)" schedule. The schedule specifically was aimed at mitigating bacterial blight in pomegranate along with satisfactory control of common diseases and insect pests with improved yields in pomegranate.

Need for IDIPM

Survey of bacterial blight (BB) infected orchards and interaction with the farmers in different areas revealed the reasons for unabated spread of BB in different areas and resultant losses by the pathogen. In order to address the issues given below formulation of IDIPM was the only answer. The issues were:

- Monoculture of cv Bhagwa – covering around 80% areas under pomegranate in India, Which is most susceptible to BB. Non availability of resistant commercial cultivars to BB.
- None of the bactericides give complete control and are more effective as prophylactic
- Regulating rainy season crop, which is most conducive for BB development.
- Taking continuous production from pomegranate orchards without rest period, leading to loss of plant vigour and making it vulnerable to BB.
- Too many unwanted sprays (every alternate day/ 10 or more sprays/month) as advised by dealers and unqualified consultants; this provided much needed water for spread rapid multiplication of the BB pathogen
- Poor soil health and imbalanced plant nutrition
- Antibiotics/bactericides being used were spurious or with lower/undeclared active ingredient contents.

Components of IDIPM

1)Change to winter season crop 2)Prune to remove BB affected stems soon after harvest 3)Rest to plants after harvest 4)Orchard sanitation 5)Balanced plant nutrition 6)Avoid frequent sprays by combining pesticides depending on compatibility as per IDIPM schedule 7)Spray interval of 7-14 days depending on season 8)Emergency sprays (2-3) consisting combination of bactericides on sudden attack of BB 9)Effect of IDIPM Schedule on Bacterial Blight Management (2012-13)in adopted orchards 10)Effect of IDIPM Schedule on Fruit Yield (t/ha) 2012-13.

Impact:

Pomegranate in Demonstration Plot at Hiraj, North Solapur showing status of orchard before and After Adoption.

Before Adoption in May 2007 **After Adoption in April 2009**

Year of Achievement 2014-15

1. Diversity analysis:

Ninety-six pomegranate genotypes comprising of wild, cultivated and exotic types were analyzed using 21 polymorphic SSR markers. Molecular genetic diversity study revealed three major clusters of pomegranate genotypes. Molecular diversity indices were used to construct 'Neighbour Joining tree' and genetic distance estimates clustered the genotypes into wild types (with large tree stature, highly acidic and small sized fruits), cultivated types and seven genotypes in a separate cluster.

2.Induction of flowering to bridge the yield gap:

To mitigate the problem of bacterial blight disease in pomegranate, it is advisable to resort to *hasthbahar* (September- October flowering) over *mrigbahar*. However, the occurrence of timely flowering often becomes difficult during *hasthbahar*due to prevailing low temperature. The growth hormones and chemicals were applied and results revealed flowering within 2-3 weeks after the foliar spray. The no. of bisexual flowers was found to be the highest in NAA 10 mg/l (192.6/ plant) whereas it was lowest in control (87.5/tree). This treatment also resulted in bearing of maximum number of fruits (125.3/tree). The untreated control trees had the least bisexual flowers (35.0/tree). The fruit set ranged from 40.0 to 65.0%. The highest fruit set (65.0%) was recorded by NAA treatment @10 mg/las compared to (40.0%) in untreated control.

3. Production of low cost healthy planting materials using hard wood cuttings

An experiment was set up to standardize the suitable length of hard wood cutting to optimize the amount of wood required for production of healthy planting materials of pomegranate with high success rate. The threshold length of the stem for use in the hard wood cutting is 15 cm with 6 mm thickness. At 120 days after planting there was no significant difference in the cutting success of 20 cm (76.33 %) and 15 cm (70.83 %) long stems but when the size was reduced to 10 cm, the success rate drastically came down to 45.33 per cent. Treatment of stems with fungicides and antibiotic/bacteriostatic compounds for sufficient duration helped in reduction of pathogen load. This pre-treatment also helped in making cuttings almost free from most of the surface inhabiting pathogens including the nodal blight caused by *Xanthomonasaxonopodispv. Punicae***.**

4. Bio-hardening of tissue culturedplanting materials of pomegranate cv. Bhagwa

Two bio-inoculants viz.*ArbuscularMycorrhizal Fungi* (mixture of different types of AMF, predominantly *G. intraradices*) and *Aspergillusniger* (AN 27) were utilized as bio-hardening agents. Root colonization, population of microbes in rhizosphere, growth, physiological and biochemical parameters of bio-hardened plants as influenced by these beneficial microbes were recorded at 180 days after inoculation. Significant colonization of AMF in the roots of pomegranate plants cv. Bhagwa raised through tissue culture was led to development of better roots system and good field establishment when AMF was used either alone (71.12 per cent root colonization) or in combination with *Aspergillusniger*(65.00 per cent root colonization

5. Protocol for preparation of sparkling wine from pomegranate.

Presence of several nutraceuticals and antioxidants in pomegranate wine makes it one of the most coveted value added product of pomegranate for utilization of low grade fruits that does not fetch the desired price in the market. Hence, the protocol for preparation of pomegranate wine earlier developed at the ICAR-NRCP Solapur was refined using enzymatic clarification of juices for preparation of sparkling, delicious and attractive wine from this wonder fruit. Pomegranate wine was prepared using the shake flask culture method. Fermentation of enzymatically clarified juice was carried out using yeast (*Saccharomyces cerevisiae*) in incubator shaker. Wine was then further clarified by centrifugation and use of neutral clarifying agent. The

sparkling wine was siphoned, bottled and stored. The wine prepared with enzyme pre-treatment was found to be superior in clarity / transparency and aroma compared to the control.

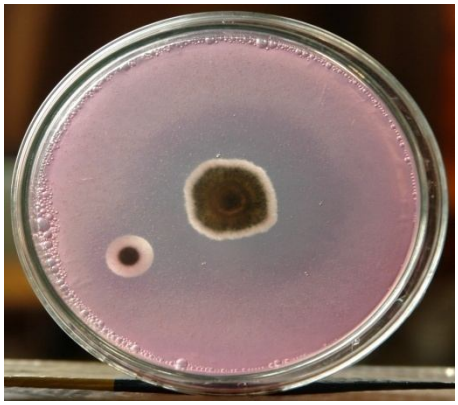
Year of Achievement 2015-16

1. A Process for Extraction of Virgin Pomegranate Seed Oil

A process of extraction of virgin pomegranate seeds oil from marc is invented. The process includes standardization of extraction process right from cleaning of marc (ie. remaining portion of fruit after juice extraction) for getting clean seeds, moisture reduction, size reduction, and standardization of oil extraction temperature with objective of higher recovery of oil while retaining important fatty acid profile components such as linolenic acid methyl ester, linolic acid methyl ester and eicosanoic acid methyl ester and antioxidant activity.

2. *Penicilliumpinophilum*—A novel microorganism for nutrient management in pomegranate (*Punicagranatum* L.)

Soil inoculation with *P.pinophilum* was found to increase nutrient uptake (N, P, and K) that resulted in improved growth, significantly higher leaf area index and photosynthetic rate of plant. Inoculation ofP. *pinophilum* with the insoluble K treated (100 mg K kg^{-1}soil) soil exhibited increased potassium and phosphorus uptake by 47.47 and 63.44 per cent, respectively. Thus, bio-intervention with *P.pinophilum*would be an alternative and viable technology to improve plant nutrition for sustainable pomegranate production under semi-arid agro-ecosystem through utilization of already available insoluble source of potassium in soil.



3. Improving water use efficiency in pomegranate

- Maximum plant height, flowers, branches, stem diameter and fruits was recorded in Sugarcane baggas mulches and water conserved over mulches treatments is 50 %.
- 0.30*ETr irrigation level is the best for Sugarcane baggas mulch for pomegranate tree.
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- A trial on sub-surface irrigation (SDI) with 5 micro-irrigation systems was conducted and based on growth parameters SDI with double in line lateral at 30x30cm were better than 5 micro-irrigation systems.
- Water is conveyed in soil through capillaryaction as well as gravity and volume up to 46 % larger to be irrigated as compared to drip irrigation.
- Eliminated water loss due to evaporation and conserved water up to 70%.
- In lateral geometry experiment double laterals with 4 drippers is the best treatment followed by ring type and single lateral (2D) and maximum plant height, flowers, branches and stem diameter in double lateral with 4 drippers.