

### **Network Project on Mitigating the Bacterial Blight Disease** of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh

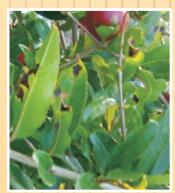
(Funded by Ministry of Agriculture, Government of India, New Delhi)

Abridged Progress Report

(2008-09 to 2010-11)











**National Research Centre on Pomegranate** 

(Indian Council of Agricultural Research) Solapur - 413 006 (Maharashtra)

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# Abridged Progress Report (2008-09 to 2010-11)

Network Project on Mitigating the Bacterial Blight Disease of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh (Funded by Ministry of Agriculture, Government of India, New Delhi)

Submitted by VT Jadhav Project Director



### National Research Centre on Pomegranate

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## Acknowledgement Acknowledgement

## Preface

Our network team, with 3 year experience of demonstrations to manage bacterial blight of pomegranate -the most threatening pomegranate disease, is convinced that eradication of pomegranate bacterial blight is not possible however, it can be successfully managed and many growers are now convinced that they can take economic yields by following Orchard Health Management Schedule. This positive attitude of growers is indicated by increase in pomegranate area and production in India during 2009-10, returning the dwindling pomegranate cultivation particularly in Maharashtra - having maximum area under pomegranate- on strong footing.

Failure of eradication campaigns of citrus canker caused by Xanthomonas axonopodis pv. citri, taken by the government of Florida (USA) twice in 1933 and 1994 is well known example to the pathologists. In spite of eradicating the citrus grooves to get rid of the canker pathogen, the disease appeared again in 1995. In 2006, the Florida government was forced to withdraw the eradication campaign and shift to management programme. The citrus canker still exists and the Florida farmers are still growing citrus following health response programmes, which keep the bacterial inoculum load below threshold level to take economic yields.

Developing resistant varieties or transgenic lines are the only long term solutions for bacterial diseases. In the absence of resistant varieties it is necessary to follow integrated management practices to keep the pathogen inoculum load in the orchard low, so that the disease does not spread and remains manageable. Looking into the importance of pomegranate crop and heavy losses caused by bacterial blight an 'Orchard Health Management (OHM) Schedule' was finalized by the pomegranate workers from all over India, which focuses on integrated approach through use of disease free planting material, orchard sanitation, proper plant nutrition and irrigation, cultural practices and chemical spray schedules.

The first successful demonstration of the OHM schedule was done by the National Research Centre on Pomegranate, Solapur in 2007-08 on a farmer's orchard at Hiraj, Solapur that had been abandoned because of severe bacterial blight infection. Reduction in bacterial blight severity was by 82.24 per cent in comparison to neighbouring unadopted orchard and a disease free harvest of 16 tons was achieved from 1 ha area.

In order to build up confidence of farmers, a Network Project on 'Mitigating the Bacterial Blight Disease of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh' was sanctioned by the Ministry of Agri. Govt, of India, New Delhi, in 2008. In addition to surveys, disease forecasting, training and nursery inspections and OHM demonstrations were taken up by different organizations. Fifty seven successful demonstrations were conducted at different locations in the three states from 2008-2010. On an average 67.49 per cent reduction in bacterial blight severity was achieved in the first year after adoption and 73.97 per cent in the second year, with an average productivity of 7.94t/ha in the first year and 9.28t/ha in the second year. The average benefit in the demonstration orchards was 1:2.36 in the first year of adoption and 1:4.31 in the succeeding year. These demonstrations, convincingly proved that the schedule if followed for 3-4 years will definitely check bacterial blight and put back stumbling pomegranate industry on right track, The beginning has already been made.

The existing orchard health management schedule has been modified at a joint meeting of pomegranate researchers from all the states on Nov. 17-18, 2010 at NRC on Pomegranate, Solapur under the Chairmanship of Dr. JH Kulkarni, former Vice Chancellor, VAS, Dharwad. The modified schedule known as 'Integrated Disease and Insect Pest Management (IDPM) Schedule' is a complete package taking care of all aspects. I thankfully acknowledge Dr. JH Kulkarni and all pomegranate workers in the country for formulating the schedule.

I would like to acknowledge with gratitude Dr. S Ayyappan, DG, and Dr HP Singh, DDG (Hort.), ICAR, N. Delhi, whose constant support and constructive criticism has encouraged us to handle the project successfully. The approval and financial aid provided by the Govt. of India, Ministry of Agriculture and Cooperation is thankfully acknowledged..



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## Project Details

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## Executive Summary

The bacterial blight of pomegranate (Punica granatum L.), caused by a bacterium Xanthomonas axonopodis pv. punicae, affects all plant parts, but is most destructive on fruits. All commercially grown cultivars including -Bhagawa the most popular variety- are susceptible to this disease, resulting on an average between 30-50% yield losses which may go up to 80-100% under congenial conditions.

The disease was first reported in India from Delhi in 1952 and was of minor economic importance until 1998. Presently the disease has been of wide occurrence as its outbreaks have been recorded in all major pomegranate growing states including Maharashtra, Karnataka and Andhra Pradesh. Losses due to bacterial blight were recorded in Hanumangarh district of Rajasthan in 2009, though state department reported its first appearance in 2008.

Till recently the disease was prevalent only in India, of late, the disease has also been reported from South Africa (Peterson et al., 2010).

The pathogenic Xanthomonas species cannot survive in soil for more than 30 days without its host, however, it can survive on infected plant debris lying in the orchards for more than 8 months. It can also survive for long periods on infected twig cankers on plants in orchard or in dormant buds. Infected fruits are also potential source of inoculum. Twig cankers, dormant buds and plant debris are therefore major sources of primary inoculum for next crop season. Transmission tests conducted at NRCP have proved that apparently healthy planting material prepared from a blight affected orchard can transmit/introduce disease in a new area. The secondary spread of bacterium is mainly through rain and spray splashes, irrigation water, pruning tools, man and insect vectors.

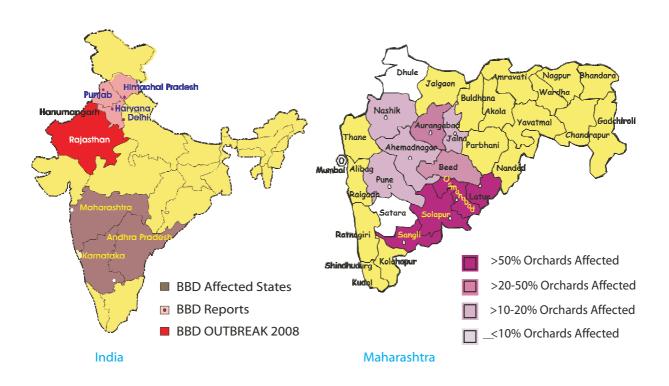
Bacterial blight remains prevalent throughout the

year at a temperature range of 9.0-43.0 °C and RH of > 30.0% available under Solapur conditions. Disease build up is rapid during the months of July to September (mrig bahar). The blight severity increases from June-July months and reaches maximum in September-October months and thereafter it again declines.

Developing resistant varieties or transgenic lines are the only long term solutions for bacterial diseases. In the absence of resistant varieties it is necessary to follow integrated management practices to keep the pathogen inoculum load in the orchard low, so that the disease does not spread and is manageable. Looking into the importance of pomegranate crop and heavy losses caused by bacterial blight an 'Orchard Health Management (OHM) Schedule' was finalized by the pomegranate workers from all over India, which focuses on integrated approach through use of disease free planting material, orchard sanitation, proper plant nutrition and irrigation, cultural practices and chemical spray schedules. In order to build up confidence of farmers, a Network Project on 'Mitigating the Bacterial Blight Disease of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh' was sanctioned by the Ministry of Agri., Govt of India, New Delhi, in 2008.

Surveys were conducted in major pomegranate growing areas of Maharashtra, Karnataka and Andhra Pradesh, to assess the status of bacterial blight. Mapping for bacterial blight (BB) has been done (Fig 1). In general bacterial blight was prevalent in 78.81% orchards of Maharashtra. The major blight affected districts were Solapur, Aurangabad, Jalna and Latur, whereas, Nashik, Pune, Osmanabad, Sangli, Satara and Ahmednagar had moderate to mild intensity. Dhule (except one orchard) had no blight incidence.





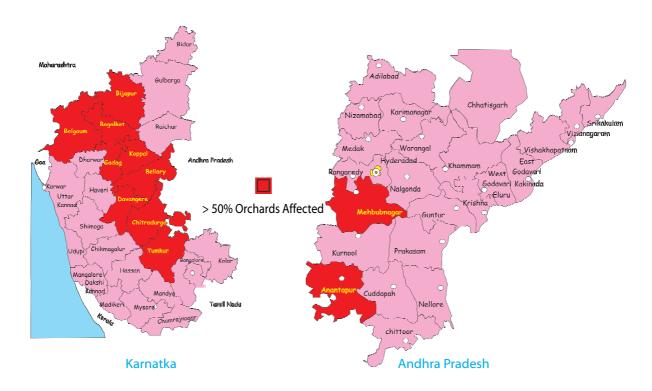


Fig. 1: Bacterial blight affected regions in India



In Karnataka blight was prevalent in 58.33% orchards surveyed in Bijapur, Koppal, Bagalkot Gadag, Chitradurga, Devangare and Tumkur districts, in moderate to mild form. In Andhra Pradesh blight was prevalent in 100% of the orchards in Anantapur and Mahaboobnagar districts having pomegranate cultivation however, the severity was below 20 per cent.

Data on various weather parameters and disease incidence and severity were recorded using disease forecasting Unit. Twenty seven weather parameters and BB disease incidence and severity were recorded for 85 weeks from July 2009 to Feb. 2011 and correlated.

Humidity, slight drizzles, number of rainy days and night temperatures play important role in BB development and spread. Among all meteorological factors relative humidity, total rainfall, number of rainy days, wind speed had significantly positive correlation with blight incidence and severity. Average number of hours/day when temperatures are from 25-35°C and RH>30% were positively correlated with blight severity. Parameters like maximum temperature per day, maximum soil temperatures at 5 and 10 cm depth, evaporation & sunshine hours and hours per day when temperatures go below 20°C or above 35°C and RH below 30%, were significantly but negatively correlated. Less disease in hasta bahar crop can be attributed to night temperatures below 20°C for most of the months (Nov. to Feb.) and low humidity and no or scanty rains. Whereas, higher blight and rapid spread in mrig bahar crop, can be correlated to conducive minimum and maximum temperatures, high humidity and more number of rainy days.

Multilocation Demonstrations in Farmer's Orchards: Total 72 orchards were adopted out of which 15 orchards in different states had to be discontinued either because of non cooperation of the orchard owners or yields were not proper

due to problems like irrigation water shortage or no flowering/fruit setting due to rains, however bacterial blight was successfully managed with improved yield in 57 orchards (79.16%). In all 57 successful demonstrations were conducted at different locations in the three states from 2008-2010. The schedule was successfully demonstrated in 28 blight affected orchards (1 ha each mostly cv. Bhagawa) in the first year and 29 in the second year (Table 1). The average disease severity was 35.50 per cent at the time of adoption, though, it varied from 10-100 per cent in different orchards. In all 16 demonstrations were taken in Hasta Bahar (Winter season crop), 4 demonstrations in Mrig bahar (rainy season crop) and 37 in Ambe bahar (Spring season crop). On an average 67.49 per cent reduction in bacterial blight severity was achieved after adoption in the first year and 73.97 per cent in the second year, with an average productivity of 7.94t/ha in the first year and 9.28t/ha in the second year. The average benefit in the demonstration orchards was 1:2.36 during the first year of adoption and 1:4.31 during the succeeding year (Table 2).

On the basis of multilocation demonstration trials in farmers orchards in the three states it was concluded that bacterial blight of pomegranate can be managed to minimize economic losses by:

- Planting and establishing new orchards with disease free planting material from a certified
- nursery
- Avoiding mrig bahar crop for few years
   Adopting stringent orchard sanitation
- messures
   Pruning blight infected stems as far as possible or removing cankers on stem and painting
- them with recommended bactericidal paints
- Providing balanced nutrition to plants
   Following rest period of 3-4 months and taking
- only 1 crop in a year
   Continuing spray schedules even during rest period, though interval could be increased



Table 1: Management of bacterial blight in adopted orchards in Maharashtra, Karnataka and Andhra Pradesh from 2008-2010

S. No.	States	Participating organizations	Number of successful Demonstration Taken in two years	Number of Demonstration Taken in different seasons/bahar		Average Disease Severity Before Adoption	Disease Disease everity Reduction Before (%)		Produ	v. ctivity ha)	
			(No./Year)	Hasta	Ambe	Mrig	(%)	1st Yr	2 <sup>nd</sup> yr	1st yr	2 <sup>nd</sup> yr
1	Maharashtra	NRCP	10 (5+5)	3	3	4	56.95	61.14	91.34	7.63	10.31
		MAU	07 (3+4)	0	07	0	21.03	35.75	74.55	5.03	7.87
		MPKV	16 (8+8)	0	16	0	41.73	47.03	63.97	7.50	8.37
		Average	35	3	26	4	39.90	47.97	76.62	6.72	8.85
2	Karnataka	UAS	09 (4+5))	09	0	0	29.21	87.12	89.40	8.3	9.57
		IIHR	05 (3+2)	4	1	0	55.05	97.18	79.58	7.17	8.0
		Average	14	13	1	0	42.13	92.15	84.49	7.74	8.79
3	Andhra	HRS (APHU)	10 (5+5)	0	10	0	24.46	62.34	60.79	9.36	10.2
	Pradesh	Average	10	0	10	0	24.46	62.34	60.79	9.36	10.2
	Total/Averag	6	57 (28+29)	16	37	04	35.50	67.49	73.97	7.94	9.28

Note: Total 72 or chards were adopted out of which 15 or chards in different states had to be discontinued either because of non cooperation of the or chard owner or due to problems like irrigation water shortage or no flowering/fruit setting due to rain, however bacterial blight was successfully managed with improved yield in 57 or chards (79.16%).

Table 2: Cost benefit ratio based on average cost of cultivation and income from sale of produce of adopted orchards

Year of adoption	Income from Produce (Rs.)	Cost of Cultivation (Rs)	Net Profit (Rs)	Cost Benefit ratio
1st Yr	2,39,076.25	71,747.69	1,69,086.17	1:2.36
2nd yr	4,22,729.39	76,264.38	3,28,828.93	1:4.31

- Taking only recommended sprays at recommended doses
- Keeping number of sprays at minimum required

Introduction of disease in new areas is primarily through planting material hence nursery inspections were carried out with state departments in Maharashtra and Andhra Pradesh to see health of planting material being supplied. Several nurseries in Solapur and Sangli were found to have infected planting material. It was also felt that nursery inspection and certification was not very stringent and requires to be streamlined.

Several on farm trainings and education programmes were organised for Sate Agricultural Officers and pomegranate growers by different organisations. Training Manuals and extension material in English and local languages were also published by all the organizations except MPKV. Rahuri and distributed to growers/State Agriculture Officers at various training programmes where the scientists participated as resource person.

Workshops and meetings for the network personnel were organised by NRCP during the period including some interactive meetings with the growers.



### **Impact of the Technology**

The perusal of pomegranate area and production statistics for last five years (Table 3), available on Indian Horticultural Data Base, 2009, shows a positive trend till 2007-08. There after pomegranate area and production decreased drastically in 2008-09 due to widespread occurrence of bacterial blight and loss of confidence in the growers to check the disease. Leaving all hopes due to bacterial blight threat, the farmers had started uprooting pomegranate orchards. In 2008-09 though, production decreased due to decrease in area but productivity increased by 3.33 per cent. It may also be worth mentioning that in 2009-10 the increase in area by 16.44 per cent over previous year

2008-09, shows regained confidence of growers to venture into pomegranate cultivation, the increase is more significant in Maharashtra and Karnataka (Table 4). This shows the impact of research and the demonstrations on orchard health management to mitigate bacterial blight in the network mode in the states of Maharashtra, Karnataka and Andhra Pradesh. The increase in area in 2009-10, includes new plantation which has not started bearing fruits, hence basically production of 820.97t of pomegranate in 2009-10 is from area of 109.21 thousand ha in 2008-09. Calculating productivity in 2009-10 on the basis of 2008-09 area it is 7.52t/ha and an increase of +1.76over 2008-09, again showing a positive impact. The impact is more noticeable in Maharashtra followed by Karnataka.

Table 3. Pomegranate area production and productivity in India during last five years

Year		Area	Pro	duction	Prod	uctivity
	x1000ha	Increase over previous year (%)	×1000MT	Increase over previous year (%)	t/ha	Increase over previous year (%)
2005-06	111.6	-	809.2	-	7.25	-
2006-07	116.9	+4.50	839.7	+3.76	7.18	-0.94
2007-08	123.6	+5.74	884.1	+5.30	7.15	-0.42
2008-09	109.21	-11.63	807.17	-8.70	7.39	+3.33
2009-10*	127.16	+16.44	820.97	+1.71	6.46	-12.65

<sup>\*</sup> includes new plantation which has not started bearing fruits, hence basically production of 820.97t of pomegranate is from area of 2008-09. Calculating productivity in 2009-10 on the basis of 2008-09 area it is 7.52t/ha and an increase of +1.76 over 2008-09

Source: Area and production data from Indian Horticultural Data Base 2009, www.nhb.gov.in

Table 4. Pomegranate area, production and productivity in 3 important pomegranate growing states of India during last five years

		2005 - 06	5		2006 -07	7		2007 -08			2008 -09	l e		2009 -10	*
	Area	Prd.	Prt.	Area	Prd.	Prt.	Area	Prd.	Prt.	Area	Prd.	Prt.	Area*	Prd.	Prt.
STATE/Uts	x1000 ha	x1000 MT	x1000 ha	x1000 MT	t/ha	t/ha	x1000ha	x1000MT	t/ha	x1000 ha	x1000 MT	t/ha	x1000 ha	x1000 MT	t/ha
Maharashtra	91.0	593.6	6.5	93.5	601.5	6.4	96.5	596.2	6.2	82.0	550.0	6.7	98.9	555.5	5.6
Karnataka	11.0	127.3	11.6	12.0	129.5	10.8	13.9	134.1	9.7	14.3	138.1	9.7	15.4	144.9	9.4
Andh ra Pradesh	4.3	36.3	8.5	4.9	44.0	9.0	5.7	85.5	15.0	6.5	64.7	10.0	5.6	56.4	10.0

<sup>\*</sup> includes new plantation which has not started bearing fruits

Source: Indian Horticultural Data Base 2009. www.nhb.gov.in



It was felt by all organizations that the disease was effectively managed with the schedule, however, government intervention in some matters is required for effectively mitigating bacterial blight. These are:

- 1. All unattended and neglected orchards require government intervention for removal or proper management of the orchard. An act needs to be promulgated by the Government of India.
- All orchards in the community should a dopt uniform bahar and management schedule to get better results. This should be the responsibility of the block/Taluka

- Horticultural/Agricultural Officer of respective areas. The concerned SAU's have to be linked for better technical support.
- 3. Some regulation to discourage self proclaimed agricultural doctors should come into force, as farmers who consult such doctors for disease management many a times aggravate the disease.
- 4. The possibilities of promoting the nurseries in the non traditional areas where there is no disease at present has to be explored.
- 5. Nursery certification programme should be made effective and needs to be stream lined.

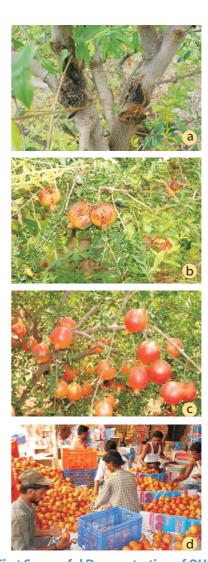
# Selected Success Stories from Demonstration Trials

#### **Maharashtra**

In an adopted orchard at Kasegaon, Tal. Pandharpur, dist. Solapur (MS), which had lost up to 40% fruits in the previous year due to bacterial blight, a 100 per cent blight free fruit yield of 9.7t/ha in the first year and 17.1t/ha in the second year of demonstration was achieved with a cost benefit ratio of 1:2.68 (₹249429) and 1:4.66 (₹669360) respectively in the two years (Fig 4). The farmer, who also followed the OHM package in the neighbouring orchard, also had low disease and got fruit yield of 9.0 and 14.5t/ha respectively in the two years.

At Janoni, Tal. Mangalveda, Solapur (MS), the orchard adopted was 100 per cent blight affected and the farmer could not take any produce during the previous 2 to 3 years. The flower regulation was done in Dec. 2008, after the loss of previous crop in the rainy season. The disease remained under check with less than 2% incidence, however, due to acute irrigation water shortage in April 70% fruits were lost due to abiotic cracking and only 1.6t produce was harvested. However, in the second year flower regulation was done in Sept. last week. Due to delayed rains the flowering was not synchronized and plants came into full bloom in Dec. 2009 The disease remained under check throughout the period and was 2.25% at harvest with a disease free produce of 10.65 t (Fig 6) and cost benefit ratio of 1:1.90. (₹314100). This was probably the first successful produce from the farmer's 5 year old pomegranate plantation. The unadopted orchard lost fruits due to disease and produced only 0.675t/ha fruits in the same season. The Orchard at Hirai, Solapur (MS) where first successful demonstration of OHM was conducted was subsequently adopted in 2009 and 2010. Due to delayed rains the plants came into flowering in Feb. The first crop was lost due to blight in June

due to light drizzles, however in July-Aug, 2010, in spite of rains 7.28t (Fig 7) of disease free fruits were produced which gave a benefit of 1:2.48 (₹310021). The disease incidence was only 21.28% with severity of 8.7% at harvest. Thus an abandoned orchard still having very old cankers on the main stem could be managed to give economic yields. The unadopted neighbouring orchard hardly produced any disease free fruits.



First Successful Demonstration of OHM
Severely blight infected orchard (a-b) adopted by
NRCP for demonstration of OHM Schedule in 2007-08 and
disease free produce (c-d) from same orchard in
April-May 2008



The demonstration plot at Massajog, Tal. Kej, Dist. Beed (MS) was adopted with 24.6% blight severity in 2010. The disease severity after adoption was reduced by 80.89% and fruit yield was 9.35t/ha with a cost benefit of 1:4.29 (Fig 9). In contrast the neighbouring orchard had 72% more disease than the adopted orchard and yield was only 4.8t/ha.

The orchard of Shri Yogesh Nandal Ahuja at village Virag. Tal. Barshi, Dist. Solapur (MS) was adopted under the project in 2010 with disease severity of 62.50%. The disease was reduced by 75.84% and fruit yield of 8.2t/ha was achieved against 2.75t/ha in non adopted orchard with 65.6% disease severity. The grower was now confident to take a healthy crop. Disease free fruits and good yield was also recorded at Deola taluka of Nashik and Sangola taluka of Solapur.

#### **Karnataka**

In a village Hebbal, Tal. Mudhol, Dist. Bagalkot (Karnataka), there was about 200 acres of pomegranate plantation, which reduced to 20 acres because of huge losses due to bacterial blight since 2006. One of the orchards (2.5 acre) in this area was adopted under the project, with 69% diseases severity on trees. The disease severity was reduced to 3.4% at the time of harvest compared to 33.1%. in non-adopted plots. The yield was 12 t/ha in adopted and 2.5 t/ha in non-adopted orchards. This orchard was visited by all higher officials of GOK and GOI. Now it is a model garden to depict the impact of OHM practices in managing bacterial blight of pomegranate in that area.

A pomegranate orchard at Maskal Matti, Hiriyur Tal., Dist. Chitradurga, Karnataka having 40% severity on trees was adopted in 2010 for ambe bahar crop. The grower was getting poor yields. The disease reduced by 68.89% after implementation of the OHM schedule and a yield of 7.5 t/ha was produced giving a benefit of 1:4.50

to the farmer (Fig 13). At the same time the farmer with his own practices could not check blight resulting in blight severity of 80.4% and fruit yield of only 0.5t/ha. The farmer who was earlier reluctant to continue with the crop, after seeing the effectiveness of the schedule became confident to continue with the crop. Another orchard at Yemmerahalli, Tal. Sira, Dist. Tumkur (Karnataka) was adopted for two years from 2008-2010. It was having a disease severity of 69.5% and farmer got poor yield of not more than 1.5t/ha.Excellent control above 90% was achieved with yield of 6.5 and 8.5t/ha with cost benefit ratio of 1:3.76 and 1:5.23 ha, respectively in first and second years (Fig 14).

### **Andhra Pradesh**

A pomegranate grower, Mr. U Prabhakar of village Kanekal Cross, Tal. Kanekal, Dist. Anantapur was about to uproot the pomegranate plantation because of heavy losses due to bacterial blight. The orchard was adopted for 2008-2010 with severity of 45.47%. On an average disease reduction of 81.57% was recorded in the two years and yield of 13.7t/ha in the first year and 7.6t in second year with benefit of 1:3.49 and 1:5.43 respectively, were obtained.

Another grower Mr. M. Damodhar Naidu of village Ammalladinne, Tal Peddapappur Dist. Anantapur though had disease severity of 18.99% in his orchard at adoption, yet was getting poor yields due to losses from blight. The orchard was adopted, the farmer also followed similar practices. Disease reduction was low in the first year but 82.44% reduction was achieved in the second year. Yield of 15.2t/ha and 9.3t/ha was achieved respectively in the two years. The yield reduction in the second year in both the plots was due to flower drop because of rains during flowering/fruit setting stage. The benefit was higher in the second year (1:3.04 and 1:6.18, respectively) due to higher rates of pomegranate in the market.

Abridged Report
Abridged Report

### Introduction

The pomegranate (Punica granatum L.) belongs to the family Punicaceae, one of the oldest known edible fruit crops which can be grown from tropical to temperate climatic conditions. It is suitable for growing under arid and semiarid regions due to its versatile adaptability, hardy nature, low cost of maintenance and high yield. It is reported to be a native of Iran and was domesticated even earlier to 2000 BC. Evidences are available that it was cultivated in ancient Egypt, Greece and Italy long back. In time, it spread into Asia (Turkmenistan, Afghanistan, India, China, etc.), North Africa and Mediterranean Europe. It is expected that wild pomegranate spread from the Balkans to the north-western part of India, especially in Western Himalayas.

It had been embedded in human history and its utilization was associated with several ancient cultures for fruits, pharmaceutical and nutraceutical values. In the recent past its wide range of significance in human health, nutritional and livelihood security has been recognized which resulted in a heavy demand for fruit consumption not only in India but also in the western world. Realising its potential of giving higher profits from smaller areas, cultivation in India steadily increased, occupying a total area of1.27 lac ha in 2009-10. Out of this area Maharashtra occupies the top position with 98.9 thousand ha area under pomegranate cultivation which is followed by Karnataka and Andhra Pradesh. Seeing all round interest in this crop and its ability to adapt to wide range of soil, water and climatic conditions one can visualize steady increase in area of pomegranate in recent future but during last few years the pomegranate production has been impeded due to diseases like bacterial blight (BB) and wilt. Monoculturing with susceptible cv. Bhagawa on large areas, congenial

weather conditions, absence of satisfactory chemical control measures for bacterial diseases, lack of understanding of its mode of propagation and spread has resulted in spread of disease to newer areas causing heavy losses to the growers. Looking into the gravity of the situation and heavy losses caused by the bacterial blight disease a "Network Project on Mitigating the BB Disease of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh" was sanctioned by the Dept. Agri.&Cooperation,Govt.ofIndia,New Delhi, vide letter F.No.33-10/2007-hort, dt.March 3, 2008 for a period of two years but was extended for third year in order to bring 2<sup>nd</sup> year demonstrations to a conclusive end.

The 'Orchard Health Management (OHM) Schedule' worked out by the workers of this network project focuses on orchard sanitation, cultural practices and spray schedules. The schedule had been adopted at farmers orchards for two consecutive years and it was found that adopting hasta bahar or early ambe bahar, proper sanitation procedures including removing of cankers or twig infections, continuing bactericidal spray schedules even in rest period at 15 days interval has resulted in drastic reduction of BB in the second year even in heavily infested orchards. The impact of proper implementation of OHM schedule is clearly visible in the form of increased area during last year and increased confidence among the growers as they can now manage this disease considerably.

The objectives and physical targets set for various organization are summarized below:

### **Objectives**

(a) Survey and surveillance of disease for assessing the incidence and to forecast the disease based on weather parameters



- (b) Demonstrate the available technology in participatory mode for mitigating the disease.
- (c) Train the departmental officers as well as resource farmers on disease management.

S.No.	Work Element			Physica	al Targets	for each	organizati	on
		NRCP	MPKV	IIHR	UAS	MAU	APHU	Total
1.	Survey & Surveillance	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	*
2.	Demonstrations in farmers field	5	10	3	5	5	5	33
3	Training to State/SAU officers	1	-	1	-	-	-	2
4.	Training to officers and resource farmers	5	15	2	5	6	2	35

## Work Progress

### I. Survey and surveillance

The survey of major pomegranate growing areas in Maharashtra, Karnataka and Andhra Pradesh was carried out by all the participating organizations for their respective regions using common survey and surveillance procedures supplied by NRC on pomegranate. The information generated from the survey is summarized below and used for disease mapping (Fig.1)

### **Maharashtra**

In Maharashtra surveys were conducted by NRCP, Solapur, MAU, Parbhani and MPKV, Rahuri.

During the year 2007-08 a total of 113 orchards were surveyed in 7 districts and blight prevelance was above 66% in Sangli, Solapur and Osmanabad, below 25% orchards were affected in

Nashik, Pune, Latur and Aurangabad. Orchards in Ahemadnagar and Satara were free in 2007-08 (Table 5). During 2009-10, surveys were conducted by NRCP Solapur in 81 villages in 15 Talukas covering 3 districts of Maharashtra. In all 116 orchards having area 608.92 acres were covered (Table 6). On an average BB was prevalent in 82.17%% orchards with 66% trees affected however, severity was only 4.79% (Table 6). In Solapur, 87.7 % orchards and in Sangli 58.82% orchards were affected. In Satara 100% orchards were affected in Man Taluka. Apart from BB average wilt prevalence was 68.47% and incidence was from 2.97%. Fungal leaf and fruit spots were prevalent respectively in 95.07% and 76.65% orchards with 47.44 and 53.66% tress affected. Severity was respectively 6.26% and 14.32%.

Table 5. Status of bacterial blight in Maharashtra in 2007-08 (NRCP Solapur)

S. No.	District	Talukas	No. of Orchards	Percent orcha	ards affected with B	acterial blight	
				Severely (Incidence > 40%)	Moderately (Incidence >10 to 40%)	Traces (Incidence up to 10%)	Blight Free
1.	Solapur	6	34	17.65	17.65	38.24	26.71
2.	Sangli	4	11	0	0	81.81	18.18
3.	Nashik	3	21	0	4.71	14.29	80.96
4.	Pune	2	10	0	0	20	80
5.	Ahmednagar	2	4	0	0	0	100
6.	Latur	5	6	16.67	0	0	83.33
7.	Osmanabad	6	3	0	66.67	0	33.33
8.	Aurangabad	-	8	0	12.5	25	62.5
9.	Satara	-	12	0	0	0	100
10.	Jalana	-	4	0	25	0	75



Table 6. Status of bacterial blight in Solapur, Sangli and Satara districts of Maharashtra during the period Oct.-Dec., 2010 (NRCP, solapur)

Trees   Severity   Pre   Inci
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Blight  se Severity ted on a tree on a tree and %)  33 4.81  4.26  54.26  56 5.30
Blig es es chard in and in 33 sign es
Trees affected in an orchard (%) (%) 48.82 84.56
Prevale nce (% 87.7 58.82 100 82.17
S Orchards Area (No.) (acres) 17 36.05 116 608.92
Orchards (No.) (No.) 17 16
Villages (No.) 63 63 81
of of Taluka  District Pandharpur, Mangalwedh, Malshiras, Sangola, Solapur, South Solapur, Mohol, Madha, Atpadi, Karmala  Satara Man  15
Sr. Name of District  1. Solapur  2. Sangli  3. Satara  Total  3
. S. S

\*Calculated on basis of only fruit bearing orchards, as some of the orchards had harvested the fruits



Surveys were conducted by MAU Parbhani, in Osmanabad, Beed and Latur districts of Maharashtra during the year 2008-09 2009-10 and 2010-11. In Osmanabad, Beed and Latur all the surveyed orchards were affected with bacterial blight during 2008-09 nd 2009-10 and severity remained between 9-22%. Bacterial blight reduced in 2010-11, with prevalence below 30% and severity below 3%.(Table7).

The surveys conducted by MPKV, Rahuri revealed that, the disease was present in mild to severe form in most of the surveyed orchards. Two years data revealed that the disease prevalence though high reduced over the year and severity was not more than 21 % in all other districts except Nashik where it was 32% . (Table 8). Disease prevalence and disease severity was less in the orchards surveyed in Pune and Ahmednagar districts respectively.

Surveys show that the disease severity has reduced over the years but areas like Ahemadnagar and Satara which were once free were having bacterial blight to varying extends.

### Karnataka

Among 123 and 257 orchards orchards surveyed by UAS, Dharwad, in North Karnataka BB was prevalent in 93.59 and 77.5 % orchards with 28.87 and 15.39% severity during 2008-09 and 2009-10, respectively (Table 9). The data in Table 10 shows that among all the districts Bagalkot reported the highest severity on tree during all the three years *i.e.*, 66.7, 23.5 and 23.71% during 2008-09, 2009-10 and 2010-2011, respectively. Severity was highest in 2008-09 and reduced in 2009-10 and 2010-11. BB was found in all the three seasons with highest severity on tree in Mrig bahar, followed by hasta and ambe bahar in decreasing order, it ranged

between 15.8- 20.8 %. Infection was highest on leaves followed by stems and fruits (Table 10). Pomegranate orchards were surveyed periodically by IIHR Bangalore in Tumkur, Chitradurga and Davanagere districts of South Karnataka for the blight incidence during 2008-2010. The mean blight incidence in Tumkur, Chitradurga and Davanagere districts during October, 2008 to May, 2009 was 11.9, 16.73 and 16.56 PDI, respectively, (Table 11). In 2009-10 the average incidence in three districts was respectively 19.49, 22.90 and 34.61 PDI.

Higher incidence during 2009-10 in some districts was due to more rains during than 2008-09.

### **Andhra Pradesh**

Survey and surveillance for bacterial blight disease was carried out in Anantapur and Mahaboobnagar district of Andhra Pradesh during 2008-09 and 2009-10, where pomegranate is cultivated intensively (Table 12). Survey results revealed that 100% incidence of bacterial blight in surveyed orchards at Anantapur and Mahaboobnagar districts of Andhra Pradesh. Mean per cent severity of disease on tree was higher at Anantapur (16.15) compared to Mahaboobnagar (12.24). Infections were more on fruits compared to leaves and stems. Less severity of disease was recorded in isolated orchards, orchards having wind breaks and high level of phytosanitation.

### **Disease Mapping**

Based on the surveys conducted disease mapping has been done to show Bacterial blight affected states in India and affected districts in each state (Fig. 1).



Table 7. Status of bacterial blight in Osmanabad, Beed and Latur districts of Maharashtra (MAU Parbhani)

			2008-09				20	2009-10					2010-11			
V		Nun	<b>Number Covered</b>	/ered		Severity		Number Covered	ered		Severity	Severity Number Covered	ber Cove			Severity
s 2	No. District	Taluka	Village	Taluka Village Orchard	Prevalence on Prevalence on Prevalence on Prevalence on (%) a tree Taluka Village Orchard (%) a tree (%) (%) (%)	on a tree (%)	Taluka	Villge (	Orchard	Prevalence (%)	on a tree (%)	Taluka	Village	Orchard	Prevalence on (%) a tree (%)	on a tree (%)
<del>-</del> :	1. Osmanabad 03		11	15	100	15.24	-	5 8		100	9.87	9.87 04 20	20	30	26.92	2.18
2.	2. Beed	90	12	21	100	11.36	_	1 2		100	22.45			ŀ		-
3.	3. Latur	03	03 05	œ	100	16.00	2	2 3 6	9	100	18.85	18.85 05 16	16	33	18.66 2.06	2.06
					Taluka w	ise disea	se situati	on in 20	10 -11 gi	Taluka wise disease situation in 2010 -11 given in Annexues 1 and 2	nexues 1	and 2				

Table 8. Status of bacterial blight in 5 districts of Maharashtra (MPKV, Rahuri)

	Prevalence Severity on	a tree (%)	5.0	32	8.0	21.0	18.9
2009-10	Prevalence	(%)	20.0	80	12	88	79
2005	ered	Taluka Village Orchard	<b>∞</b>	14	9	7	30
	<b>Number Covered</b>	Village	9	∞	4	4	15
	Nur	Taluka	5	က	4	4	2
	Prevalence Severity on a	tree (%)	4.56	35	1.97	16.21	15.0
60-1	Prevalence	(%)	16.67	100	25	85.70	100
2008-09	red	ıka Village Orchard	9	12	4	7	m
	Number Covered	Village	9	∞	4	7	ĸ
	Nun	Taluka	2	က	4	7	М
	S.No. District		Ahmednagar	Nashik	Pune	Sangli	Solapur
	S.No.		-	7	3	4	2



Table 9. Status of bacterial blight in North Karnatakka

	Wilt	Incidence (%)	6.0	0.7	4.1	4.00	1	1	1	4:1
	Severity	on a tree (%)	15.83	23.4	17.3	20.4		1		15.39
2009-10	Prevalence	(%)	96.92	100	90.57	100	I	1	I	77.5
	ered	Taluka Village Orchard	65	51	106	35	1			257
	Number Covered	Village	<sub>∞</sub>	8	30	16	1		1	62
	N	Taluka	2	-	m	7		1		œ
	Wilt	Incidence (%)	3.5	6.5	0.8	9.9	1.6	1.4	1.6	3.14
	Severity	on a tree (%)	19.6	2.99	13.5	19.2	8.8	51.1	23.2	28.87
2008-09	Prevalence	(%)	95	100	80	100	80	100	100	93.59
	ered	Taluka Village Orchard	25	12	20	26	2	23	12	123
	<b>Number Covered</b>	Village	2	9	6	16	4	10	4	54
	Nun	Taluka	2	4	ĸ	2	7	-	1	15
	District		Bijapur	Bagalkot	Koppal	Bellary	Belgaum	6. Gadag	Chitradurga	Tota I/Average
	s.	o Z	-:	7.	e,	4.	2.	9	7.	Tota



Table 10 : District wise and bahar wise average severity of bacterial blight in North Karnataka

(a) l	Bacterial blight sc	enario over three y	ears				
		2008-09	9	2009-	-10	2010-	-11
S.No.	District	No. of fields	SOT	No. of fields	SOT	No. of fields	SOT
1.	Bijapur	25	19.6	65	15.9	20	11.74
2.	Bagalkot	12	66.7	51	23.5	21	23.71
3.	Koppal	20	13.5	108	17.4	30	21.81
4.	Bellary	26	19.2	35	20.4	30	19.45
	Total	83	29.8	259	19.3	101	19.1
(b) B	ahar wise disease	severity					
S.No.	Name of Bahar	Period of Survey	Total No.	of fields	Severi	ty on	SOT
				Lea	f Fru	it Stem	
1.	Ambe	Jan-May	34	31.4	10.	8 25.3	15.8
2.	Mrig	June-Aug	132	2 40.9	9 15.	7 30.2	20.8
3.	Hasta	Sept-Dec	79	53.8	3 11.	1 25.6	17.3
SOT:	Severity on Tree						

Table 11 . Bight incidence in South Karnataka during 2008-2010 (IIHR, Bangalore)

District		Bacterial Blight Dis	sease incidence (PD	I)
	20	08-09	200	9-10
	Mean	Range	Mean	Range
Tumkur	11.90	7.3-13.9	19.49	9.0 – 32.8
Chitradurga	16.73	4.82-22.6	22.90	8.4 – 40.5
Davanagere	16.56	5.36-23.6	34.61	22.6 – 58.9

Table 12. Status of bacterial blight in Andhra Pradesh

	2008-09									2009-10	
S No	o. District	Number Covered			Prevalence	Severity	Number Covered		Prevalence	Severity	
Sirtor Bistrict		Taluka	Village	Orchard		on a tree (%)	Taluka	Village	Orchard	(%)	on a tree (%)
1.	Anantapur	5	10	17	100	21.65	5	21	29	100	8.86
2.	Mehboobnagar	1	4	15	100	16.6	4	7	7	100	3.05
Total/Average		6	14	32	100	19.13	9	28	36	100	5.96



# II. Weather Parameters and Disease Development

Disease forecasting units have been purchased by NRCP, Solapur, MPKV, Rahuri, UAS Dharwad and Horticultural Research Station, Anantapur during 2009-2010 (Fig 2).

and severity either positively or negatively (Table 13).

Both incidence and severity were strongly positively and significantly correlated. Among all weather factors relative humidity, number of hours when RH>80% rainfall, number of rainy



Kegaon research Farm, NRCP Solapur



At farmers orchard by UAS Ddharwad



Horticultural Research Station (APHU), Anantapur

Fig 2. Weather Forecasting Units Installed by different Participating Organization

Data on various weather parameters and disease incidence and severity was recorded using disease forecasting Unit which was installed at NRCP Farm Kegaon in June 2009 Twenty seven weather parameters and BB disease incidence and severity were recorded for 85 weeks from July 2009 to Feb. 2011 and correlated. On the basis of correlation analysis it was found that all factors except average daily temperatures, minimum soil temperature at 5 and 10 cm depth and average hours per day when RH remains between 30-50% were significantly correlated with BB incidence

days, evaporation and sunshine hours and max. soil temperature at 5 cm depth most significantly affected BB. Average, minimum and maximum RH and wind speed was positively correlated. Total rainfall and number of rainy days also had significantly positive correlation with BB. Minimum temperature and average number of hours per day when RH was from 50-80% or above significantly positively affected blight incidence where as average number of hours per day when temperatures are from 25-35°C and RH>30% positively affected severity.



Table 13. Correlation of weather parameters with blight incidence and severity (based on weekly data from July 2009- Feb. 2011

S. No	Parameter	Correlation (r) values			
		Bacterial blight Incidence	Bacterial blight Disease Index		
V1	Average Temperature ( °C)	-0.117	-0.099		
V2	Min.Temperature (°C)	0.238*	0.164		
V3	Max.Temperature ( °C)	-0.291*	-0.229*		
V4	Av hrs/day temperature < 20 °C	-0.345*	-0.253*		
V5	Av hrs/day temperature < 25 °C	0.15	0.079		
V6	Av hrs/day temperature 25 -35 °C	0.184	0.269*		
V7	Av hrs/day temperature >35 °C	-0.377*	-0.334*		
V8	Min. Soil Temperature at 5 cm depth (°C)	-0.118	-0.125		
V9	Max Soil Te mperature at 5 cm depth (°C)	-0.406*	-0.368*		
V10	Min Soil Temperature at 10 cm depth (°C)	-0.202	-0.195		
V11	Max Soil Temperature at 10 cm depth (°C)	-0.249*	-0.229*		
V12	Min Soil Temperature at 20 cm depth (°C)	-0.240*	-0.203		
V13	Max Soil Temperatur e at 20 cm depth (°C)	-0.249*	-0.2		
V14	Average Relative Humidity (%)	0.585*	0.392*		
V15	Min Relative Humidity (%)	0.584*	0.435*		
V16	Max. Relative Humidity (%)	0.441*	0.300*		
V17	Av hrs/day when RH<30%	-0.214	-0.272*		
V18	Av hrs/day when RH>30%	0.214	0.272*		
V19	Av hrs/day when RH<50%	-0.388*	-0.174		
V20	Av hrs/day when RH from 30 -50%	-0.19	-0.014		
V21	Av hrs/day when RH>50 -80%	0.243*	0.134		
V22	Av hrs/day when RH>80%	0.441*	0.181		
V23	Average Wind speed (Km/hr)	0.277*	0.355*		
V24	Evaporation (mm)	-0.442*	-0.334*		
V25	Sunshine hrs.	-0.582*	-0.476*		
V26	Total rainfall (mm)	0.380*	0.351*		
V27	No of rainy days	0.469*	0.329*		
		* significant at 5%			

Parameters like maximum temperature per day, maximum soil temperatures at 5 and 10 cm depth, evaporation and sunshine hours and hours per day when temperatures go below 20°C or above 35°C and RH below 30%, were significantly but negatively correlated. Soil temperatures at 20 cm soil depth, and number of hours when RH goes below 50% negatively affected blight incidence, whereas number of hours when RH is below 30% negatively affected the severity.

Regression models using various combinations of

significantly correlated weather parameters were made and the one with 11 parameters *viz.* average RH, minimum RH, Maximum RH, total rainfall, number of rainy days, maximum temperature, number of hours when temperature was less than 20°C and above 35 °C and maximum soil temperature at 5cm (Table 14) was most suitable as it could account for maximum variation in the blight severity among 5 different models made. However, before making any conclusions data for more years are required.



Table 14. Most suitable regression model based on 85 weeks observations

Weather Parameters used for the model	Regression Model	Coefficient of determination (R²)
V3: Max.T V4: Hrs. Av T < 20 °C V7: Hrs. Av T > 35 °C V14: Av RH V15: Min. RH V16: Max. RH	BBD (I%) = -69.955 +(3.289) V3+(0.367) V4 +( - 1.109)V7+(0.035)V14+(0.077) V15+(0.056)V16+( -1.523) V24+(-1.074) V25+(0.028)V26+( -0.562) V27+(-0.625) V95cm+4.821	0.531
V24: Evaporation V25: Sunshine hrs. V26: Total Rainfall V27: No. of Rainy day V9: Max Soil Temp. at 5cm depth	BBD (DI) = -16.851 +(1.008) V3+(0.069) V4+( -0.414)V7+ (-0.047) V14+(0.033) V15+(0.044)V16+(-0.147) 24+(-0.284) V25+(0.019)V26+(-0.297) V27+(-0.387) V95cm+1.132	0.511

Note: Data for more years required before arriving at any conclusion.



# III. Demonstrations of Orchard **Health Management Schedule in Adopted Orchards**

The 'Orchard Health Management' schedule

followed with minor modification by different organizations, for demonstrations is given in Annexure 3 and Fig 3



Disinfection of secatures



Pruning with disinfected secatures



Severe pruning in infected old gardens







Dumping the puned parts outside the orchard and burning them



Pasting of cut ends with Bordeaux mixture



Maintaining orchard sanitation



Removing infected fruits from the tree as and when observed



Taking recommended sprays at specified intervals

Fig 3. Various operations in the demonstration plots



### **Demonstrations by NRCP Solapur**

Five demonstration plots each of 1ha orchard with more than three years old plantation at Tuljapur, Wadgi, Pandharpur, Janoni and Malegaon were selected during 2008-09. The irrigation water, soil and leaf samples from adopted orchards were analyzed for assessing irrigation water quality and nutrient status of soil and plant and necessary corrective measures were taken up while carrying out the demonstrations. Six demonstration plots 4 each of 1ha at Tuljapur, Pandharpur, Janoni and hiraj and 2 neighbouring orchards of 1 and 1.5 acres at Malegaon with more than four years old plantation were adopted in 2009-10 (Table 15). The adopted orchards were given rest and sprays were continued at 15 days interval. The recommended OHM schedule was used for demonstrations.

# Soil physicochemical properties and fertility status of the adopted orchards.

The soils of adopted orchards were normal to slightly alkaline with pH ranging from 7.15 to 8.27 and electrical conductivity ranging from 0.11 to 0.16 dSm<sup>-1</sup>. The soil organic carbon content of orchard at Janoni (0.18%) and Kasegaon (0.43%) was low, it was medium (0.53-0.60%) in orchards at Wadgi and Malegaon (a) and high (0.84 0.97%) in orchards at Malegaon (b) and Tuljapur. Soils of all the adopted orchards were calcareous with CaCO<sub>3</sub> content ranging from 8.9 to 19.3%. The higher CaCO<sub>3</sub> content is reported to have adverse effect on plant growth through its effect on nutrient availability.

The soil fertility status as indicated by macro and micronutrient content showed that soils of all the orchards were medium in available nitrogen, low to medium in available phosphorus and high in available potassium content (Table 16a).

DTPA extractable Fe content was low in all the orchards whereas, Cu content was very high in all the orchards which might have resulted from the use of copper fungicides for disease control. DTPA

extractable Mn content was towards higher side of the sufficiency range in orchards at Wadgi, Tuljapur and Malegaon (a) & (b) whereas it was toward lower side in orchards at Janoni and Kasegaon. DTPA extractable Zn content was also low in most of the orchards except in Kasegaon and Malegaon (a) orchards where it was in the sufficiency range.

## **Quality of irrigation water**

The irrigation water used in adopted orchards was of moderate salinity as indicated by pH and EC values given in Table 16b. This type of water can be safely used for irrigation purpose in most of the soils provided drainage provision is proper. The water used for irrigation at Osmanabad orchard had moderate content of residual sodium carbonate (RSC>1.25 me/l). Other parameters, such as calcium, magnesium, carbonates and bicarbonates as well as chlorides contents were within the permissible limits which can be safely used for pomegranate production.

#### Leaf nutrient status

#### (a) At adoption

The data on nutrient content in the leaves of all the adopted orchards at the time of adoption showed that most of the nutrients were within low to optimum range except potassium (Table 16c). The N content of all the orchards was in the optimum range. The leaf phosphorus content of Janoni, Baramati (b) and Tuljapur was towards higher side while it was optimum in other orchards. The potash content of most of the orchards was in higher range except Janoni and Baramati (a) where, it was in the optimum range. The micronutrient content in the leaves showed that the Fe and Zn content was optimum in all the orchards while Mn and Cu Content was low except Mn and Cu content in Baramati (a) orchard and Mn content of Baramati (b) orchard which was in theoptimum range.



Table 15. Details of demonstration plots selected by NRCP Solapur

	Kasegaon,	aon,	N CON	choylepach.	ioc pc/W	П :	Sindphal,	ohal,		Malegaon, Baramati	aramati	
	Pandharpur, Solapur	arpur, pur	Janoni,	Janoni, Solapur	Solapur	Solapur	Tulajapur, Osmanabad	ıpur, ıabad	Khurd	þ.	Nepatwalan	alan
20	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10	2008-09	2009-10
_	1 ha.	1 ha.	1.40 ha.	1.40 ha.	1 ha.	1 ha.	1 ha.	1 ha.	1 acre	1 acre	1.5 acre	1.5 acre
17	759	759	1000	1000	800	800	740	740	350	350	375	375
В	hagawa	Bhagawa Bhagawa	Bhagawa	Bhagawa	Bhagawa	Bhagawa	Bhagawa	Bhagawa	Bhagawa	Bhagawa	Bhagawa	Bhagawa
=	10'X15'	10'X15'	10'X15'	10'X15'	10'X 15'	10'X15'	9' X 15'	9' X 15'	11'x 13'	11'x 13'	10'×15'	10'×15'
_	19	19	11	11	6	6	∞	∞	48	48	10	10
72	5 +	+ 9	+ +	5 +	+ 4	5 +	+ 4	+ +	+ &	+ &	3+	3+
ш.	Plane	Plane	Low lying	Low lying	Plane /low lying	Plane	Sloppy Land	Sloppy Land	Plane	Plane	Plane	Plane
S	Light Soil	Light Soil	Light Soil	Light Soil	Medium to light Soil	Medium to deep black	Light Soil	Light Soil	Light	Light	Black	Black
_	None	None	None	None	On one side — Shewaga	None	Casuarina equisetifolia	Casuarina equisetifolia	Casuarina equisetifolia	Casuarina equisetifolia	None	None
7 7	28 <sup>th</sup> July, 2008	14 <sup>th</sup> May, 2009	11 <sup>th</sup> Aug., 2008	24 <sup>th</sup> Sept., 2009	7 <sup>th</sup> Aug., 2008	5 <sup>th</sup> Oct., 2009	2 <sup>nd</sup> Aug., 2008	11 th Oct., 2009	11 <sup>th</sup> Aug.,2008	20 <sup>th</sup> Aug.,2009	11 <sup>th</sup> Aug., 2008	7 <sup>th</sup> Aug., 2009



Table 16a: Analysis of soil of adopted orchards by NRCP, Solapur

Adopted Orchard		chemica	chemical properties	es	Avaialble M	acro nutri	Avaialble Macro nutrients (Kg/ha)	Availab	le Micro	nutrien	Available Micronutrients (ppm)
	Hd	EC (ds/m)	OC (%)	CaCO3 (%)	z	۵	×	Fe	Cu	Mn	Zn
Kasegaon, Pandharpur, Solapur	8.27	0.159		14.7	320.5	11.5	744.8	0.31	3.7		96.0
noni, Mangalveda, Solapur	8.15	0.134	0.18	18.8	302.7	14.9	67.2	0.81	0.68		0.16
Wadji, S. Solapur, Solapur	8.05	0.142	0.53	16.9	213.7	16.0	733.6	0.29	1.23		0.29
Sindphal, Tuljapur, Osmanabad	7.15	0.141	0.84	19.3	338.3	14.7	313.6	1.51	3.14	9.94	0.36
Malegaon, Baramti, (a)	7.88	0.112	0.65	11.7	409.5	41.3	924	0.53	6.46		1.16
Pune (b)	7.58		0.97	8.9	373.9	22.7	991.2	0.25	5.6		0.45

Table 16b: Analysis of Irrigation water of adopted orchards by NRCP, Solapur

Adopted orchard	Source	Н	EC(ds/m)	Ca+Mg	Carbonates	Bicarbonates (me/L)	Chlorides	Sodium	SAR
Janoni, Mangalveda, Solapur	Well	7.65	0.687	4.80	0.40	4.70	2.80	3.80	2.46
Sindphal, Tuljapur, Osmanabad	well	7.73	0.732	7.30	0.00	4.60	4.40	2.70	1.41
Kasegaon, Pandharpur, Solapur	well	7.33	0.675	4.40	00.00	2.20	1.80	2.30	1.55
Wadji, S. Solapur, Solapur	Well	7.39	0.745	8.00	09.0	7.30	4.00	3.00	1.50

Table 16c; Analysis of leaf samples of adopted orchards by NRCP, Solapur for nutrient status (At adoption July, 2008)

Adopted orchard		Macro	Macronutrients (%)	(%		Micronutrients (ppm)	ints (ppm)	
		z	۵	¥	Fe	Mn	J	Zn
lanoni, Mangalveda, Solapur		1.54	0.25	0.98	103.9	25.9	22.3	17.1
Kasegaon, Pandharpur, Solapur		1.26	0.16	2.30	92.9	21.3	30.3	17.7
Malegaon, Baramti, Pune	Khurd	1.61	0.17	0.74	135.5	48.9	55.4	25.1
	Nepatwalan	1.65	0.24	1.69	75.4	80.4	22.5	24.3
Sindphal, Tuljapur, Osmanabad		2.03	0.23	2.28	6.86	23.9	17.8	23.9
Wadji, S. Solapur, Solapur		1.26	0.16	2.51	92.8	23.0	22.4	28.5



#### (b) After adoption

The leaf nutrient status after adoption of the orchard showed significant increase of all the nutrients in all the orchards except phosphorus which recorded considerable decrease over the initial values (Table 16d). If we compare the data with non adopted orchards, it is observed that

The orchard at Hiraj adopted for the second year in Ambe bahar in 2008-09 by the Centre recorded less than 1 % blight till June 1<sup>st</sup> week, however >80% immature fruits were lost due to bacterial blight because of rains in second week of June. The OHM schedule was continued in the same orchard for third year in 2009-10 after adoption by the

Table 16d: Analysis of leaf samples of adopted orchards by NRCP, Solapur for nutrient status (Nov. 2008 Samples)

Orchard location			Macron	utrient	s (%)	Micron	utrients	s (ppm)
		N	Р	K	Fe	Mn	Cu	Zn
Kasegaon, Pandharpur, Solapur	Adopted	2.38	0.113	1.42	82.4	42.7	37.5	23.7
Kasegaon, Fananarpai, Solapai	Non adopted	1.33	0.113	2.11	113.1	66.6	44.3	20.9
Malegaon, Baramti, Pune (0.5 acre)	Adopted	1.82	0.136	2.10	147.3	65.1	64.8	26.2
Malegaon, baranti, rune (0.5 acre)	Non adopted	1.46	0.149	2.12	111.4	60.2	55.2	18.4
Malegaon, Baramti, Pune (1.5 acre)	Adopted	1.68	0.116	2.19	111.1	50.8	27.4	19.4
Malegaon, baranti, rune (1.5 acre)	Non adopted	1.49	0.147	2.34	971	41.1	29.1	19.1

some of the nutrients were more in adopted and some in non adopted however, in both adopted as well as non adopted orchards nutrient contents were in the optimum limit. The N content was lower in non adopted orchards as farmers use less quantity of N fertilizers in their orchards.

## Effect of Orchard Health Management Schedule on BB and Fruit Productivity in Adopted Orchards (Fig. 4-8)

The disease control achieved and yield benefits obtained after adoption of orchards have been summarized in Table 17. The disease severity was very low in all the adopted orchards (Max 8.7%). The cost benefit ratio varied from 1:2.17 to 1:5.27 during first year and 1:1.90 to 1:4.66 in second year (Table 18). Although the blight was successfully managed in all the orchards in second year, yield levels were lower in some orchards due to flower/fruit drop or no flowering due to unseasonal rains.

Centre under the network project. In spite of rains this orchard gave a disease free yield of 7.28 tonnes (+ approximately 1-1.5 tonnes was lost due to delayed harvest by farmer) and BB incidence was only 21.28% with severity of 8.7% in *Ambe bahar crop* compared to almost total loss of immature fruits in previous year in the same season . At Baramati average reduction in blight after adoption was 30.17 and 94.63% respectively after first and second year of adoption. Significant reduction in disease and increment in yield were also recorded from Malegaon, Kasegaon, Sethphal and Janoni.

The disease control in Janoni was also highly significant and registered a decline of 98.20 and 97.75 % during first and second year of adoption respectively (Table 17).















Fig 4. Produce in a moderately bacterial blight affected orchard at Kasegaon, adopted by NRCP in mrig bahar 2009-10 i











Fig 5. Blight free produce of adopted orchard at Tuljapur





Fig. 6. Produce of a severely bacterial blight affected orchard (top) at Mangalweda, Junoni, in first year (middle) and second year (bottom) of adoption by NRCP during ambe bahar crop





Fig. 7. Produce of a severely bacterial blight affected orchard at Hiraj, South Solapur



Fig. 8. Produce in adopted orchard at Malegaon (Baramati)



Table 17. Effect of OHM schedule on bacterial blight and yield in demonstration plots adopted by NRCP, Solapur during 2008-09 and 2009-10

	ield a)	2009-10	Bah <i>a</i> r not taken	I	I	14.90	3.36	0.68	ī
lopted	Fruit Yield (t/ha)	2008-09	8.00	I	8.0	9.00	3.00	0.00	ı
Non adopted	Disease Severity at harvest (%)	2008-09 2009-10	40.00	I	40.0	0.00	2.53	60.00	Crop lost due to blight
	Dis Seve har	2008-09	30* bahar taken later	I	30	0.00	12.00	5.00	I
	Fruit Yield(t/ha)	2009-10	7.5 (3t/acre) flower fruit drop due to rains at fruit setting	no flowering due to rains	7.5 (3t/acre)	17.10	9.03 (7.4 t from only 600 plants, 140 plants wilted)	10.65	7.28
	Fruit Yi	2008-09	22.30 (9.01/vacre)	2.67 (1.6 t/1.5 acre)	12.49	9.70	10.60	1.6 tons (70% fruits lost due to abiotic cracking*)	Discontinued due to non cooperation of farmer
oted	cent disease duction after adoption	2009-10	91.45	95.00	94.63	1 00.00	74.70	97.75	89.13
Adopted	Per cent disease reduction after adoption	2008-09	7435	25.00	30.17	100.00	6930	9820	0.00
	Severity vest	2009-10	1.00	5.00	3.00	0.00	2.53	2.25	8.70
	Disease Severity at harvest (%)	2008-09	3.00	75.00	39.0	0.00	3.07	1.80	80.00
	Disease Severity	Before/ At adoption	11.70	100.00	55.85	40.00	10.00	1 00.00	80.00
	Flower regulation date	2009-10	Oct. 15, 2009	Oct. 25 2009		July 7-15, 2009	10-Jul-08 Dec. 4-12,	Sept. 24, 2009	Oct 5- 15,2009
	Flower r	2008-09	03-Aug-08	08-Mar-09		10-Aug-08 2009	10-Jul-08	08-De c- 09	Feb.2009
	Adopted orchard (area 1ha unless	Indicated)	Malegaon, Baramati (1 acre)	Malegaon, Baramati (1.5 acre)	AVERAGE	Kasegaon, Tal Pandharpur (Solapur)	Sethphal, Tuljapur Dist. Osmanabad	Janoni, Mangalvedha (Solapur)	Wadagifor 2008-09 and Hiraj (Solapur) for 2009-10
	S.No.		1(i)	1 (ii)		2	m	4	72



Table 18. Effect of orchard health management schedule on cost benefit ratio in adopted orchards by NRCP, Solapur

			2008-09	60			2009-10	9-10	
S. No	Adopted Orchard/variet y/area	Income from Produce (Rs.)	Cost of Cultivation (Rs)	Net Profit (Rs)	Cost Benefit Ratio	Income from Produce (Rs.)	Cost of Cultivation (Rs)	Net Profit (Rs)	Cost Benefit Ratio
1(i)	Malegaon, (Baramati)/ Bhagawa/ 1 acre)	4,55,000.00	34,834.00	4,20,166.00	1:12.05	1,80,000.00	57034.00	122966.00	1:2.15
1 (jj)	Malegaon, (Baramati)/ Bhagawa/ 1.5 acre)	76,800.00	50,000.00	26,800.00	1:0.28	No flowering a	nd fruit setting d	No flowering and fruit setting due to continuous rains	ains
	TOTAL (1 ha)	131,804	84,834.00	4,46,966.00	1:5.27	1			
7	Kasegaon, Tal Pandharpur (Solapur) /Bhagva/1 ha	3,42,260.00	92,831.00	2,49,429.00	1:2.68	8,12,955.00	1,43,595.00	6,69,360.00	1:4.66
æ	Tuljapur Dist. Osmanabad,/ Bhagva/1 ha	3,28,800.00	1,03,456.00	2,24,544.00	1:2.17	4,44,000.00	97,456.00	3,46,544.00	1:3.55
4	Janoni, Mangalvedha (Solapur) /Bhagva/1 ha	44,800.00	1,25,000.00	Loss	1	5,32,50.00	1,65,150.00	314100.00	1:1.90
5	Wadagi for 2008 -09 and Hiraj (Solapur) for 2009-10	Discontin	ued due to nor	Discontinued due to non cooperation of farmer	ffarmer	434962	1,24,941.00	3,10,021.00	1:2.48
	Erratum: The values of cost benefit ratio for 2009-10, in the Network Project Annual Report, second year 2009-10, should be replaced with values in this edition. The typing error in previous report is regretted.	cost benefit ratio f ng error in previou	for 2009-10, in that is report is regre	ne Network Proj etted.	ect Annual Rep	oort, second year	· 2009-10, should	be replaced with v	alues



# Demonstrations of Orchard Health Management Schedule by Maratwada Agricultural University (MAU), Parbhani (Fig 9.)

Five orchards (two at Osmanabad, two at Beed and one at Latur) were adopted by MAU, Parbhani during both the years. Amongst the five demonstration plots adopted during 2008-09, two demonstration plots (Hali Khurdali and Upali) were not continued for the year 2009-10 due to acute shortage of water (Table 19). Incidence of bacterial blight and its severity before the adoption of orchards are presented in Table 20. During the first year (2008-09), the hasta bahar was prolonged due to heavy rains in the month of October and November, 2008 when the demonstration plots were adopted, which resulted in delay of various activities (pruning, defoliation) to be undertaken in the orchards. The pruning operation was undertaken in the fourth week of Deember, 2008 at Hangarga and second week of January, 2009 at Upala (Ma.) and Seluamba. Weather conditions at Hali Khurdali and Upali were not favourable, hence, the orchards were pruned in March, 2009. The condition of orchards at Hali Khurdali and Upali

was not good, however condition of demonstration plots adopted at Hangarga, Upala (Ma.) and Seluamba was better. Bacterial blight disease on fruits was observed in the first week of June, 2009 in demonstration plots adopted at Hangarga, Upala and Seluamba, however, the disease intensity was very low. Spraying operations were undertaken in these demonstration plots at 7 days interval. The harvesting of fruits in above mentioned orchards was done in the month of August-September, 2009. During second year (2009-10), prunning was undertaken in the second week of December 2009 at Upala, Seluamba and Massjog, first week of January (2010) at Hangarga and Fourth week of January (2010) at Ramegaon. There was reduction in disease severity in all the adopted orchards at harvest w.r.t. non adopted orchards, however reduction was more significant after second year of adoption. Yield in adopted orchards were 1.5 to 1.95 times higher than non adopted orchards in both the years and significant improvement in yields were recorded in second year (Table. 21). The cost benefit ratio (after first year of adoption) ranged from 1:1.21-1.64 in adopted orchards, which increased to 1:2.37-4.29 in the second year of adoption (Table 22). Two orchards in first year and 1 in second year were discontinued.



Fig. 9. Produce in demonstration plot adopted by MAU



Table 19. Details of demonstration plots selected by MAU, Parbhani

		T.	m.	σ.	, m	Œ.
	Variety	Bhagawa	Bhagawa	Bhagawa	Bhagawa	Bhagawa
	Area (Ha)	10	10	01	10	10
2009-10	Taluka and Dist.	Tq.& Dist. Osmanabad.	Tq. Tuljapur, Dist. Osmanabad	Tq. Ambajogai Dist. Beed.	Tq. Kej Dist. Beed	Tq.& Dist. Latur
	Village	Upala(Ma.)	Hangarga	Seluamba	Massajog	Ramegaon
	Name	Mrs. Kamal Uddhavrao Gilbile	Shri. Kishor Vasantrao Hangargekar	Shri.Keshav Dattagir Giri	Shri. Jaising Sajjanrao Deshmukh	Mrs. Gangadevi Gopikishan Kabra
	Variety	Bhagawa	Bhagawa	Bhagawa	Bhagawa	Bhagawa
	Area (Ha)	01	10	01	10	01
2008-09	Taluka and Dist.	Tq. & Dist. Osmanabad.	Tq. Tuljapur, Dist. Osmanabad	Tq. Ambajogai Dist. Beed.	Tq. Wadawani, Dist. Beed.	Tq. Chakur, Dist. Latur.
	Village	Upala(Ma.)	Hangarga	Seluamba	Upali	Khurdali
	Name	Mrs. Kamal Uddhavrao Gilbile	Shri. Kishor Vasantrao Hangargekar	Shri. Keshav Dattagir Giri	Mr. Shaikh Mayur Shaikh Rauf	Mr. Bhanudas Sudamrao Jadhav
	S.No.	<del>-</del> :	2.	ĸi.	4.	.5



Table 20. Disease status of demonstration plots adopted by MAU Parbhani

	S							
	Stems / Twigs	S	1.5	1.0	1.5	1.5	1.5	
	Stems	-	2.5	2.5	2.5	2.5	3.0	
	Fruits	S	16	15	15			
2009-10	Fru	- S	35	30	30		1	
	Leaves	S	11	10	10	33	33	
	Lea	-	30	30	35	55	55	
	Demonstration	plots adopted	Tq. & Dist. Osmanabad	Tq. Tuljapur, Dist. Osmanabad	Tq. Ambajogai Dist. Beed	Tq. Kej Dist. Beed	Tq. & Dist. Latur	
	Stems / Twigs	_	56	09	51	47	44	
	Stems	S	18	19.5	17.5	15	13.5	
2008-09	Fruits	-	52	54	48	42	40	
200	Frı	_	56	09	51	47	44	
	Leaves	S	18	19.5	17.5	15	40 13.5	%
	Leg	-	52	54	48	42	40	everity
	Demonstration		Tq. & Dist. Osmanabad	Tq. Tuljapur, Dist. Osmanabad	Tq. Ambajogai Dist. Beed	Tq.Wadawani, Dist.Beed	Tq. Chakur, Dist. Latur	l= incidence %, S= severity %
		S.No.	1.	2.	က်	4.	.5	<u>II</u>



Table 21. Disease and yield status of demonstration plots adopted by MAU

	ted Plots	Yield (t/ha)	5.75	4.83	4.10	4.80	ı
	Non adopted Plots	Per cent Disease Severity on tree (At harvest)	15.6	15.0	16.9	16.3	ŀ
	Plots	Yield (t/ha)	8.05	7.55	6.54	9.35	Vitiated
2009-10	Adopted Demonstration Plots	Per cent Disease Severity on tree After Adopting (At harvest)	3.7	4.7	7.7	4.7	Vitiated
	Adopted	Per cent Disease Severity on tree Before adopting	12.7	13.7	11.8	24.6	31.6
	Area		1.0	1.0	1.0	1.0	1.0
		Demonstration Sites	Upala (Ma.) Dist. Osmanabad	Hangarga Tq.Tuljapur, Dist. Osmanabad	Seluamba Tq. Ambajogai, Dist. Beed	Massajog, Tq. – Kej, Dist. Beed	Ramegaon Tq. Latur, Dist- Latur
	ed Plots	Yield (t/ha)	3.20	2.95	2.70	2.9	ı
	Non adopted Plots	Per cent Disease Severity on tree (At harvest)	20.3	21.2	17.6	21.0	1.6
	ion Plots	Yield (t/ha)	5.75	4.80	4.55	Vitiated*	Vitiated*
2008-09	Adopted Demonstration Plots	Per cent Disease Severity on tree After Adopting (At harvest)	12.7	13.7	11.8	Vitiated	Vitiated
	Adopted	Per cent Disease Severity on tree Before adopting	19.5	21.7	18.3	16.3	15.5
	Area	(ha)	1.0	1.0	1.0	1.0	1.0
		Demonstration Sites	Upala (Ma.) Dist. Osmanabad.	Hangarga Tq.Tuljapur, Dist. Osmanabad.	Seluamba Tq. Ambajogai, Dist. Beed.	Upali, Tq. – Wadawani, Dist. Beed.	Hali Khurdali Tq. Chakur, Dist – Latur.
		S.N.O.	<del>-:</del>	7	m	4.	



Table 22. Effect of orchard health management schedule on cost benefit ratio in bacterial blight affected adopted orchards by MAU, Parbhani

			200	8-09			2009	9-10	
S. No	Adopted Orchard	Income from Produce (Rs.)	Cost of Cultivation (Rs)	Net Profit (Rs)	Cost Benefit Ratio	Income from Produce (Rs.)	Cost of Cultivation (Rs)	Net Profit (Rs)	Cost Benefit Ratio
1.	Upala, Tq. and Dist. Osmanabad	2,08,500/-	78,796	1,29,704	1:1.64	2,96,100/-	72,034/-	2,24,066/-	1:3.11
2.	Hangarga, Tq. Tuljapur, Dist. Osmanabad	1,77,000/-	75,739	1,01,261	1:1.34	2,79,500/-	73,354/-	2,06,146/-	1:2.81
3.	Sehamba, Tq. Ambejogai, Dist. Beed	1,59,850/-	72,279	87,579	1:1.21	2,46,980/-	73,299/-	1,73,681/-	1:2.37
4.	Upali, Tq. Wadwani, in 2008-09/ Massajog, Tq. – Kej, in 2009-10 Dist. Beed	0.00	69,670	Vitiated	-	4,02,200′=	75,994/=	3,26,206/-	1:4.29

# Demonstrations of Orchard Health Management Schedule by Mahatma Phule Krishi Vidyapeeth, Rahuri (Fig. 10 and 11)

Three Orchards in Nashik, three in Solapur, two in Sangli, one in Ahmednagar and one in Pune district were selected for demonstrations by MPKV Rahuri. The orchard health management schedule was followed as per the approved programme. The data presented in Table 23, revealed that the bacterial blight in adopted orchards during 2008-09 was checked up to 50% in four adopted orchards at Telangwadei Lotewadi, Dahitane and Pimpri Khurd. The control

of bacterial blight to the extent of 35-40% was achieved in orchards at Atpadi, Vadgaon, Landge and Narayanwadi but three demonstrations failed to yield positive results in other adopted orchards. The average fruit yield was 1.78 t/ha more in adopted orchards than non adopted orchards during first year of adoption

In the second year the control of bacterial blight to the extent of 50-65 % was achieved in the orchards adopted at Vadgaon Landge, Atpadi, Hajagi, Banegaon and Deola. The disease control was to the extent of 40-50% in the remaining three adopted orchards. The average fruit yield was 5.88 t/ha more in adopted orchards than none adopted orchards.





Fig. 10 Demostration sites of MPKV



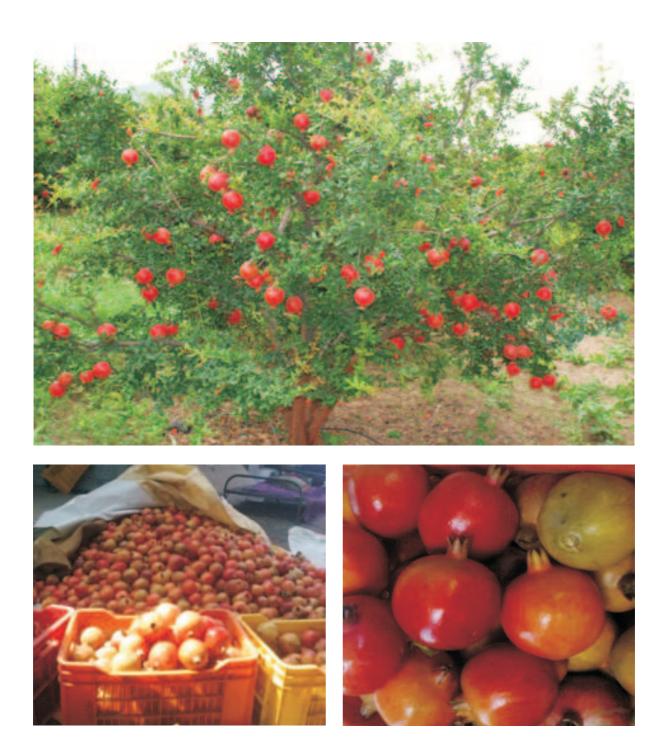


Fig 11. Produce of adopted orchards at Deola (Nashik) and Sangola (Solapur) by MPKV, Rahuri



Table 23. Effect of orchard health management schedule on bacterial blight and yield in adopted orchards by MPKV

	Productivity Fruit Yield at harvest (t/ha)	Non Adopted	2.75	2.83	3.10	2.50	4.0	2.10
	Produ Fruit \ harve	Adopted	8.20	8.50	8.30	7.80	8.10	9.20
	<i>.</i>	Non Adopted (at harvest)	65.60	55.10	45.35	00.09	31.50	58.70
2009-10	Disease severity (%)	Adopted (at harvest)	15.10	18.30	14.20	19.00	10.70	15.0
	Dis	Adopted (Before/at adoption)	62.50	40.00	35.45	70.40	28.70	25.10
	Flower regulation Date		Feb-March 2010	Feb-March 2010	Feb-March 2010	Feb-March 2010	Feb-March 2010	Feb-March 2010
	Adopted orchard variety / area		At Vairag Tal.Barshi Dist. Solapur Vr. Bhagwa/1.0 ha.	At Banegaon Tal. North Solapur Dist. Solapur Vr. Bhagwa/ 1.0 ha.	At. Hanjagi Tal. Akalkot Dist. Solapur Vr. Bhagwa/ 1.0 ha	Tal.Jat Dist. Sangli Vr. Bhagwa 1.0 ha	Tal. Atpadi Dist. Sangli Vr. Bhagwa/ 1.0 ha	Makarandwadi Tal.Deola Dist.Nashik Vr.Bhagwa/ 1.0 ha
	Productivity Fruit Yield at harvest (t/ha)	Non Adopted	4.0	4.15	5.10	6.0	5.45	17.18
	Productivity Fruit Yield at haı (t/ha)	Adopted	6.50	8.80	8.50	6.15	6.18	18.25
	ity	Non Adopted (at harvest)	50.0	40.0	35.00	22.00	23.50	13.10
2008-09	Disease severity (%)	Adopted (at harvest)	18.37	12.72	16.33	21.00	20.50	11.3
	Θ	Adopted (Before/at adoption)	50.79	37.02	31.55	73.5	33.80	3.7
	Flower regulation Date		Feb-march 2009	Feb-March 2009	Feb-March 2009	Feb-March 2009	Feb-March 2009	Feb-March 2009
	Adopted orchard variety / area		Telangwadi, Tal. Mohol, Dist. Solapur./ Bhagwa /1.0 ha	Lotewadi, Tal. Sangola, Dist. Solapur./ Bhagwa /1.0 ha	Dahitane, Tal. Akalkot, Dist. Solapur./ Bhagwa /1.0 ha	Pimpri Kurd, Tal. Alpadi, Dist.Sangli / Bhagwa /1.0 ha	Atpadi, Tal. Atpadi, Dist. Sangli/ Bhagwa /1.0 ha	Indira Nagar Satana, Dist. Nashik./ Bhagwa /1.0 ha
	S .		-	7	m	4	2	9



Table 23 contd.

	Productivity Fruit Yield at harvest (t/ha)	Non Adopted	2.40	2.60	3.00	3.90	2.62
	Produ Fruit Y harves	Adopted	9.50	8.90	7.80	8.75	8.50
		Non Adopted (at harvest)	48.50	46.80	32.00	18.0	46.15
2009-10	Disease severity (%)	Adopted (at harvest)	14.0	15.0	12.00	9.0	14.23
	Dise	Adopted (Before/at adoption)	30.00	26.00	31.60	17.50	3.72
	Flower regulation Date		Feb-March 2010	Feb-March 2010	Feb-March 2010	Feb-March	
	Adopted orchard variety / area		Tal. Deola Dist. Nashik Vr. Bhagwa/ 1.0 ha	Kapshi Tal. Deola Dist. Nashik Vr. Bhagwa/ 1.0 ha	Vadgaon Landge Tal. Sangamner Dist. Ahmednagar Vr. Bhagwa/ 1.0 ha	Narawadi, Taluka Narayangaon, Dist. Pune Bhagwa/1.0 ha	
	Productivity Fruit Yield at harvest (t/ha)	Non Adopted	7.75	4.19	4.44	8.43	5.54
	Productivity Fruit Yield at han (t/ha)	Adopted	8.33	5.0	5.18	10.36	7.32
	×.	Non Adopted (at harvest)	49.60	68.70	29.9	14.6	34.61
2008-09	Disease severity (%)	Adopted (at harvest)	43.30	64.50	24.2	11.9	24.41
	Dis	Adopted (Before/at adoption)	50.5	18.8	37.5	19.2	35.63
	Flower regulation Date		Feb-March 2009	Feb-March 2009	Feb-March 2009	Feb-March	
	Adopted orchard variety / area		Thengoda Satana, Dist. Nashik./ Bhagwa/ 1.0 ha	Arai shiwar Satana, Dist. Nashik./ Bhagwa 1.0 ha	Vadgaon Landge, Tal. Sangamner, Dist. Ahmednagar. Bhagwa/ 1.0 ha	Narawadi, Taluka Narayangaon, Dist. Pune Bhagwa/1.0 ha	Average
	S. Š		_	∞	Q	10	



# Demonstrations of Orchard Health Management Schedule by UAS Dharwad (Fig.12)

The survey team traveled almost all pomegranate areas of North Karnataka and selected six pomegranate orchards (5ha) based on the severity of bacterial blight disease during both the years. The list and details of orchards selected for demonstration have been given in Table 24.

Highest disease severity at adoption was 69.1% whereas after adoption at harvest max. severity was 7.2% in 2008-09,5.2% in 2009-10 and 2010-11 (Table 25, 26 and 27). Yields were significantly much higher in all adopted orchards in all three years (Max 12-14 t/ha). In contrast in non adopted the yields were very poor (Max 4 t/ha, 5t/ha and 6.5t/ha during 2008-09, 2009-10 and 2010-11, respectively).



Fig 12. Produce in severely bacterial blight affected orchards (top left) adopted by UAS Dharwad during 2008-09 and 2009-10



Table 24. Details of orchards selected by UAS, Dharwad for demonstrations during 2008-10

S No.	Name of farmer	Area (Ha)	Variety
<del>-</del>	1. Mr.Rangappa Nigappa Talawar, Hebbal, Tq. Mudhol, Dt: Bagalkot	1.00	Arakta, Ganesh
2.	Mr. Sharanappa Tippanna Koudi, Hiremannapur, Tq. Kustagi, Dt: Koppal	1.00	Kesar
3.	Mr. Sharanappa Arakeri, Bandi, Tq. Yelburga, Dt. Koppal	1.00	Kesar
4	Mr. Hari Raju, Shivanada Nagar Camp, Tq: H.B. Halli, Dt: Bellary	1.00	Bhagwa
5.	5. Mr. Dundappa Parasappa Navi, Baradol, Tq: Indi, Dt: Bijapur	0.50	Kesar
9	6. Mr.Sharanappa Kakamari, Utnal, Tq: Bijapur, Dt: Bijapur	0.50	Ganesh

Table 25. Disease and yield status of pomegranate plots adopted by UAS, Dharwar during 2008-10

	Farmer's Plot		Yield t/ha	4.0	5.0	4.0	2.5	2.0	3.5							
	Farmer's	Percent Disease Severity on tree (At harvest)		33.1	29.5	28.0	28.2	17.8	20.0							
2009-10	Ť	on tree	Yield t/ha	12.00	12.00	6.25	9.6	8.0	<del>*</del> 8:							
200	Demonstration Plot	ease severity o	sease severity	sease severity	Percent disease severity on tree	sease severity	sease severity o	sease severity	sease severity	After Adoption (At harvest)	2.5	1.5	5.2	2.5	3.0	5.0
	Dem	Percent di	Before adoption	69.1	18.3	30.5	25.4	21.0	13.5							
			Demo- nstration Site	Hebbal	Shivanada Nagar Camp,	Bandi	Muradi	Baradol-II	Baradol-I							
	Plot		Yield t/ha	2.5	0.4	2.0	2.5	2.0	2.0							
	Farmer Plot	Percent G:	Ulsease Severity on tree (At harvest)	38.3	8.2	20.0	15.3	29.1	13.1							
	Plot	ty on tree	Yield t/ha	12.00	10.50	00.6	6.50**	4.20	3.00*							
2008-09	Demonstration Plot	Percent disease severity on tree	After Adoption (At harvest)	3.4	4.	7.2	6.4	3.8	1.9							
	Derr	Percent di	Afte Before Add adoption (At har	69.1	18.3	13.5	26.7	25.4	7.2							
			S.No. Area Demonstration Site	1.0 Hebbal	H.B. Halli	Bandi	Hiremannapur	Bardol	0.5 Utnal							
			. Area		1.0	1.0	1.0	0.5								
			S.No.	<u>-</u>	5.	w.	4	5.	9							

<sup>\*\*</sup>September -October pruned plots have received un -seasonal rainfall during crop period hence other fungal disease dominated

<sup>\*</sup>Fall of hail stone for 2 hours during May 25-26, 2009 lead to heavy fall of fruits



Table 26. Disease and yield status of pomegranate plots adopted by UAS, Dharwad in 2010-11

				Demonstration Plots		Farmer's	Plots
			Percent	disease severity on tree			
S. No	Demonstration Sites	Area in	Before	After Adopting	Yield	Percent Disease Severity on	Yield t/ha
INO	Sites	Ha	adopting	2010-11	(t/ha)	tree	(/IIa
1.	Hebbal *	1.0	69.1	2.4	7.0	33.1	4.0
2.	H.B. Halli	1.0	18.3	1.4	14.0	21.4	6.5
3.	Hanumasagar	1.0	26.2	5.2	9.0	28.1	5.0

Table 27.District wise reduction of bacterial blight of pomegranate after adopting OHM schedule by UAS, Dharwad

				After D	emonstra	tion		Farmer's Field			
Location (Districts)	PDS on Tree Before	PDS on Tree Yields (t/ha.)			PDS on Tree Yields(t/ha.)						
(Districts)	Adoption	2008-09	2009-10	2010-11	2008-09	2009-10	2010-11	Range in %	2008-09	2009-10	2010-11
Hebbal (Bagalkot)	69.1	3.4	2.5	2.4	12.0	12.0	7.0	33.1-38.3	2.5	4.0	4.0
H.B. Halli (Bellary)	18.3	1.4	1.5	1.4	10.5	12.0	14.0	8.5-21.4	4.0	5.0	6.5
Bandi (Koppal )	13.5	7.2	5.0		9.0	1.8		20.00	2.0	3.5	
Bardol (Bijapur)	25.4	3.8	3.0		4.2	8.0		28.0-29	2.0	2.5	
Murdi (Koppal)	30.5		5.2			6.2		28.0		4.0	
Hanumasa gar (Koppal)	26.2			5.2			9.0	28.1			5.0
Average	30.5	3.95	3.44	3.00	8.93	8.01	10.0	8.5 to 38.3	2.62	3.2	5.17

PDS: per cent disease severity

# Demonstrations of Orchard Health Management Schedule by IIHR (Fig. 13 and 14)

Demonstration of the Orchard Health Management (OHM) schedule was carried out in the pomegranate orchards at Sira, Tumkur district, Hiriyur, Chitradurga district and Jagalur, Davanagere districts during 2008-2010 (Table 28). The pomegranate orchards (1ha each) selected at Sira, Hiriyur and Jagalur had plant density of 750 plants of Bhagawa variety with spacing of 10' x 15'. The age of the orchards was five to six years old

and was severely affected by bacterial blight disease. The infection was noticed on leaves, stems and fruits and the disease incidence before implementation of the programme was 69.5, 56.8 and 53.4 PDI, respectively.

During the first year of the trials, the crops were taken up during *Hast Bahar* (September October, 2008) in all the three locations. Whereas in the second year, at Sira the crop was taken up during *Hast Bahar* (September-October, 2009) and at Jagalur and Hiriyur the crops were taken up during *Ambe Bahar* (January-February, 2010).





Fig 13.: Blight affected orchards at Maskal Matti, Hiriyur, before and after adoption by IIHR, Bangalore





Fig 14 Blight affected orchards at Sira, Tumkur, before and after adoption by IIHR, Bangalore



Table 28. Details of demonstration plots selected by IIHR, Bangalore during 2008-2010

S.No.	Name and Address of farmer	No. of trials conducted	Cropping season
1.	Shri. Chickkananjappa Sy. No. 11/3, Yemmerahalli, Yaliyur Post, Sira Taluk,	2	<i>Haste Bahar</i> September.– October 2008
	Tumkur Dist., Karnataka State		Haste Bahar September October 2009
2.	Shri. B.G. Thimm a Reddy Sy. No. 184/1 & 170/3, Metikurke Village, Hiriyur Taluk Chitradurga Dist., Karnataka State	1	<i>Haste Bahar</i> September.– October 2008
3.	Smt. G.Y. Sudha W/o J.S. Manjunath Sy. No. 15, Dyamalingavahalli (Bennehalli),	2	<i>Haste Bahar</i> September.– October 2008
	Jagalur Taluk, Davanagere Dist., Kamataka State		<i>Ambe Bahar</i> January – February, 2010
4.	Shri. R. Manjunath Sy. No. 812 Maskal Matti Village, Hiriyur Taluk Chitradurga Dist., Karnataka State	1	<i>Ambe Bahar</i> January – February, 2010

#### Soil and water analysis

The soil and water samples from Sira, Hiriyur and Jagalur were analysed for nutrient status and irrigation suitability. Test report of soil sample from Sira, Tumkur district indicated that the soil was alkaline in reaction. The electrical conductivity of the soil was in the safer range. The organic carbon content and available nitrogen were low in the soil. The phosphorus level was high and that of potassium was in the optimum range. Among the micronutrients, the available iron, manganese, zinc and copper were at optimum range. Since in the soil available phosphorus was high, the judicious application of phosphorus was suggested. As the soil was alkaline in nature, gypsum application @ 1 ton per ha in the soil was advised

Test report of Hiriyur samples indicated that the soil was calcareous in reaction. The electrical conductivity of the soil was in the safer range. The organic carbon content and available nitrogen were low in the soil. The phosphorus and potassium levels were near to the optimum range. The available calcium, magnesium and sulphur were in higher range as the soil was calcareous in nature. Among the micronutrients, the available iron was only low while manganese, zinc and copper were at optimum range.

Similarly, the test report of Jagalur samples indicated that the soil was calcareous in reaction. The electrical conductivity of the soil was in the safer range. The organic carbon content, available nitrogen, phosphorus, sulphur and potassium levels were low in the soil. The available calcium and magnesium were in higher range as the soil is calcareous in nature. Among the micronutrients, the available iron, manganese and zinc were at low levels and copper was at optimum range.

Test report of water samples from all the three locations indicated that EC, chlorides, bicarbonates and sodium were present at higher level indicating that the water was not so good for



irrigation purpose and continuous use of this water may result in salinity problem in the long run.

#### **Results**

Results showed that the mean blight incidence during the first year in adopted orchards in all the districts was significantly low (0.0-4.60%), when compared to high incidence of 5.40-35.9% recorded in non-adopted orchards (Table 29). Similarly, the blight incidence in adopted orchards during the second year was also significantly low (0.0-15.60%) in Sira and Hiriyur, when compared to high incidence of 25.06-82.30% in non-adopted orchards. However, the blight incidence in adopted orchards in Jagalur was comparatively high when compared to disease incidence recorded in adopted orchards of Sira and Hiriyur (Table 29). But compared to the high incidence of 35.45-88.30% recorded in non-adopted orchards,

the incidence recorded in adopted orchards of Jagalur was significantly low.

The yield was also significantly high during the first year in all the adopted orchards which ranged from 6.5-8.0 t/ha, when compared to low yield of 1.5-3.0 t/ha obtained in non-adopted orchards (Table 30). Similarly, the yield obtained during the second year trials was also significantly high (3.5-8.5 t/ha) as compared to low yield of 0.5 1.5 t/ha in non-adopted orchards. The cost benefit ratio varied from 1:4.07 to 1:5.23 (Table 31). The high disease incidence and low yield recorded in adopted orchard in Jagalur was mainly due to unusual rains and cloudy weather prevailed during the cropping period.

Thus, the implementation of the management strategy for the mitigation of BBD in pomegranate has worked very well and the disease incidence was remarkably reduced in adopted orchards as compared to non-adopted orchards.

Table 29. Blight incidence in adopted and non-adopted orchards by IIHR

	Per cent Disea	ase Incidence
Pomegranate orchard	2008-09	2009-10
Sira, Tumkur district Adopted	0.00 - 4.36	0.0 – 8.97
Non-adopted Hiriyur, Chitradurga district	10.4 – 30.70	25.06 – 58.40
Adopted	1.81 – 4.60	0.0 – 15.60
Non-adopted Jagalur, Davanagere district	5.40 – 29.9	32.48 – 82.30
Adopted	0.00 – 4.50	0.00 – 43.60
Non-adopted	6.60 – 35.9	35.45 – 88.30



Table 30. The yield of pomegranate in Adopted and non-adopted orchards by IIHR

Pomegranate orchard	Total yield (t/ha) 2008-09	2009-10
Sira, Tumkur district		
Adopted	6.50	8.50
Non-adopted	1.50	1.20
Hiriyur, Chitradurga district		
Adopted	8.00	7.50
Non-adopted	3.00	0.50
Jagalur, Davanagere district		
Adopted	7.00	3.50
Non-adopted	1.50	1.20

Table 31. Effect of Orchard Health Management Schedule on cost benefit ratio in adopted orchards by IIHR., Bangalore

S. No.	Adopted orchar d	Income from produce (Rs.)	Cost of cultivation (Rs.)	Net Profit (Rs.)	Cost Benefit Ratio
1.	Yemmarahalli, Sira Bhagwa/1 ha	7,65,000	1,22,800	6,42,200	1:5.23
2.	Mettikurke, Hiriyur Bhagwa/1 ha	7,20,000	1,22,800	5,97,200	1 : 4.86
3.	Bennehalli, Jagalur Bhagwa/1 ha	6,30,000	1,22,800	5,08,000	1 :4.14
4.	Maskal Matti, Hiriyur Bhagwa/1 ha	6,75,000	1,22,800	5,52,200	1 : 4.07

## Demonstrations of Orchard Health Management Schedule by APHU (Fig. 15)

Survey of pomegranate orchards was carried out in association with the Department of Horticulture in Anantapur and Mahaboobnagar districts of Andhra Pradesh to select orchards. The details of orchards selected is given in Table 32.

The per cent disease incidence and severity varied considerably after adoption. Mean per cent severity on tree in case of adopted orchards was recorded to be 9.38 whereas in case of non-adopted orchards it was 12.25 (Table 33). The

mean per cent reduction of disease severity over nonadopted orchards was found to be as high as 53.21 (Table 34)

Yield from adopted orchards varied from 3.9 t/ha to 12.5 t/ha where as in non adopted orchard respectively the figures were 3.5 and 11.2 t/ha (Table 35). The cost benefit ratio in adopted orchards ranged from 1:4.69 to 1:9.58 during 2009-10 as against 1:1.23 to 1:5.48 during the first year of adoption (table 36). The disease and yield in non adopted orchards did not vary much from adopted orchards as almost similar practices were adopted by the farmer.



Table 32. Details of demonstration plots adopted by APHU

	Age of the orchard	9 years	5 years	9 years	6 years	8 years	9 years	5 years
	Variety	Bhagwa	Bhagwa	Ganesh	Bhagwa	Ganesh	Mridula	Bhagwa
	Area in acre	1.0	1.0	2.5	2.5	2.5	2.0	2.5
2009-10	Date of adoption	25.07.09	25.07.09	12.07.09	15.07.09	18.07.09	16.07.09	19.07.09
	Name of village	Ammalladinne, dist. Anantpur	Naminankapalli, dist. Anantpur	Kanekal cross, dist. Anantpur	LB Nagar, dist. Anantpur	Godiselapalli, dist. Anantpur	Kondampalli, dist. Anantpur	Settyatmakur, dist. Mahaboobnagar
	Name of farmer	M. Damodhar Naidu	V. Ramakrishna Reddy	U. Prabhakar	G. Sreenivasulu	Sri. Hanumanthappa	P.Ragahavendra Rao	P.Jammanna
	Age of the orchard	8 years	4 years	8 years	4 years	4 years	4 years	8 years
	Variety	Bhagwa	Bhagwa	Ganesh	Bhagwa	Bhagwa	Bhagwa	Mridula
	Area in acre	2.0	1.0	2.5	2.5	2.5	2.5	2.0
6(	Date of adoption	04.09.08	04.09.08	05.09.08	05.09.08	07.09.08	17.09.08	27.09.08
2008-09	Name of village	Ammalladinne, dist. Anantpur	Naminankapalli, dist. Anantpur	Kanekal cross, dist. Anant pur	LB Nagar, dist. Anantpur	Godiselapalli, dist. Anantpur	Settyatmakur, dist. Mahaboobnagar	Kondampalli, dist. Anantpur
	Name of farmer	M. Damodhar Naidu	V. Ramakrishna Reddy	U. Prabhakar	M. Ramakrishna	P.Ravi ndra Reddy	P. Jammanna	P. Ragahavendra Rao
	S.No.	<del>L.</del>	2.	e,	4.	5.	9	7.



Table 33. Status of bacterial blight in adopted and non adopted plots at Anantapur and Mahaboobnagar during November, 2008 to December, 2010.



Table 34. Effect of orchard health management schedule on bacterial blight in adopted and non-adopted orchards during 2008-09 and 2009-10 by APHU

				Disea	Disease Severity on tree (%)	ty on tree	(%)			Reduction in	ni no	
Add	Adopted Orchard	Flower regulation month	Before adoption	Adopt	Adopted (at harvest)	vest)	Nor	Non Adopted (at harvest)	(at	Disease : Non - ad	Disease severity over Non - adopted (%)	<u>.</u>
				2008-09	2009-10	Mean	2008-09	2009-10	Mean	2008-09	2009-10	Mean
Amn Anar dist.	Ammalladinne, Anantapur dist.	November, 2008	18.99	14.68	3.34	9.01	22.17	5.95	14.06	33.8	43.87	38.84
Nam Anar dist.	Naminankapall, Anantapur dist.	November, 2008	21.84	3.78	7.55	5.67	6.73	12.85	9.79	43.8	41.25	42.53
Ka Ar dis	Kanekal, Anantapur dist.	November, 2008	45.47	96.9	9.8	8.38	10.77	33.8	22.29	35.4	71.01	53.21
LB Ar dis	LB nagar, Anantapur dist.	November, 2008	23.20	8.33	ł	8.33	11.51	I	11.51	27.6	Ē	27.60
A Ar dis	LB nagar, Anantapur dist.*	December, 2009	14.54	*	8.82	8.82	ŀ	14.02	14.02	I	37.09	37.09
Gudi Anar dist	Gudisellapalli, Anantapur dist	November, 2008	32.67	13.88	ŀ	13.88	19.63	ı	19.63	29.3	ı	29.30
Gud Anaı dist	Gudisellapalli, Anantapur dist	December, 2009	14.54	I	8.97	8.97	ł	11.0	11.00	I	18.45	18.45
Kon Anal dist	Kondampalli, Anantapur dist	November, 2008	0.36	1.29	0.98	1.14	1.98	2.76	2.37	35	64.49	49.75
Se Mis	Settyatmakur, Mahaboobn agar dist.	November, 2008	5.92	11.67	7.99	9.83	13.65	10.97	12.31	18	27.16	22.58

Note: \*Demonstration conducted for 1 year



Table 35. Mean fruit yield in adopted and non-adopted orchards during 2008-09 and 2009-10 by APHU

				Fruit Yield	d (t/ha)		
S.No.	Adopted Orchard		A do pted			on Adopte	ed
		2008-09	2009-10	Mean	2008-09	2009-10	Mean
1.	K. Damodhar Naidu , Ammalladinne, Anantapur dist.	15.2	9.3	12.2	11.6	8.5	10.0
2.	V. Ramakrishna Reddy, Naminankapalli, Anantapur dist.	7.4	15.9	11.6	6.9	13.5	10.2
3.	U. Prabhakar, Kanekal, Anantapur dist.	13.7	7.6	10.6	11.4	6.2	8.8
4.	M. Ramakrsihna, LB nagar, Anantapur dist.	3.9	-	3.9	3.5		3.5
5.	G. Sreenivasulu, LB nagar, Anantapur dist.		12.1	12.1		11.2	11.2
6.	P. Ravindra Reddy, Gudisellapalli, Anantapur dist	6.6	-	6.6	5.3		5.3
7.	K. Hanumanthappa, Gudisellapalli, Anantapur dist		6.5	6.5		5.7	5.7
8.	P. Jammanna, Settyatmakur, Mahaboobnagar dist.	9.0	8.2	8.6	8.2	6.4	7.3
9.	P. Raghavendra Rao, Kondampalli, Anantapur dist	10.3	14.8	12.5	8.6	12.5	10.6



Fig. 15 Harvest and fruit quality in a blight affected orchard adopted by HRS(APHU) Anantpur



Table 36. Effect of orchard health management schedule on cost benefit ratio in adopted orchards during 2008-09 and 2009-10 by APHU

1
2009-10 Mean 2008-09
210429/- 401750/- 306090 114207/- 354000/- 234104
135564/- 633765/- 384665 108306/- 536500/-
204280/- 353000/- 278640 153146/-
* 14107 -975/-
412500/- 412500
125049 82706/-
203000/- 203000
195861/- 311225/- 253543 160084/-
336200/- 729000/- 532600 273000/- 600500/-

Note: \*Demonstration conducted for 1 year



#### **IV.NUSERY INSPECTION**

# Monitoring of Nurseries by NRCP (Fig.16)

Nursery inspections were carried out along with respective district SAOs in the districts of Pune (Talukas-Purandar, Baramati, Indapur, Daund, Junnar, Khed, Shirur), Sangali (Talukas - Jat, Aatpadi) and Solapur (talukas - Malshiras, Sangola,

Padharpur, Mohol, Akkalkot, Barshi, Karmala, Madha ). The summarized data is presented in Table 37 and detailed in annexures .In Pune all 10 inspected nurseries were free from BB, in Solapur out of 16 only 7 were free and in Sangali out of 15 only 10 were free from BB. Most of the nurseries were having fungal leaf spots, which require proper fungicidal sprays. At the time of inspection most of the planting material was as air layers.



Taluka Ahricultural office Nursery Baramati

Nursery at Daund





Nursery at Taluka Purandar





Nursery at Indapur

**KVK Nursery Baramati** 

Fig. 16 Nurseries inspected at Pune district by NRCP Solapur



Table 37. Nursery Inspection of Solapur, Pune & Sangali District in July and August 2010 (NRCP)

S. No.	District	Talukas	Total Nursery Inspected	Nurseries infected of BBD	Nurseries BBD Free				
1.	Pune	Purandar, Baramati, Indapur, Daund, Junnar, Khed, Shirur,	10	Nil	10				
2.	Solapur	Malshiras, Sangola, Padharpur, Mohol, Akkalkot, Barshi, Karmala, Madha	16	7	9				
3.	Sangali	Jat, Aatpadi	15	10	5				
		Total	41	17	24				
De	Detailed status of diseases in these nurseries in Annexure 4, 5 & 6								

# Monitoring of Nurseries by MAU, Parbhani (Fig. 17)

Nursery inspection was carried out in Osmanabad district to check the spread of bacterial blight disease of Pomegranate through planting material. The details of nursery inspection is given in Table 38. All the three nurseries inspected in Osmanabad had bacterial blight incidence ranging from 10-20 per cent however, the spots in Ganesh nursery at Pimpalgaon were doubtful, all the nurseries had fungal spots.







Fig 17. Nursery inspection by MAU



Table 38. Nursery Inspection during 2010 by MAU

General health	Condition		Healthy	Healthy	Healthy	
Major	pests	S	05	15	20	
Ma	be	-	10	25	30	
Fungal		_ S	15	10	10	
	-	_	20	20	20	
BBD status		S	01	05*	10	
BBD		_	15	*01	20	
Packing material	nsed		Moss	Moss	Moss	
Type of planting	material		Air Iayering	Air Iayering	Air Iayering	
Period of	klddns		July- Sept.	Sept - Oct.	July- Sept	
Varieties being			Bhagwa	Bhagwa	Bhagwa	
Area	Nursery		01 ha	04 Acre	01 Acre	
Name of Owner			Sonabai Sopanrao Kele	Shri. Subhashrao Kisanrao Tekale	Shri. Arun Manohar Bawale	
Name of the nursery	`		H.B.P. Sopankaka Kele Nusery, Kelewadi Tq. Washi Dist.	Ganesh Ropwatika At. Po. Pimpalgaon (Dola) Tq. Kalamb Dist.	Baliraja Ropwatika At.Po. Itkur Tq. Kalamb Dist. Osmanabad	ymptoms
S. Date of No. Survey			28/8/2010	28/08/2010 Ganesh Ropwatika At. Po. Pimpalgaoı (Dola) Tq. Kalamb Dist. Osmanaba	28/08/2010 Baliraja Ropwat At.Po.Itl Tq.Kala Dist.	* Doubtful symptoms
S. No.			01	02	03	



# Monitoring of Nurseries by MPKV, Rahuri (Fig. 18)

Nursery inspection was carried out in Ahmednagar, Dhule, Jalagaon, Nandurbar and Nashik districts (Table 39). The pomegranate nurseries located at different places in the different districts were visited regularly by the pathologist and monitored for the disease incidence and severity of the bacterial blight. In all 121 pomegranate nurseries were inspected for incidence of the BBD. Out of 121 nurseries only five

nurseries were observed infected with the disease while remaining 116 nurseries were disease free. Out of five nurseries, three nurseries were found infected with the disease in Nashik district. The incidence of the disease was around four per cent in these nurseries. Similarly, two nurseries were found infected with the disease in Ahemadnagar district. The incidence of the disease was around five per cent in these nurseries. License of the bacterial blight disease infected nurseries were cancelled by the competent authority.





Fig 18 Nursery inspection by MPKV



Table 39. Inspection of pomegranate nurseries in the year 2010 by MPKV

District	Particulars of nursery	Total No's of Nurseries	No of nurseries verified	Disease free Nurseries	Disease prone nurseries	Remark
Ahamednagar	Govt.	7	7	7	-	
	Pvt.	10	10	7	3	License cancelled
Dhule	Govt.	3	3	-	-	
	Pvt.	7	7	-	-	
Jalgaon	Govt.	3	3	3	-	-
	Pvt.	2	2	2	-	-
Nandurbar	Govt.	-	-	-	-	
	Pvt.	2	2	2	-	
Nashik	Govt.	4	4	4	-	-
	Pvt.	83	83	81	2	License cancelled
Total	Govt.	017	017	017	-	
	Pvt.	104	104	99	05	
Grand Total		121	121	116	05	

# Monitoring of Nurseries by APHU (Fig.19)

Pomegranate nurseries located at Chigicherla farm of Department of Horticulture, Anantapur and Adarsha Nursery at Hindupur of Anantapur district were visited regularly and monitored incidence and development of bacterial blight. As the disease incidence was less than 5% it is advised to destroy the infected plants in the nursery and progeny block and foliar spray of Copper oxychloride (0.3%) + Streptocycline (250 ppm) was suggested.





Fig 19. Nurseries inspected by APHU Anantpur



# V. Trainings Conducted and Extension Material Published

Training manuals in English and local languages as well as folders and identification guides were published by different organizations (Fig 20a and 20b)

#### **NRC on Pomegranate**

Four training manuals (2 in English and 2 in Marathi) were prepared and published by the Centre. These training manuals contain a complete package on pomegranate cultivation including nursery raising, pest identification and orchard health management with special reference to bacterial blight. These manuals have several other useful information appended as annexure. These training manuals were distributed to groups/individual farmers visiting

the Centre from different states and also to the farmers in Maharashtra state where our scientists were invited to impart training. Several groups of growers from Maharashtra, Karnataka and Rajasthan have expressed their interest to have such training. The Centre has distributed several copies of these training manuals to the participating organizations to facilitate training programme, the details of which is given in Table 40. Organizations in Karnataka- UAS Dharward and IIHR, Bangalore and in Andhra Pradesh-APHU, Ananthpur were asked to translate the training manual for farmers in the local language of their respective states. The manuals were also distributed to farmers visiting the Centre and also to the farmers attending the training programmes organized by our own Centre or other organizations.

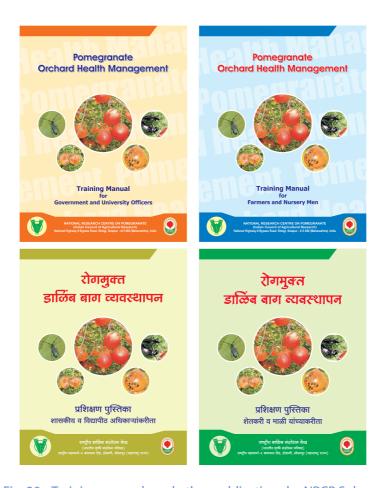
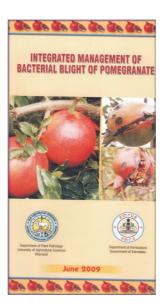


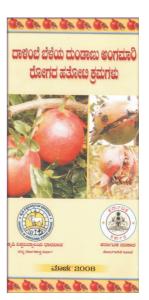
Fig 20a. Training manuals and other publications by NRCP, Solapur











UAS, Dharwad



IIHR Bangalore





**APHU Annantapur** 

MAU Parbhani

Fig 20b. Training manual and other publications by different organizations



Table 40. Training manuals published by NRCP and distributed to other participating organizations

			Number	of Manuals fo	or each org	anization	
	TRAINING MANUAL	NRCP	MAU	MPKV	UAS	IIHR	APHU
1.	Pomegranate Orchard Health Management - Training manual for Farmers and Nursery Me n English) '	500	100	100	100	100	100
2.	'Pomegranate Orchard Health Management - Training Manual for Government and Universities Officers (English)'	600	25	25	25	300	25
3.	'Rogmukta Dalimb Bag Vyavasthapan – Prasikshan Patrika Sashkiya va Vidyapeeth Adhikaryankarita '	2225	750	2000	-	-	-
4.	(Marathi) ' Rogmukta Dalimb Bag Vyavasthapan – Prasikshan Patrika Shetkari va Mali Yanchyakarita ' (Marathi)	800	100	100	-	-	-

#### **MAU Parbhani**

In all 15 training programmes were either organized or attended training programme organized by other Govt. and private organizations, as resource person (Fig 21). One thousand four hundred farmers were trained in these programmes (Table 41).

#### **MPKV.Rahuri**

Few training and educational programmes were organised by MPKV at demonstration sites (Fig. 22 and 23).

#### **UAS Dharward**

The university organized 21 training programmes at Belgaun, Koppal, Bellary and Gaddag from Aug. 2008 to Jan. Total 2604 farmers were trained (Table 42). The training manual "Pomegranate Orchard Health Management - Training manual for Farmers and Nursery Men (English)" has been translated in Kannada by UAS, Dharward and published. The university has also prepared and published other relevant literatures in English and Kannada for the benefit of farmers. In addition a two days training programme for officers of Department of Horticulture on Pomegranate Bacterial Blight was conducted on 24-25, Oct, 2010, at Department of Plant Pathology, UAS, Dharwad (Fig. 24).













Fig. 21Trainings and workshops conducted by MAU Parbhani



Table 41. Trainings organized/ attended as resource person by MAU, Parbhani

S.No.	Date	No. of farmers attended	Venue
01	25/07/2008	40	College of Agriculture, Osmanabad.
02	01/08/2008	50	S. D. A. O. Office, Bhoom, Dist. Osmanabad.
03	07/08/2008	45	T.A. O. Office, Washi, Dist. Osmanabad.
04	12/08/2008	50	K.V.K., Tuljapur, Dist. Osmanabad.
05	13/08/2008	60	Agril. Polyclinics, Omerga, Dist. Osmanabad.
06	26/08/2008	50	Agril. Polyclinics, Songiri, Tq. Paranda. Dist. Os'bad.
07	11/12/2008	250	K.V.K.Kharpudi, Dist. Jalna
08	16/07/2009	25	At.Po. Kalamb, Dist. Osmanabad
09	29/07/2009	500	At.Po. Jalna, Dist. Jalna
10	19/09/2009	30	At.Po. Lohara, Dist. Osmanabad
11	27/02/2010	100	At. Po. Kati, Ta. Tuljapur, Dist. Osmanabad
12	12/03/2010	20	At.Po. Killari, Dist. Latur
13	3/12/2009	30	At.Po.Tongaon, Ta. Dist. Aurangabad
14	23/12/2009	50	At. Po. Kalamb, Ta. Kalamb, Dist. Osmanabad
15	27/02/2010	100 1400	At. Po. Kati, Ta. Tuljapur, Dist. Osmanabad









Fig. 22 BBD Management Technology education through discussion by MPKV







Fig 23. Training programme organised by MPKV at demonstration site

Table 42. Trainings conducted by UAS Dharward

S.No.	Date	Venue	No of farmers attended
1.	18/08/2008	Shirkanhalli, (Tq. Indi) Dist: Bijapur	104
2.	19/09/2008	KVK Bijapur Tq: (Bijapur) Dist: Bijapur	85
3.	26/09/2008	Govinkoppa Tq: Bagalkot Dist: Bagalkot	53
4.	26/09/2008	Chiksaunshi Tq: Bagalkot Dist: Bagalkot	64
5.	27/09/2008	Hiremanappur Tq. Kustagi Dist: Koppal	105
6.	10/11/2008	UAS Dharwad for adopted orchard progressive growers and training helpers	21
7.	18/12/2008	Chinchkanddi B.K Tq: mudhool Dist: Bagalkot	82
8.	10/01/2009	Bandi Tq: Yelburga Dist: Koppal	165
9.	23/01/2009	H. B Halli Tq: H.B. Halli Dist: Bellary	115
10.	24/01/2009	Kundkur	156
11	28/11/2009	Shri Shiddeshwar Ashram Kottalagi (Tq. Athani) Dist: Belgaum	87
12.	01/12/2009	Verupakashappa Battad, Venue: Kankagiri Tq.: Gangawati, Dist Koppal	104
13.	14/12/2009	Baslingappa Arkeri, Venue: Bandi Tq. Yelaburga, Dist: Koppal	146
14.	06/01/2010	Sidappa Ramshetti, Venue: Sankanur Cross Tq. Kustagi, Dist: Koppal	212
15.	16/01/2010	C.H. Venkatasubbaraju, Venue: Baystageri Tq. H.B. Halli, Dist: Bellary	98
16.	18/01/2010	Shri. Parsuram Shirol Hanumasagar , Tq: Kustagi Dist: Koppal	145
17	24/01/2010	Basangouda Malipatil, Venue: Kundukur Tq: Kustagi Dist: Koppal	156
18	28/01/2010	Shri. Vinayak Vernakar, Rajur (Tq.Ron) Dist: Gadag	150
19	12/11/2010	Field day and Training Atharga	150
20	21/01/2011	ARS, Gangawathi	89
21	22/01/2011	Shri Shiddeshwar Ashram Kottalagi (Tq. Athani) Dist: Belgaum	317





Fig 24:Training programmes conducted by UAS Dharwad



#### **IIHR, Bangalore**

Four on-farm training programmes were organised for pomegranate growers of Davanagere, Chitradurga and Tumkur districts of Karnataka State during 2009-2011 and 780 growers were trained (Fig 25,26). During the training programme the farmers were provided with manual for the management of insect pests and diseases of pomegranate. Two training programmes (20-22 May and 8-10 June, 2010) of similar nature were organised for Officers of State Department of Horticulture and State Agriculture and Horticulture Universities at IIHR, Bangalore (Fig 27). There were 30 participants in each training programme and most of them were senior level officers (Assistant Directors of

Horticulture and Assistant Professors) from different districts of Karnataka (Table 43).

#### **APHU, Annantapur**

Training programmes were conducted for Horticultural Officers, Field Consultants and Farmers to impart them training on integrated management practices against bacterial blight in particular and health of orchard in general (Fig 28 and 29). Total 36 training programmes were conducted during 2008-09 and 2009-10 (Table 44 and 45). Out of which 8 are exclusively organized by the Project Coordinator under the Project and 28 training programmes by Department of Horticulture where Project Coordinator participated as a resource person.









Fig 25 .Field visits for farmers during training programme organised by IIHR., Bangalore















Fig 26. On-farm Training programme for pomegranate growers conducted by IIHR., Bangalore



















Fig 27 . Training Programmes for Officers of State Horticultural Departments, University of Agricultural and Horticultural Sciences by IIHR., Bangalore



Table 43. Details of training programmes conducted for pomegranate growers and officers IIHR, Bangalore

S.No.	Location	Date	No. of Participants
Trainir	ng Programmes conducted for pomegranate growers		
1.	Yemmarahalli, Sira, Tumkur district	26 <sup>th</sup> July, 2009	150
2.	Bennehalli, Jagalur, Davanagere district	2 <sup>nd</sup> Aug., 2009	80
3.	Kondlahalli, Molkalmur, Chitradurga district	13 <sup>th</sup> Dec., 2010	300
4.	Kerekethanahalli, Sira, Tumkur district	17 <sup>th</sup> Jan., 2011	250
	TOTAL		780
Trainir	ng Programmes conducted for Officers		
1.	IIHR., Bangalore	20 <sup>th</sup> to 22 <sup>nd</sup> May, 2010	30
2.	IIHR., Bangalore	8 <sup>th</sup> to 10 <sup>th</sup> June, 2010	30
	TOTAL		60

















Fig 28. Training programmes conducted at Annantapur and Mahaboobnagar by APHU







Gadwal





RHTI, Pillalamarri

Fig 29. Training Programmes at Mahaboobnagar district (AP)

Table 44. Training programmes conducted for growers during 2009-10 under Network project (APHU)

S.No.	Date	Training to	Venue/Village	Mandal	District					
1.	10.12.08	Pomegranate growers	Setty atmakur	Gadwal	Mehaboobnagar					
2.	11.03.09	Pomegranate growers	Anantapur	Anantapur	Anantapur					
3.	26.11.2009	Pomegranate growers	Ammalladinne	Peddapappur	Anantapur					
4.	19.01.2010	H.O's and F.C 's *	RHTI, Anantapur	Anantapur	Anantapur					
5.	23.01.2010	Pomegranate growers	N.R. Roppam	Madakasira	Anantapur					
6.	25.02.2010	Pomegranate growers	MDO's meeting hall	Penukonda	Anantapur					
7.	27.3.2010	Pomegranate growers	KLI guest house	Gadwal	Mahaboobnagar					
8.	28.03.2010	H.O's, F.C' s and Adarsarytulu	RHTI, Mahaboobnagar	Mahboobnagar	Mahaboobnagar					
Note:	Note: * H.O.'s – Horticulture Officers,: F.C.'s – Field Consultants.									



Table 45. Trainings organized by department of horticulture, Anantapur and Mahaboobnagar districts (Network Project Coordinator participated as resource person)

Date	Training to	Venue/Village	Mandal	District
04.09.2008	Pomegranate growers	Ammalladinne	Peddapappur	Anantapur
05.09.2008	Pomegranate growers	Sankargall	Madakasira	Anantapur
06.09.2008	Pomegranate growers	Kanekal	Kanekal	Anantapur
06.09.2008	Pomegranate growers	L.B.Nagar	Bomanahall	Anantapur
07.09.2008	Pomegranate growers	Gudiselapalli	D. Heerehall	Anantapur
20.11.2008	Pomegranate growers	Godiselapalli	D. Heerehall	Anantapur
27.01.2009	Pomegranate growers	Kanekal cross	Kanekal	Anantapur
27.01.2009	Pomegranate growers	L.B.Nagar	Bomanahall	Anantapur
28.01.2009	Pomegranate growers	Godiselapalli	D. Heerehall	Anantapur
29.01.2009	Pomegranate growers	Nidragatta	Ammarapuram	Anantapur
04.02.2009	Pomegranate growers	Peddatandrapadu	Alampur	Anantapur
08.09.2009	Pomegranate growers	RHTI, Anantapur	Anantapur	Anantapur
23.9.2009	Pomegranate growers	RHTI, Mahaboob Nagar	Mahaboob Nagar	Mahaboob Nagar
20.10.2009	Pomegranate growers	RHTI, Anantapur	Anantapur	Anantapur
30.10.2009	Pomegranate growers	Gramadatla (onfarm training)	Kanekal	Anantapur
30.10.2009	Pomegranate growers	Godiselapalli	D-Heerehall	Anantapur
31.10.2009	Pomegranate growers	Mudugallu, Pullampalli, Dodagatta, Nagireddypalli, (onfarm training)	Kalyandurgam & Kanekal	Anantapur
07.11.2009	Pomegranate growers	Kanekal cross	Kanekal	Anantapur
07.11.2009	Pomegranate growers	LB Nagar	Bommanahall	Anantapur
20.11.2009	Pomegranate growers	RHTI, Anantapur	Anantapur	Anantapur
21.11.2009	Pomegranate growers	Kanekal cross	Kanekal	Anantapur
21.11.2009	Pomegranate grow ers	LB Nagar	Bommanahall	Anantapur
03.01.2010	Pomegranate growers	Kanekal cross	Bommanahall	Anantapur
04.01.2010	Pomegranate growers	Penukonda & Madakasira (onfarm training)	Penukonda & Madakasira	Anantapur
17.02.2010	Pomegranate growers	RHTI, A nantapur	Anantapur	Anantapur
26-11-2010	Pomegranate growers	RHTI, Anantapur	Anantapru	Anantapur
21-12-2010	Pomegranate growers	Guddampalli	Madakasira	Anantapur
19-01-2011	Pomegranate growers	RHTI, Anantapur	Anantapru	Anantapur
Note: RHTI – Re	egional Hoticultural Trainin	g Institute.		



## VI. Workshops and Meetings

Four workshops and meetings were organized during the first year of the project at NRCP Solapur

to finalize the action plan and review the work (Table 46). In addition 4 high level meetings were organized at NRCP, Solapur where all associated with Network project were invited (Fig 30).

Table 46. Workshops and meetings conducted at NRCP, Solapur and attended by personnel associated with the network project

Venue and Date	Title	Purpose
NRC on Pomegranate, Solapur, May 17, 2008	Network Project on Mitigating the Bacterial Blight of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh Technical Workshop (proceedings in Annexure 7)	To finalize action plan for mitigating bacterial blight disease of pomegranate, in the states of Maharashtra, Karnataka and Andhra Pradesh, along with finalization of administrative, financial and technical details.
NRC on Pomegranate, Solapur, July 26, 2008	Meting on Implementation of package for the control of bacterial blight and wil t diseases of pomegranate and Network Project on 'Mitigating Bacterial Blight Disease of Pomegranate in the sate of Maharashtra' (proceedings in Annexure 8)	To discuss the changes if any in the package for the control of bacterial blight and finalize package for wilt diseases of pomegranate (Package in Annexure 30)
NRC on Pomegranate, Solapur, Dec. 17-18, 2008	Workshop on Network Project on Mitigating the Bacterial Blight of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh (proceedings in Annexure 9)	To review physical and financial targets and achievements during the six months of implementation of the network project
NRCon Pomegranate, Solapur, Sept 10, 2009.	Annual review Meeting of Network Project on Mitigating the Bacterial Blight of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh (proceedings in Annexure 10)	To review physical and financial targets and achievements during the one year of implementation of the network project
NRC on Pomegranate, Solapur, Sept. 25, 2010	Technical Session on Pomegranate Research and Development at NRCP, Solapur	Interactive meet of scientists from different states to review status of pomegranate research
NRC on Pomegranate, Solapur, Sept. 26, 2010	National Consultation on Pomegranate	Interactive meet of scientists and farmers from different states
NRC on Pomegranate, Solapur, Sept. 27, 2010	Meeting with Quinnquenniql Review Team for NRC on Pomegranate	To review the status of bacterial blight and its management in the three states
NRC on Pomegranate, Solapur, Nov.17-18, 2010	Review meeting for modifying pomegranate bacterial blight management schedule (proceedings in Annexure 11)	To modify the existing OHM







Technical Session on Pomegranate Research and Development' on Sept. 25, 2010, chaired by Hon'ble deputy Director General, ICAR, New Delhi





'National Consultation on Pomegranate' on Sept. 26, 2010, chaired by Hon'ble Director General, ICAR, and Secretary DARE, New Delhi





Review Meeting for modifying Orchard Health Management schedule on Nov17-18, 2010, Chaired b Dr. JH Kulkarni, Former VC, UAS, Dharwad

Fig. 30. Meetings and workshops organized by NRCP, Solapur during 2010, where network scientists participated



## **VII. Expenditure Statement**

The Govt. of India had sanctioned a budget outlay of Rs 374.95 lakhs, vide letter No.F.No.33-10/2007-hort, Dept. Agri. & Cooperation, Govt, of India, New Delhi, on March 3, 2008 and revalidated the same on May 13, 2008, for the three states, Maharashtra, Karnataka and Andhra Pradesh, out of this only Rs 241.15 lakhs was released, including total

sanctioned budget of Karnataka and Andhra Pradesh released and only Rs117.01 lakhs of Maharahtra. Total expenditure till March 2011 was Rs223.17 lakhs for all the three states. The component and organization -wise budget sanctioned, released and utilized including all the three years, is summarized in Tables 47-48.

Table 47. Institute and head wise budget details (Rupees in Lacs)

S. No.	Head	Sanctioned	Released	Expenditure (till March 31, 2011)	Unspent Balance (D-E)	Amount Not Released (C-D)	Available Amount (F+G)				
А	В	С	D	Е	F	G	Н				
I. MAHARASHTRA											
(a.) National Research Centre on Pomegranate, Solapur											
1.	Training	36.54	17.40	25.12	(-)7.72	19.14	3.36				
2.	Demonstrations	12.78	12.78	21.1	(-)8.32	0.00	(-)8.32				
3.	Survey And Surveillance	25.2	25.20	9.04	16.16	0.00	15.58				
4.	Disease Forecasting Unit	4.00	4.00	5.22	(-)1.22	0.00	(-)1.31				
5.	Contingencies	42	25.32	24.22	1.10	16.68	26.51				
	Total (a)	120.52	84.70	84.70	0.0	35.82	35.82				
	* head wise release for 2nd ar	nd 3rd year com	municated vi	de fax dated March 1	4,2011						
(b.) Ma	ahatma Phule Krsihi Vidyapeeth	n, Rahuri									
Α	В	С	D	E	F	G	Н				
1.	Training	55.06	-	-	-	55.06	55.06				
2.	Demonstrations	18.03	8.60	4.91	3.69	9.43	13.12				
3.	Survey And Surveillance	2.31	2.31	1.67	1.04	0.00	1.04				
4.	Disease Forecasting Unit	4	4.00	4.00	0.00	0.00	0				
5.	Contingencies	4.2	4.2	4.20	0.00	0.00	0				
	Total (b)	83.60	19.11	14.78	4.73	64.49	69.22				
(c.) Ma	arathwada Agricultural Univers	ity, Parbhani									
Α	В	С	D	E	F	G	Н				
1.	Training	23.40	0.00	1.82	(-)1.82	23.40	21.58				
2.	Demonstrations	12.78	6.10	6.08	0.02	6.68	6.7				
3.	Survey And Surveillance	02.31	1.10	0.87	0.23	1.21	1.44				
4.	Disease Forecasting Unit	4.00	4.00	0.0	4	0.00	4				
5.	Contingencies	4.20	2.00	4.43	(-)2.43	2.20	(-)0.23				
	Total (c)	46.69	13.20	13.20	0	33.48	33.48				
Total	for Maharashtra (a+b+c)	250.81	117.01	112.68	4.73	133.79	138.52				



Table 47 contd.

				.,								
S. No.	Head	Sanctioned	Released	Expenditure (till March 31, 2011)	Unspent Balance (D-E)	Amount Not Released (C-D)	Available Amount (F+G)					
Α	В	С	D	Е	F	G	Н					
	II KARNATAKA											
(d) Un	(d) University of Agricultural Sciences, Dharwad											
1.	Training	24.45	24.45	24.42	0.031	Nil	0.031					
2.	Demonstrations	12.78	12.78	12.07	0.71	Nil	0.71					
3.	Survey And Surveillance	2.31	2.31	1.19	1.12	Nil	1.12					
4.	Disease Forecasting Unit	4	4	4	0	Nil	0					
5.	Contingencies	4.2	4.2	4.03	0.17	Nil	0.17					
	Total (d)	47.74	47.74	45.71	2.03	Nil	2.03					
(e) Ind	lian Institute of Horticultural Re	esearch, Bangalo	ore									
Α	В	С	D	E	F	G	Н					
1.	Training	14.2	14.2	10.95	3.25	Nil	3.25					
2.	Demonstrations	10.68	10.68	9.61	1.07	Nil	1.07					
3.	Survey And Surveillance	3.78	3.78	2.92	0.86	Nil	0.86					
4.	Disease Forecasting Unit	0	0	0	0	Nil	0					
5.	Contingencies	4.2	4.2	3.40	0.80	Nil	0.80					
	Total (e)	32.86	32.86	26.88	5.98	Nil	5.98					
	Total for Karnataka (d+e)	80.6	80.6	72.59	8.01	Nil	8.01					
			III. ANDHR	A PRADESH								
(f) And	dhra Pradesh Horticultural Univ	ersity, Tadepalli	gudem, West	Godavari District								
Α	В	C	D	E	F	G	Н					
1.	Training	20.25	20.25	15.25	5	Nil	5					
2.	Demonstrations	12.78	12.78	12.78	0	Nil	0					
3.	Survey And Surveillance	2.31	2.31	2.31	0	Nil	0					
4.	Disease Forecasting Unit	4	4	4.28	(-) 0.28 (Additional cost)	Nil	(-) 0.28					
5.	Contingencies	4.2	4.2	3.4	0.8	Nil	0.8					
	Total for AP (f)	43.54	43.54	38.02	5.52	Nil	5.52					

Note: For year wise expenditure details of each organization see Annexure 12-17

Table 48. Statewise summary of budget sanctioned, released and expenditure (Rupees in Lakhs)

S. No.	Head	Head Sanctioned Release		Expenditure (till March 31, 2011)	Unspent Balance	Amount Not Released	Total Available Amount
I.	Maharashtra	250.81	117.01	112.68	4.73	133.79	138.52
II.	Karnataka	80.6	80.6	72.59	8.01	Nil	8.01
III.	Andhra Praesh 43.54		43.54	38.02	5.52	Nil	5.52
Gran	d Total (I+II+III)	374.95	241.15	223.27	18.28	133.79	152.05

Annexures Annexures



Status of bacterial blight in pomegranate growing areas of Latur district (2010-11)



Per cent wilt 1.0 1.0 1.5 1.0 1.0 1.0 2.0 2.5 1.0 1.0 1.0 1.0 1.0 1.0 2.0 1.0 1.0 2.5 2.0 3.0 7.0 Continued on next page Severity on Tree 21.0 36.8 32.9 11.5 19.2 30.5 57.5 54.5 23.1 12.3 1.0 3.8 3.8 3.8 3.8 0.5 0.5 16 45 54 10 15 10 15 20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 S Stem Incidence (1%) & Severity (5%) 20 30 20 25 20 25 0 0 0 0 0 0 0 0 0 0 0 0 40 28 14 15 36 20 55 65 50 S 22 70 26 65 2 2 0 0 2 Fruit 40 40 10 55 50 10 10 15 70 10 20 75 50 35 90 50 90 90 0 0 0 10 10 45 45 18 35 35 25 18 23 20 28 9 55  $\sim$  $_{\infty}$ 2 S  $^{\circ}$ 2 Leaf 10 70 9 9 40 20 20 45 10 45 50 10 10 15 20 85 40 90 10 70 45 1.5 1.5 (YY) 9gA m m m 4 m m  $\sim$  $\sim$ 4 9.0 0.4 0.3 0.4 9.0 9.0 0.2 9.0 0.4 0.4 0.4 0.8 0.4 0.4 0.4 0.4 9.0 9.0 0.2 9.0 0.8 Area (Ac) Srikrishna Vankatrao Thormate Chandrkant Shankar Wadaskar **Vaidhnath Dadasaheb Shelke** Pandurang Dhon diba Niture Lalasaheb Babasaheb Mane Sangram Sudhakar Awaskar Hanmant Bhaurao Rathode Sambhaji Pandurang Bolbe Sayyed Bashir Saheb S. Nur Ramkishan Tukaram Katke Dipak Madhukar Awaskar Nagnath tukaram katke Sunil Manikrao Kulkarni **Eknath Baburao Pawar** Dattatray Niruvti Mule Dhanraj Nagnath Patil Baburan Niruvti Mule Sunita Pandit Dudile Papa Gulab Tamboli Name of the Bhimrao Channagir Santosh Pimpale Darjiborgaaon Darjiborgaon Darjiborgaon Darjiborgaon Khalangi Kolgaon Khrola Khrola Ashta Ashta Ashta Ashta Ashta Ashta Ashta Bhidi Bhidi Bhidi Bhidi Bhidi Wala Renapur Renapur Renapur Renapur Renapur Renapur Renapur Renapur Renapur Chakur Chakur Chakur Chakur Chakur Chakur Chakur Taluk Latur Latur Latur Latur Latur s Š 10 12 13 7 15 16 17 18 19 20 Ξ 21 7 6. 7.  $\dot{\infty}$ 6 ë. 4.



Annexure 1. cntd.

Per cent wilt		1.0	1.0	2.0	2.5	1.0	1.0	10	5.0	5.0	1.0	1.0	2.0		
	Severity	on Iree	0.5	0.5	9.0	15.1	13.8	22.1	47.9	52.8	0.5	4.0	20.5	2.2	
	Stem	S	0	0	0	0	0	0	7	0	0	0	0	0	
y (S %)	Ste	-	0	0	0	0	0	0	10	0	0	0	0	0	
Incidence (I %) & Severity (S %)	Fruit	S	0	0	0	20	18	59	09	70	0	2	27	0	
ce (I %)		Н	0	0	0	35	40	45	80	06	0	10	40	0	
nciden	af	S	2	2	9	11	12	18	45	38	2	2	16	22	
_	Leaf	-	10	15	15	30	35	40	09	55	15	15	35	40	
(YY)	) aby	1	8	2.5	m	m	2.5	4	7	7	2	4	m	1.5	
(>A)	rea (	A	0.2	9.0	0.4	9.0	0.3	9.0	9.0	9.0	0.3	9.0	0.4	0.2	Ganesh
Name of the	farmer		Dnynoba Ramrao Pawar	Subhash Bhaurao Patil	Sanjay Kisan Bhosle	Sangita Netaji Suryawanshi	Sarswati ashokrao Suryawanshi	Vinod Eknath Babalsure	Srinivas Vaijanath Revadkar	Vaijanath Baispaling Revadkar	Madhav Baburao Dive	Madhukar Pandurang	Dashrath Limbappa Tambole	Vayankat Gopal Chame	Variety Bhagawa and sometimes Ganesh
	Village		Masalanga	Matola	Tungi	Tungi	Killari	Karkaj	Panchincholi	Panchincholi	Anandwadi	Jau	Korale	Borsuri	Period of surveyAug. t 25 -30, 2010,
	Taluk		Ausa	Ausa	Ausa	Ausa	Ausa	Ausa	Nilanga	Nilanga	Nilanga	Nilanga	Nilanga	Nilanga	of survey Aug.
ک	, o N		22	23	24	25	26	27	28	29	30	31	32	33	Period c



- Status of bacterial blight in pomegranate growing areas of Osmanabad district (2010-11)

	Per	cent wi <b>l</b> t		2.0	2.5	1.0	1.0	10	5.0	5.0	1.0	1.0	2.0	1.0	1.0	2.0	1.0	5.0	4.0	3.0	2.0	1.0	1.0	1.0	page
		Severity	on Iree	56.3	52.7	46.2	1.0	1.5	2.0	2.6	45.2	52.8	51.8	1.0	1.0	30.7	40.8	45.2	53.3	1.0	44.9	33.9	53.0	57.0	Continued on next page
		Stem	S	10	12	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	-	0	-	Continu
( ) ( )	rity (5 %)	Ste	-	15	20	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	1.5	0	2	
	Incidence (1 %) & Severity (5 %)	Fruit	S	70	65	09	0	0	0	10	09	70	65	0	0	40	55	09	70	0	09	45	70	75	
-	nce (I %	ш	-	06	06	06	0	0	0	20	80	06	06	0	0	09	70	80	06	0	80	09	06	06	
-	Incide	Leaf	S	53	48	42	10	15	20	27	32	38	43	10	10	27	23	32	43	10	29	22	40	43	
		Le	-	70	65	9	25	30	35	40	22	09	65	20	30	40	40	40	09	20	45	40	9	65	
(	(YY)	əɓ∀	1	4	2	7	11	4	4	4	2	4	7	m	m	2	2	4	2	2.5	9	4	9	2	
(:	οA)	/kea	∀	9:0	2	9.0	0.4	1.20	0.7	7	0.75	0.5	1.25	1.50	1.50	0.4	0.4	0.5	0.7	1.5	_	_	8.0	-	
	Name of the	farmer		Gangadhar Narhari Shete	Sidheshwar Dhondiba Shete	Kumbhraj Pandhari shete	Julekha Yusufkhan Pathan	Shekhar Rangrao Patil	Kalidas Ranga Jadhav	Kamal Uddhav Gilbile	Vasant Namdev Bhargande	Yuvraj Apparao Mule	Bapurao madhukarao Chavan	Makuram Bhavansingh Mansavle	Bhanabai Makuram Mansavle	Angad Popat Ingale	Kisan Apparao Ingale	Narsingh Raosaheb Malba	Nagnath Shankar Gore	Pandurang Dnyandev Bansode	Ramkishan Dudrao Khalkate	Madhukar Narayan Patil	Janabai Bhanudas Mule	Satish Mahadu Buva	
		Village		Kond	Kond	Kond	Khanapur	Nadurga	Nadurga	Upla	Yevati	Andur	Andur	Khadki	Khadki	Kumbhari	Kumbhari	Sindhphal	Apsinga	Kasai	Davlwradi	Undergaon	Hipparag kh.	Dhanori	
		laluk		Osmanabad	Osmanabad	Osmanabad	Osmanabad	Osmanabad	Osmanabad	Osmanabad	Tuljapur	Tuljapur	Tuljapur	Tuljapur	Tuljapur	Tuljapur	Tuljapur	Tuljapur	Tuljapur	Tuljapur	Tuljapur	Lohara	Lohara	Lohara	
	S.	No.		<del>-</del>	5.	m,	4.	5.	9	7.	οċ	6	10	11	12	13	14	15	16	17	18	19	20	21	



Annexure 1.cntd.

v			Name of the	(>∀	(1X		Incider	/(// J) ອວເ	Incidence (I %) & Severity (S %)	ity (S %)			Per
s Š	Taluk	Village	farmer	,rea (	) əb/	Leaf		Fr	Fruit	Stem	٤	Severity	cent
				A	1	_	S	_	S	-	S	on Tree	
22	Lohara	Dhanori	Ram Ganpati Chavan	0.5	72	45	18	50	30	2	_	23.0	2.0
23	Lohara	Dhanori	Bhagwat Shivaji Bankar	1.2	2	55	27	80	09	0	0	44.7	1.0
24	Lohara	Khed	Gulab ShivnarayanZavar	2	7	20	12	0	0	0	0	1.2	1.0
25	Kalamb	Pratapur	Shivshala Vishnu Gaikwad	0.37	3.5	25	15	0	0	0	0	1.5	1.5
26	Kalamb	Pratapur	Dattatray Pralhad Gaikwad	9:0	3.5	35	20	0	0	0	0	2.0	1.0
27	Kalamb	Pratapur	Arvind Shesh Rao Jadhav	-	4.5	40	19	55	30	1.5	-	23.1	1.0
28	Kalamb	Magrul	Kashinath Murlidhar Jamale	_	3.5	20	10	0	0	0	0	1.0	1.0
29	Kalamb	Pimpalgaon	Subhash Kisanrao Patil	2	2	25	10	0	0	0	0	1.0	2.0
30	Kalamb	Adala	Satyabhama Bhaskar Bavne	0.5	4	30	13	09	40	0	0	29.3	2.5
Perio	Period of survey Oct 01 -07, 2010,	: 01 -07, 2010,	Variety Bhagawa and sometimes Ganesh	anesh									



### Orchard Health Management Schedule (Original)

#### Guidelines for Pomegranate orchard health management

These are the package of practices approved by the scientists (ICAR, SAU), technical officers and grower representatives, attending the conference, and have come from Maharashtra, Karnataka and Andhra Pradesh.

#### 1. Selection of planting material to raise nursery:

- Air layered cuttings for raising the nursery should be obtained from apparently disease free (Bacterial blight caused by Xanthomonas axonopodis pv. punicae) orchard.
- The mother plants should be tested for the presence of pathogen through appropriate techniques like visual / microscopy, isolation, ooze testing, ELISA, , Bacteriophages, DNA finger printing technique.
- Potting mixture used for raising saplings in nursery be solarised. The solarisation time could be 2 to 4 months. Steam/Chemical sterilization can also be practiced.
- Consortium consisting local isolates @ 1 kg Trichoderma viride or T. harzianum per 100 kg of soil, Pseudomonas fluorescence 10° CFU per g of formulation, neem cake (5 kg/100 kg soil) mixed with the compost, VAM culture (200 g/100 Kg of soil) either alone or in combination of all these may be incorporated.
- While preparing the planting material, the air layered portion can be covered with moss, P. fluorescence (10<sup>9</sup> CFU per g) formulation and IBA (1500 ppm).
   Bordeaux paste (10%) should be applied to the cut ends of the plants.
- The ratio of compost/FYM to soil (loam) should be 50:50 in potting mixture. This
  mixture should be used after 8 days for planting the air layers in the nursery.
- The air layered cuttings should preferably be raised in black polythene bags (4"x6" size, 250 gauge).
- While bagging, the roots of the air layered cutting should be treated with Copper oxychloride (0.2%) for various diseases.
- The ideal age of air layered plant should be minimum 4 months after cutting from mother plant.
- The air layered plant material be kept at 50% shade net and about 10 bags can be kept in 1 meter area and adjacent 1 meter area is left between two rows. The nursery shall be sprayed with mancozeb (0.25%) or chlorothalonil (0.25%) at 15 days interval.
- · The air layered planting material should be watered as per requirement.



#### 2. Main Field (up to first year):

- From nursery the planting material is shifted to main field in pits treated with Calcium hypochlorite (100gm/pit).
- Minimum planting distance should be 4.5 X 3.0 m and plant should be trained to have 3 stems as it alleviates microclimate for disease development.
- Sanitation measures should be strictly followed and all fallen leaves be collected
  and burnt. Drenching of bleaching powder 150 gm per 5-7 litre of water per plant
  (as per the age of plant) or dusting of Copper dust 4% @ 20 kg/ha. on soil below
  canopy at the time of bahar treatment could reduce the bacterial inoculum
- Branches have to be pruned about 2" below the infected area.
- During pruning, secateurs should be sterilized with detol (1%) after every cut.
- Bordeaux paste (10%) should be applied to the cut ends after pruning. Preferably apply Mahathotex wax immediately over the pasted wounds if available

#### 3. Orchards Management Schedule:

- Urea 5% may be used to force plants for defoliation.
- Branches have to be pruned about 2" below the infected area.
- During pruning, secateurs should be sterilized with detol (1%) after every cut.
- Bordeaux paste (10%) should be applied to the cut ends after pruning and stems
  up to 2 feet. Preferably apply Mahathotex wax immediately over the pasted
  wounds if available
- First spray should be given of Bordeaux mixture (1%) immediately after pruning
- Second spray should be applied at foliage emergence with streptocycline (250ppm) + copper oxy-chloride (0.25%). Non ionic sticker may be used with the fungicides (except Bordeaux mixture), particularly during the rainy season.
- Third spray should be given at 15 days interval with Bordeaux mixture (0.4%)
- Fourth spray should be consist of streptocycline (250 ppm) + carbendazim (0.1%)
- However, under favorable weather conditions for disease development such as
  overcast sky and rains and high disease inoculum pressure, higher concentrations
  of strepto cycline (500ppm) may be used. Also spray interval can be reduced to 8
  to 10 days.
- In those areas where scab (Sphaceloma sp) is a problem a spray of Thiophanate methyl (0.15%) can be sprayed once at peak.



- Rest period of 3 to 4 month's should be practiced and during the period Bordeaux mixture (1.0%) be sprayed at one month's interval. Streptocycline (250ppm) should be applied once during the rest period.
- For controlling shot hole borer (*Xyleborus* spp.), which is associated with wllt disease, 10 litres preparation of Red Soil (4kg) + lindane (25gm) + chlorpyriphos (20ml) + copper oxy chloride (25 gms) can be applied on plant base from second year onwards.

EMPHASIS SHOULD BE ON CLEAN POMEGRANATE CULTIVATION PRACTICES AND VILLAGE LEVEL CLEAN-UP CAMPAIGN OF ALL ORCHARDS ANNUALLY.

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Odly spot Project, April Call. Devel 24.2-07 Mr. B. M. Bhosale Research Associate, Agn. College Pune.



Status Report of planting material in nurseries at Pune on August 4 to 6, 2010

		Govt.				Source of			
Sr. No.	Name of Nursery	License Holder	Area of Nursery	No. of Cuttings/year	Variety	Mother plant	BE	BD	Other Diseases
							<b>I</b> %	S%	
1.	KVK Shardanagar, Baramati	Yes	1.5 acres	50000	Bhagawa	MPKV Rahuri	NIL	NIL	Cercospora spots I= 25% S= 15%
2.	Taluka Ropwatika, Baramati	Yes	3 acre	14000	Gangesh	MPKV Rahuri	Nil	Nil	Cercospora spots I= 5% S= 25%
3.	Jaimalhar Nursery, Dhalewadi	Yes	2 acre	70000	Bhagawa	Malegaon	Nil	Nil	Cercospora spots I= 10% S= 2%, Alterneria spots I=23%, S=
4.	Shriram Nursery, Sakurde	Yes	1 acre	20-25,000	Bhagawa	MPKV Rahuri	Nil	Nil	30% Cercospora spots I= 22% S= 16%
5.	Saint Sawata Mali Nursery, Kathi	Yes	1 acre	2 lakh	Bhagawa	Modnimb	Nil	Nil	Cercospora spots I= 80%S=
6.	Shriram Nursery, Ramkund	Yes	0.5 acre	10000	Bhagawa	Modnimb	Nil	Nil	20% Cercospora spots I= 10% S= 5%
7.	Kshitija Nursery, Nimgaon Ketaki, (Ramkund)	Yes	200 plants	1 lakh	Bhagawa	Jailamalhar Nursery	Nil	Nil	Cercospora spots I= 80% S=60, Sphaceloma spots I=40% S=10%
8.	Bafana Nusery, Patethan, Rahu	Yes	6 ha	1 lakh	Bhagawa	Own	Nil	Nil	Cercospora spots I= 65% S= 10%
9.	TAO Nursery, Goremala, Shirur	Yes	368 plants	22,000	Bhagawa	MPKV Rahuri	Nil	Nil	Cercospora spots I= 5% S=2%
10.	Jilha Madhyavarti Fal Ropwatika, Khed	Yes	55 R	10,000	Bhagawa	Satana Nashik	Nil	Nil	Cercospora spots I= 45% S= 5%



Status report of planting material in nurseries at Sangali on August 11 to 12, 2010

Sr. No.	Name of Nursery	Govt. License Holder	Area of Nursery	No. of Cuttings/year	Variety	Source of Mother plant	В	BD	Other Diseases
							<b>I</b> %	<b>S</b> %	
1.	Shriram Nursery, Belanki	Yes	2 acre	15,000	Bhagawa	MPKV Rahuri	60 %	25 %	Cercospora spots I= 30%, S=5%
2.	Akshay Nursery, Hingangaon	Yes	1 acre	50,000	Bhagawa	Shriram Nursery, Belanki	Nil	Nil	Cercospora l= 25%, S=6%
3.	Om Ropwatika, Jakhapur	Yes	1.2 acre	60,000	Bhagawa	Shriram Nursery, Belanki	< 1%	-	Cercospora spots I=15%, S=2%
4.	Vakratunda Nursery Shegaon	Yes	1.75 acre	25,000	Bhagawa	Vibhutewadi	Nil	Nil	Cercospora spots I=10%, S=2%
5.	Parvati Ropwatika, Walekhindi	Yes	0.60 acre	32,000	Bhagawa	Vibhutewadi, (Aatpadi)	30	%10	Nil
6.	Laxmi Nursery, Pandozari	Yes	1 ha.	1 <b>l</b> ac	Bhagawa	M.S. Vibhute	2%	5%	Cercospora spots I= 1%,
7.	Bagadebaba Ropwatika, Shankh	Yes	0.40	19,200	Ganesh	Shashkiy Ropwatika, Kupwad	Nil	Nil	Nil
8.	Bagadebaba Ropwatika, Shankh	Yes	0.40	32,000	Bhagawa,	Ganesh Vibhute Malgund, Aatpadi	10	%7%	Nil
9.	Kisan Nurse <b>y</b> r , Kargani	Yes	1 ha	40,000	Bhagawa		3%	1%	Cercospora spots l= 2%, S=2%
10.	Sanjivani Ropwatika, Kargani	Yes	2 acre	20,000	Bhagawa		1%	2%	
11.	Vimal Nursery, Aatpadi	Yes	1.26 acre	27,700	Bhagawa	MPKV Rahuri	10%	2%	-
12.	Chaitaya Nursery, Kawthuli	Yes	1.5 acre	23, 000	Bhagawa	Walekhindi, Jat	Nil	Nil	Alterneria=I=40%, S=60%
13.	Mayakka Nursery, Pis ewadi	Yes	2 acre	25, 000	Bhagawa	Sidhanath Nursery, Aatpadi	10%	3%	Cercospora I.= 60%, S=15%
14.	Pankaj Nursery, Dinghanchi	Yes	1.5 ha.	1.25 lac	Bhagawa	MPKV Rahuri	Nil	Nil	Cercos pora I.= 1.5%, S=1%
15.	Potdar Nursery, Dinghanchi	Yes	0.22 acre	18,000	Bhagawa	-	5%	1%	Cercos pora I.= 5%, S=1%



Status report of planting material in nurseries at Solapur on July 29 to 31, 2010

Sr. No.	Name of Nursery	Govt. License Holder	Area of Nursery	No. of Cuttings/year	Variety	Source of Mother plant	BE	3D	Other Diseases
							1%	<b>S</b> %	
1.	Sargar Nursery, Kudus	Yes	1 ha.	1,29000 (518 Plants)	Bhagawa	Govt. Nursery	< 1%	< 1%	Nil
2.	Snehal Nursery, Kudus	Yes	1.5 ha.		Bhagawa	Govt. Nurs ery	Nil	Nil	Nil
3.	Sagar Nursery, Kudus	Yes	1 ha.	1,29000 (518 Plants)	Ganesh	Govt. Nursery	< 1%	< 1%	Nil
4.	Raj Nursery, Ajnale	Yes	212 Plants	300/plants	Bhagawa	Sargar Nursery	Nil	Nil	Cercospora I.= 1%
5.	Dines h Nursery, Chopadi	Yes	200 Plants		Bhagawa	MPKV Rahuri	< 1%	< 1%	Cercospora I.= < 1%
6.	Ganesh Nursery, Chopadi	Yes	100 Plants		Ganesh	MPKV Rahuri	1%	1%	Nil
7.	Varsha Nursery, Sonand	Yes	1000 Plants	100-150/plant	Bhagawa	Aatpadi	1%	5%	Nil
8.	Taluka Agri. Office Nursery, Akkalkot	Yes	1.5 ha	30000	Bhagawa		Nil	Nil	Cercospora spots I= 100%
9.	Taluka A.O. Nursery, Mohol	Yes	180 Plants	150-200/ Plant	Bhagawa	MPKV Rahuri	Nil	Nil	Cercospora spots I= 1%, S=5%
10.	Adyansidha Nursery,	Yes	0.5acre	10-15 p <b>l</b> ant	Bhagawa	MPKV Rahuri &	< 1%	< 1%	Cercospora s pots I= 5%, S=10%
11.	Siddheshwar Nursery, Shetfal	Yes	500 Plant	150-200/ Plant	Bhagawa	MPKV Rahuri	1%	5%	Cercospora s pots I= < 1%, S=<1%
12.	TAO Nursery, Kurduwadi	Yes	450 Plant		Bhagawa	MPKV Rahuri	Nil	Nil	Cercospora s pots I= 60%, S=20%
13.	TAO Nursery, Barshi	Yes	200 Plants		Bhagawa	MPKV Rahuri	Nil	Nil	Cercospora s pots I= 10%
14.	Shri Ganesh Ropwatika, Tembhurni	Yes	6.5 acre		Bhagawa	MPKV Rahuri	Nil	Nil	Cercospora spots I= 5%, S=2%
15.	TAO Nursery, Pandharpur	Yes	1800	1,10,000	Bhagawa	MPKV Rahuri, Govt. Nurs ery Jeur	Nil	Nil	Cercospora spots I= 1%, S=1%
16.	SDO Nursery, Pandharpur	Yes	275		Mridula	MPKV Rahuri	Nil	Nil	Nil



## Network Project on Mitigating the Bacterial Blight of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh

Technical Workshop (May 17, 2008)

#### **PROCEEDINGS**

The 'Technical Workshop' on the 'Network Project on Mitigating the Bacterial Blight of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh' began under the Chairmanship of Dr. V.T. Jadhav, Director, NRCP, Solapur on 17.05.2008 at 10.00 am in the Director's Chamber of National Research Centre on Pomegranate, Solapur. The following officials from the participating institutes attended the workshop.

- 1. Dr.V.T.Jadhav, Director, NRCP, Solapur
- 2. Dr.C.Gopalakrishnan, Principal Scientist (Pathology), IIHR, Bangalore
- 3. Dr.V.I.Benagi, Prof. and Head (Pathology), UAS, Dharwad
- 4. Dr.M.R.Ravikumar, Associate Professor (Pathology), KVK, Sirsi, Uttar Kannada
- 5. Dr. U.G. Kulkarni, Associate Dean and Principal, COA, Osmanabad
- 6. Dr.V.G.Mulekar, Associate Professor (Pathology), COA, Osmanabad
- 7. Dr.C.V.Ambadkar, Assistant Professor (Pathology), ARS, Tuljapur
- 8. Dr. Kiran Raghuvanshi, Junior Pathologist, AICRP on Arid Zone Fruits, MPKV, Rahuri
- 9. Dr.K.Subramanyam, Sr. Scientist (Pathology), ARS, Anantapur
- 10. Dr.Ram Chandra, Pr. Scientist, (Hort.-Fruit Science), NRCP, Solapur
- 11. Dr.K.K.Sharma, Senior Scientist (Pathology), NRCP, Solapur
- 12. Dr. (Mrs.) Jyotsana Sharma, Senior Scientist (Pathology), NRCP, Solapur
- 13. Dr.R.A. Marathe, Senior Scientist (Soil Science), NRCP, Solapur
- 14. Dr.K.Dhinesh Babu, Scientist (Hort.-Fruit Science), NRCP, Solapur.
- 15. .Dr. Ashish Maity, Scientist, (Soil Science), NRCP, Solapur
- 16. Dr.S.P.Raut, Head (Plant pathology) from KKV, Dapoli

Dr. VT Jadhav, the Project Director welcomed all the coordinators and additional coordinators from participating organisations to the workshop and deliberated upon the importance of the network project sanctioned by the Govt. of India, in the light of current scenario of bacterial blight in the three states.

Dr.(Mrs). Jyotsana Sharma briefed the participants with the elements of the project and expenditure details.. She explained the criterion for selection of the orchard for adoption under the project, survey and surveillance methodology and Disease Assessment Keys. This was followed by discussions and clarification of doubts by the participants. She also presented the 'Format of the Agreement' which was approved by all.

On the request of participants, Dr. K. K. Sharma shared his experiences on the adoption of orchard by NRCP,



Solapur for mitigating the bacterial blight during 2007-08. Dr. C. Gopalakrishnan demonstrated the operation of Automatically Disinfecting Secateur, available with Mr. Sanju Mathew, KASB Agro solutions 51/27, Swamy Towers, First Floor, D. Nakkundi, Outer Ring Road, Marathalli, Bangalore 560 037, Ph. No. 08025237887

The Meeting ended at 16:30 hours with the vote of thanks by Dr.KK Sharma.

The final recommendations of the meeting are:

- 1. All were asked to take 'Pre-Hasta Bahar 'for 1st'. year demonstrations, and to Venture for Mrig Bahar in the next year.
- 2. For demonstrations, when orchard of 1 ha area is not available for adoption, Orchards of 0.5 ha/1acre can be adopted in two adjacent orchards.
- 3. All were asked to conduct surveys in and around their areas so that disease mapping may be done for the three states.
- 4. MPKV, Rahuri will take up demonstrations in Ahmednagar, Nashik, Pune, Solapur and Sangli districts.
- 5. Looking into the large number of demonstrations and trainings to be undertaken by MPKV, Rahuri, it was decided that the university authorities may be requested to nominate more additional coordinators, for better execution of the project work.
- 6. It is mandatory to undertake the agreement / MOU in the prescribed form with the owner of the orchard for a period of 2 years (April 2008- March 2010) in non-judicial stamp paper of atleast Rs 20/-, for adoption of orchard and demonstration of OHMS. A copy of the 'Agreement Format' was given to all the participants.
- 7. Two training manuals (one for State Govt. Officers and other for farmers) already prepared by NRCP, Solapur, will be printed in English and Marathi and supplied in requisite number to the participating organizations as per their demand (given below).

Organization	Requi	rements
	Training Manuals for Officers	Training Manuals for Farmers
	(English)	(in Marathi)
MAU, Parbhani	5	750
MPKV, Rahuri	20	2000
UAS, Dharwad	20	Nil
ANGRAU, AP	20	Nil
IIHR, Bangalore	50	Nil

8. The participating organizations from Karnataka and Andhara Pradesh, were provided the final draft of the 'Training Manuals for Farmers' in English, for preparing manuals in respective local languages.



- 9. For purchase of items of non recurring nature for this project, the centres should get approval from NRCP Solapur.
- 10. The participants should send the proposals for purchase of equipments, inputs etc, hiring of vehicles a well as appointments of Training Associates and Training Helpers as per their requirement but within the specified budget, for approval to Director, NRCP, Solapur.
- 11. It was unanimously decided by the house, that NRCP, Solapur will process the purchase of Disease Forecasting Units and send a copy to participating organizations so that they can process on the same lines.
- 12. The Disease Forecasting Units will be installed at a bacterial blight hot spot area in the respective regions under the jurisdiction of the organization and that the organization will be responsible for the safety of the unit..
- 13. For financial sanction they may follow the norms of their respective organization.
- 14. The powers of revalidation of unspent amount will be with NRCP, Solapur/DAC, New Delhi
- 15. The Nodal Agency, NRCP, Solapur will co-ordinate the technical programme of this project and may issue the guidelines as and when required for better out put of the project.
- 16. Coordinators from respective organizations will submit Quarterly Progress Reports (Physical and Fiscal) of the Network Project to the Project Director, NRCP, Solapur for review and further transmission to Ministry of Agriculture, Govt. of India, N. Delhi.

VT Jadhav (Chairman)



Minutes of the Meeting on Implementation of Package for the Control of Bacterial Blight an Wilt Diseases of Pomegranate and Network Project on Mitigating the Bacterial Blight of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh. (July 26, 2008)

The meeting to discuss implementation of package for the control of bacterial blight and wilt diseases of pomegranate and Network Project on 'Mitigating Bacterial Blight Disease of Pomegranate in the sate of MaharashtraKarnataka and Andhra Pradesh" began under the Chairmanship of Dr. V.T. Jadhav, Director, NRCP, Solapur on July 26, 2008, in the Director's Chamber at National Research Centre on Pomegranate, Solapur. The following officials from the MPKV, Rahuri, MAU, Parbhani and NRCP, Solapur attended the meeting

- 1. Dr.VT Jadhav, Director, NRCP, Solapur
- 2. Dr. SG Borkar, HOD, Pathology, MPKV Rahuri
- 3. Dr. AG Chandele, Head Entomology, MPKV, Rahuri
- 4. Dr. UG. Kulkarni, Associate Dean and Principal, COA, Osmanabad
- 5. Dr.V.G.Mulekar, Associate Professor (Pathology), COA, Osmanabad
- 6. Dr. Kiran Raghuvanshi, Junior Pathologist, AICRP on Arid Zone Fruits, MPKV, Rahuri
- 7. Dr. MB Shete, Asstt. Prof. of Hort., NARP, ZARS, Solapur
- 8. Dr. SD Masalkar, Horticulturist, MPKV, Rahuri
- 9. Prof. DR Murumkar, Pathologist, NAARP, ZARS, Solapur
- 10. Dr. NL Mhase, Nematologist, MPKV, Rahuri
- 11. Dr. Santosh Kulkarni, scientist I (Ent.), MPKV, Rahuri
- 12. Dr.Ram Chandra, Pr. Scientist, (Hort.-Fruit Science), NRCP, Solapur
- 13. Dr. KK Sharma, Senior Scientist (Pathology), NRCP, Solapur
- 14. Dr.(Mrs.) Jyotsana Sharma, Senior Scientist (Pathology), NRCP, Solapur
- 15. Dr. RA Marathe, Senior Scientist (Soil Science), NRCP, Solapur
- 16. Dr. K Dhinesh Babu, Scientist (Hort.-Fruit Science), NRCP, Solapur.
- 17. .Dr. Ashish Maity, Scientist, (Soil Science), NRCP, Solapur
- 18. Mr.YR Shinde, Training Associate, NRCP, Solapur
- 19. Mr.Rahul N Madane, Training Associate, NRCP, Solapur
- 20. Ghuge Kundlik S, Training Associate, NRCP, Solapur
- 21. AS Lohakare, Training Associate, NRCP, Solapur

Dr. VT Jadhav, the Project Director welcomed all the delegates from both the universities and the centre and apprised the house with the contents of the letters received from Managing Director, Maharashtra State Horticultural and Medicinal Plant Board, Pune and Director of Research, MPKV, Rahuri, because of which this meeting was convened.

The house discussed at length the Orchard Health Management (OHM) Schedule, finalized by Scientists from ICAR and SAUs and representatives of farmers at a meeting in Pune on Feb. 24, 2007, under the



Chairmanship of Hon'ble DDG (Hort.), ICAR, New Delhi. After thorough discussions, all present felt that, no changes were required in the OHM schedule and should be implemented as such.

Thereafter the package for pomegranate wilt was discussed. Dr. KK Sharma, Sr. Scientist, NRCP, Solapur, briefed the house about the etiology, predisposing factors and control measures for wilt. He told that the primary cause of wilt was Ceratocystis fimbriata, on the basis of association of this fungus in more than 60-65% samples collected from various orchards and pathogenicity which he has convincingly proved in pot culture experiments. Other fungi like Fusarium, Rhizoctonia, Macrophomina, Nematodes and shot hole borers were also found associated in some cases. Dr. Kiran Raghuvanshi, Junior Pathologist, MPKV, Rahuri, informed about the 'Package of Pomegranate Wilt' finalized by MPKV, Rahuri. The Chairman requested him to send a copy so that the final draft could be prepared for the package for wilt management.

The implementation of Network Project on 'Mitigating Bacterial Blight Disease of Pomegranate in the sate of Maharashtra" was also discussed. The Project Director informed the house that NRCP, Solapur had finalized the 5 demonstration plots to be adopted by the Centre and is taking flowering in August. He requested Co-ordinators from MPKV, Rahuri and MAU, Parbhani to select the orchards as early as possible and send complete contact details of the selected orchards to this office. The cordinators requested the project Director to ask SHM to release the funds, which have not been released so far, so that the project work is properly executed. The meeting ended with vote of thanks by Dr. (Mrs.) Jyotsana Sharma, Sr. Scientist, NRCP, Solapur.

#### **Recommendations:**

- 1. No changes were required in the OHM schedule for mitigating bacterial blight of pomegranate, and should be implemented as such.
- 2. Package for wilt was finalized. The recommended package is enclosed, herewith (Annexure 30)
- 3. Co-ordinators 'Netwok Project' from MPKV, Rahuri and MAU, Parbhani should select the orchards as early as possible and send complete contact details of the selected orchards to this office.

(VT Jadhav) Project Director



## Annexure 8a

# Package for Wilt Management finalized in the Meeting on July 26, 2008, at NRCP Solapur

The package for wilt management was finalized by the scientists from NRC on Pomegranate, Solapur, MPKV, Rahuri and MAU Parbhani, in the meeting held at NRCP, Solapur on July, 26, 2008.

- Prefer site having light-medium soil for the orchard with proper drainage.
- Plant orchard with disease free planting material grown in disease free solarized soil.
- Make Pits 1m x 1m x 1m, at a spacing of 4.5m (row-row) x 3.0m (plant-plant). This will accommodate about 740 plants. Disease also spreads through root to root contact hence narrower spacing will aggravate the wilt problem.
- Pits are dug about a month prior to planting and kept open for at least 1 month. So that it is disinfected by intense solar radiation during the day.
- Drench pits with 0.2% Carbendazim in 5L water/pit.
- Carbaryl dust or Chloroopyriphos 50g/pit is dusted on the bottom and sides of the pits just before filling pits.
- Pits are also treated with Calcium hypochlorite@100g/pit, before filling.
- At pit filling if soil is heavy mix sand: soil in 1:1 ratio. In each pit mix with top soil-

FYM	20Ka
	20Kg,
Vermicompost	2Kg
Neem cake	3Kg
Trichoderma formulation	25g
Phosphate Solublising bacteria	10Kg/ha (15g/plant)
Azotobacter formulation	10Kg/ha (15g/plant)

- Follow proper soil water management.
- On observing a wilted plant immediately drench soil with Chlorpyriphos (0.25%)+ Carbendazim (0.2%) or Propiconazole/Tilt (0.15%) or Hexaconazole (0.15%) @ 5 L solution/tree. Drench at least 2-3 plants on all the four sides around the infected plant/s. Chlorpyriphos will take care of shot hole infestation if any.
- The pathogen propagules are also observed on arial parts. So spray entire orchard with 0.1% Carbendazim.
- Uproot dead wilted dry plants and burn immediately. While removing the wilted plants from the orchard for burning, protect the root zone with cover, as the spores of the pathogen are present abundantly on the roots and may spread to other plants.
- Avoid pruning in spring and early summer which is also insect active period, because insects are attracted to sap produced on pruning wounds and thus help in dissemination of pathogen propagules.
- Protect all pruning wounds, with Bordeaux paste.
- For controlling shot hole borer (Xyleborus spp.) which is associated with wilt disease, 10 litres preparation containing Red Soil (4kg) + Chlorpyriphos (20ml) + Copper oxychloride (25 g) can be



- applied on plant base from second year onwards. Red soil should be soaked in water overnight and chemicals mixed next day.
- For stem borer control, inject in the holes on the trunk Fenvalerate @5 ml/litre and plug the holes with mud.
- Where nematodes are a problem apply Phorate @ 20Kg/ha or Carbofuran @2Kg a.i. /ha in the plant basin, in a ring near root zone and cover it with soil.
- Plant Tagetes *erecta* (African marigold) between plant to plant space in a row, or in a ring, on he border of plant basin, these help in reducing nematode population. For effective results these should be grown for more than 4-5 months.
- Follow clean cultivation and orchard sanitation measures strictly.



## Annexure 9

Minutes of the Workshaop to Review the Progress Made in the Network Project on Mitigating Bacterial Blight Disease in Maharashtra, Karnataka and Andhra Pradesh

(Dec 17-18, 2008)

The workshop to review the progress made in the network project on 'Mitigating Bacterial Blight Disease in Maharashtra, Karnataka and Andhra Pradesh' was held at National Research Centre on Pomegranate, Solapur on 17<sup>th</sup> and 18<sup>th</sup> December, 2008 under the chairmanship of Dr.VT Jadhav, Project Director & Director, NRCP, Solapur. The workshop was attended by the Coordinators, Additional Coordinators and Training Associates from NRCP and other participating organizations. Dr. Fartade, Programme Coordinator, KVK, Tuljapur and Dr. Ram Chandra, Principal Scientist, NRCP, Solapur were the special invitees to review the progress. The following participants attended the workshop

- 1. Dr.VT Jadhav, Project Director and Director, NRCP, Solapur
- 2. Dr.GM Fartade, Programme Cordinator, KVK, Tuljapur Dist. Osmanabad (Special invitee)
- 3. Dr.Ram Chandra, Pr. Scientist, (Hort.-Fruit Science), NRCP, Solapur (Special invitee)
- 4. Dr. SG Borkar, Coordinator and HOD, Pathology, MPKV Rahuri
- $5. \quad Dr. VI\, Benagi, Coordinator, Prof. and Head\, (Pathology), UAS, Dharwad$
- 6. Dr. MR Ravikumar, Additional Coordinator and Associate Professor (Pathology), KVK (UAS, Dharward), Sirsi, Uttar Kannada
- 7. Dr.C Gopalakrishnan, Coordinator and Principal Scientist (Pathology), IIHR, Bangalore
- 8. Dr. AK Saxena, Additional Coordinator and Senior Scientist (Pathology), IIHR, Bangalore
- 9. Dr.K Subramanyam, Coordinator and Sr. Scientist (Pathology), ARS, APHU, Anantapur
- 10. Dr.VG Mulekar, Additional Coordinator and Associate Professor (Pathology), COA, Osmanabad
- 11. Dr.CV Ambadkar, Additional Coordinator and Assistant Professor (Pathology), ARS, Tuljapur
- 12. Dr. (Mrs.) Jyotsana Sharma, Coordinator and Senior Scientist (Pathology), NRCP, Solapur
- 13. Dr. KK Sharma, Additional Coordinator and Senior Scientist (Pathology), NRCP, Solapur
- $14. \ \ Dr. RA\, Marathe, Additional\, Coordinator\, and\, Senior\, Scientist\, (Soil\, Science), NRCP, Solapur\, Additional\, Coordinator\, and\, Senior\, Scientist\, (Soil\, Science), NRCP, Solapur\, Science, NRCP, Solapur\, Science,$
- $15. \ \ Dr. K Dhinesh Babu, Additional Coordinator and Scientist (Hort.-Fruit Science), NRCP, Solapur.$
- $16. \ Mr. MR \ Ravikumar, Training \ Associate, UAS, Dharward$
- 17. Mr. P Ranga Naidu, Training Associate, ARS, APHU, Anantpur
- 18. Mr.YR Shinde, Training Associate, NRCP, Solapur
- 19. Mr. Rahul N Madane, Training Associate, NRCP, Solapur
- 20. Mr. Ghuge Kundlik S, Training Associate, NRCP, Solapur
- 21. Mr. AS Lohakare, Training Associate, NRCP, Solapur
- 22. Mr.Om Prakash Shisodya, Training Associate, NRCP, Solapur

In the morning session of the first day of the workshop Dr.VT Jadhav, the Project Director welcomed all the coordinators, additional coordinators and Training Associates from participating organizations to the two



day workshop. Looking into the tremendous losses caused due to bacterial blight during recent years, the Director in his introductory remarks requested all the participants to take the work under the project seriously. He reiterated that the OHM schedule finalized in a high level meeting at Pune needs to be tested at multiple locations under this project, so that recommendation can be put on a sound footing. This was required to built up confidence of the pomegranate growers suffering due to Bacterial Blight Disease (BBD). He also informed the house that NRCP had already successfully implemented the 'Orchard Health Management Schedule (OHM)' in a severely infected pomegranate orchard of a farmer at Hiraj (Solapur) during Hast Bahar (2007-08), and got 16 tons of disease free produce from 1 ha, hence there is no reason, not to get good BBD management with the schedule. He promised full cooperation and support to all the participants for timely release of funds by respective state missions, so that the work does not suffer due to lack of funds. After his introductory remarks he asked all present to introduce themselves.

Dr. SG Borkar, presented progress report for MPKV Rahuri and pointed out that the work cannot be carried out unless and until delegation of financial power is given to Director of Research, MPKV, Rahuri. The Project Director agreed and the letter to this effect was handed over to him for early implementation of project by MPKV. He also asked for slight amendment in the 'Clause 7 of the Agreement for Adoption of Pomegranate Orchard for the Network Project on Mitigating Bacterial Blight of Pomegranate' which was agreed upon. He informed that list a 10 selected orchards has been proposed to Director Research for approval.

Dr. CV Ambadkar, presented the progress of work done by MAU, Parbhani, under the network project. The University has already conducted the surveys and adopted 5 orchards but due to heavy rains during October & November the Hasth bahar could not be taken, hence they are now taking Ambe Bahar. He also felt that several farmers were unaware about various aspects of BBD and extension activities were required to create awareness in some areas.

Dr. (Mrs.) Jyotsana Sharma presented progress made under the project by NRCP, Solapur. The Centre had already adopted 5 orchards and the demonstrations are in progress. She informed that the trainings are to be imparted shortly.

The progress report for UAS, Dharwad was presented by Dr.V.I.Benagi. He expressed satisfactory control of the BBD as well as of Wilt in the adopted orchards using Orchard Health Management Schedule. He also mentioned about release of publications viz., technical leaflets and training manual in local language for distribution to farmers, besides publication of articles on BBD in Annadatha Kannada magazine. He also showed photographs of various pomegranate diseases found in Karnataka. He felt hat the amount of Rs.50,000/plot was not sufficient fordemonstration, hence this should be increased. He also informed that wilt was a severe problem in some orchards and drenching with recommended fungicides and insecticides at proper stage gave effective control of the disease.

Dr. C Gopalakrishnan presented report for IIHR, Bangalore. He informed that the progress of the project was as per schedule and the incidence of fruit borer (Helicoverpa) was severe besides other pests viz., thrips, mites, aphids etc. he also expressed satisfaction of the farmers over BBD control using the OHM schedule.

Dr.K Subramanyam while presenting the progress report for APHU, Andhra Pradesh reported adoption of 8 orchards instead of 5. The project Director permitted to take extra demonstrations if these can be carried out within the sanctioned budget. He too expressed satisfaction of the farmers over BBD control using the OHM schedule. He also brought some diseased fruit samples for identification of diseases, which were identified by Dr KK Sharma.

In the post lunch session Dr. Jyotsana Sharma delivered a lecture on 'Disease Diagnosis'. She explained



various diseases and pests of pomegranate and methods to differentiate BBD from other fungal diseases like Cercospora spot using coloured photographs. Dr.KK Sharma presented 'Disease Assessment Scale for BBD of pomegranate for uniform collection of data under the project. Doubts expressed by Dr K Subramanyam were cleared. Dr. RA Marathe gave an informative talk on 'Nutrient Disorders and Role of Nutrients in Disease Development.' Though much was not available on Pomegranate, however related literature on other crops was presented. It was proposed to come out with a pomegranate special micronutrient mixture similar to that of banana special micronutrient developed by IIHR. The project Director requested all to submit progress reports if not submitted and also the expenditure details so that further action could be taken accordingly. Dr. Jyotsana Sharma concluded the sessions with vote of thanks The session ended at 5.30 PM.

On Dec 17, 2008 a field visit to NRCP Farm, Kegaon and Farmers Orchard at Hiraj was organized. Dr. Ram Chandra highlighted the salient features of the accessions available in the National Germplasm Repository for pomegranate at NRCP, Solapur besides ongoing experiments were shown to the participants. Dr. RA Marathe explained about the water harvesting structure and other farm development works of NRCP, Hiraj farm. In the farmers orchard various diseases were shown and doubts cleared regarding different diseases. Dr. KK Sharma and Dr. Jyotsana Sharma explained the progress of work at the adopted farmers orchard. The participants returned to NRCP at 4.30 PM. Relevant documents required by respective organizations were provided on request for unhindered progress of the project work.

VT Jadhav (Project Director)



## Annexure 10

Minutes of the Annual Review Meeting of Network Project on Mitigating Bacterial Blight Disease of Pomegranate in Maharashtra, Karnataka and Andhra Pradesh Held at NRC on Pomegranate, Solapur (September 10, 2009)

The meeting to review the progress made during first year of implementation of the network project on 'Mitigating Bacterial Blight Disease of pomegranate in Maharashtra, Karnataka and Andhra Pradesh' was held at National Research Centre on Pomegranate, Solapur on September 10,2009, under the chairmanship of Dr. VT Jadhav, Project Director & Director, NRCP, Solapur. The meeting was attended by the Coordinators, Additional Coordinators and Training Associates from NRCP and other participating organizations. Dr. Ram Chandra, Principal Scientist and Dr. Ashish Maity, Scientist Soil Science, NRCP, Solapur were the special invitees. The following participants attended the workshop

- 1. Dr.VT Jadhav, Project Director and Director, NRCP, Solapur
- 2. Dr.Ram Chandra, Pr. Scientist, (Hort. Fruit Science), NRCP, Solapur (invitee)
- 3. Dr. VI Benagi, Coordinator, Prof. and Head (Pathology), UAS, Dharwad
- 4. Dr.MR Ravikumar, Add. Coordinator and Assoc. Prof. (Path.), KVK (UAS, Dharwad), Sirsi, Uttar Kannada
- 5. Dr.C Gopalakrishnan, Coordinator and Principal Scientist (Pathology), IIHR, Bangalore
- 6. Dr. AK Saxena, Additional Coordinator and Senior Scientist (Pathology), IIHR, Bangalore
- 7. Dr.K Subramanyam, Coordinator and Sr. Scientist (Pathology), ARS, APHU, Anantapur
- 8. Dr.RA Raghuwanshi, Assoc. Prof., Plant Path., MPKV, Solapur
- 9. Dr.CSThakare, Asstt. Prof., AICRP, AZF, MPKV, Rahuri
- 10. Dr.DV Indi, ADR, ZARS, Solapur
- 11. Dr. AS Dhawan, Associate Dean and Principal, COA, Omanabad.
- 12. Dr. VG Mulekar, Additional Coordinator and Associate Professor (Pathology), COA, Osmanabad
- 13. Dr. (Mrs.) Jyotsana Sharma, Coordinator and Principal Scientist (Pathology), NRCP, Solapur
- $14. \quad Dr. KK Sharma, Additional Coordinator and Senior Scientist (Pathology), NRCP, Solapur$
- 15. Dr.RA Marathe, Additional Coordinator and Senior Scientist (Soil Science), NRCP, Solapur
- 16. Dr.K Dhinesh Babu, Additional Coordinator and Scientist (Hort.- Fruit Science), NRCP, Solapur
- 17. Dr. Nripendra Vikram Singh, Additional Coordinator and Scientist (Hort.- Fruit Science), NRCP, Solapur
- 18. Dr. Ashish Maity, Scientist, Soil Science, NRCP, Solapur (invitee)
- 19. Mr. P Ranga Naidu, Training Associate, ARS, APHU, Anantpur
- 20. Mr. Basawaraj B. Pawar, Training Associate, UAS, Dharward
- 21. Mr.YR Shinde, Training Associate, NRCP, Solapur
- 22. Mr.Rahul N Madane, Training Associate, NRCP, Solapur
- $23. \ Mr. AS\, Lohakare, Training\, Associate, NRCP, Solapur$

The meeting initiated with the welcome address by the Project Director and Director NRCP, Solapur, Dr.VT Jadhav. He welcomed the delegates and briefed about the outcome of the work



done during the first year of implementation of the Network Project and targets of the project that are to be taken in the second year. He also welcomed Dr. AS Dhawan, Associate Dean and Principal, COA, Osmanabad, to join the project as Coordinator for MAU, Parbhani in place of Dr. UG Kulkarni, earlier coordinator, who was transferred as Associate Dean and principal to COA, Latur.

He expressed satisfaction that now mers are aware that the bacterial blight can be kept low and managed if proper management practices are followed. He also felt that the expenditure by some of the participating organization was low due to their organizational procedures and norms and this needs to be sorted out at their level, however, he also informed that if the project outcome is positive and satisfactory, the savings from this project will be utilized for the third year demonstrations in other orchards after due approval of the Government. He felt that after one year experience in this project, on several trials taken on its control by NRCP and other organizations and on the basis of information and views of the progressive growers who have produced good pomegranate in spite of the blighted orchards in the neigbouring sites some newer schedules should be developed and tried by all the concerned organizations in the growers orchard. The Director told that the nursery inspection is one of the objectives of the network project, for which proforma has been prepared by NRCP, this should be finalized in this meeting and changes if any should be made, so that inspections can be carried out wth the help of state departments. The director then asked all coordinators to present the work done during first year and requested all to be brief.

Dr. C Gopalakrishnan, Coordinator, IIHR, Bangalore presented the work in brief at adopted orchards in Sira, Hiriyur and Jagalur talukas of Tumkur, Chitradurga and Davanagere districts of South Karnataka. He informed that the farmers were highly satisfied with the management of bacterial blight and expressed regain of confidence in taking pomegranate crop. He also found that tip drying was causing some problems for which studies were required. He also felt that aotomaticly disinfected secateurs can be of great help in reducing spread of the pathogen during pruning operation and hence **government should think about giving subsidy to farmers for its purchase as it costs about Rs 15, 000/-. This was followed by discussions and clarifications by the participants** 

Dr. VI Benagi, Coordinator, UAS, Dharwad, highlighted the performance of adopted orchards at Belgaum, Gadag, Chitradurga, Bellary, Bagalkot, Koppal and Bijapur districts of North Karnatakka and claimed considerable reduction in bacterial blight severity in adopted demonstration plots. The status of bacterial blight and other diseases in N. Karnataka was also discussed based on his survey. He also said pasting of cankers with Streptocycline and sulphuric acid yielded positive results. He cautioned scientists to create awareness in farmers to get pruning done by skilled pruning team, though it may costlier. He said variability in Xanthomona isolates was observed and that a weed Tridex sp. from compositae family was also a host of the blight pathogen. During the surveys he found bacterial blight was prevalent in 80-100 % of the inspected orchards and that Bellary district was more wilt affected than bacterial blight. He was happy to announce that the farmers in Karnataka are now confident and that area was increasing under pomegranate. He expressed satisfaction over outcome of implemented OHM schedule and its adoption by growers. He however, felt that several farmers left abondoned blight infected orchards for getting packaged, which served as source of infection. Such orchards should either be uprooted or sanitation maintained. He was of the opinion that up to 80% disease control can be achieved through sanitation alone.Dr. K Subramanyam, Coordinator, APHU, Anantapur informed the house about the status of bacterial blight and other diseases in Anantpur and Mehaboobnagar districts of Andhra Pradesh and also development of bacterial blight indifferent months. The performance of OHM in adopted orchards was also discussed. He



shared with the participants the feedback gathered from farmers. The pruning period as per the experience of farmers in AP was location specific and in general June July pruning gave better quality than Sept. Oct. Pruning. Among various pests bacterial blight, fungal fruit spots and fruit sucking moths were a major threat in these areas. He said farmers using 1% Bordeaux mixture at flowering reported falling down of flowers and newly set fruits. He was advised that 1% Bordeaux mixture was recommended soon after pruning or rest period whereas, after defoliation and during the crop period till harvest, only 0.5% Bordeaux mixture was recommended. He also informed health status of Dept. Of Hort. nursery at Chigicherla which was inspected by him.

Dr. Ambadkar from College of Agriculture, Osmanabad presented survey work carried out in the districts of Osmanabad, Beed and Latur and informed that respectively, 33.59, 28.81 and 62.36 % area under pomegranate in these districts was affected with bacterial blight. The project Director asked them to include Jalana and Aurangabad districts in the survey. He also presented the work done in the demonstration plots and achieved reduction in bacterial blight severity in adopted orchards. He also informed that some orchard owners did not cooperate and this creates problems in carrying out the operations. To this the Project Director, advised to discontinue such orchards and take new orchard.

Dr. (Mrs.) Jyotsana Sharma, Coordinator, NRC on Pomegranate while presenting the work carried out by NRCP under the project presented bacterial blight maps of Maharashtra and Solapur. She also reported that since NRCP had already taken the schedule in adopted farmer's orchard prior to initiation of this project and got highly satisfactory results, hence it ventured to evaluate the schedule in mrig bahar (rainy season)-which is the main period for pomegranate in these areas. She reported that in orchards with high bacterial blight severity, disease could not be satisfactorily checked in rainy season / Ambe Bahar crop, however, Hasta Bahar crop when taken in the same orchards gave high disease control. She informed the house that the schedule has to be followed in Hasta bahar, which is also one of the recommendation in the schedule. Out of the 5 adopted orchards she reported discontinuing of one Orchard at Wadgi due to non cooperation of the owner, satisfactory disease control in others with good yield in 3 (>9t/ha) and in one there was 60-70% loss due to cracking one month before harvest due to acute water shortage. She also requested all to go through the proforma prepared for the nursery inspections so that necessary changes be made and distributed to all.

The Project Director then asked Dr. K. Raghuwanshi, Additional Coordinator, MPKV to present the progress. He informed that he had not prepared the presentation however, hard copy of the same has been submitted to NRCP.

Detailed discussion took place on various aspects of tackling pests and diseases in pomegranate. The Director then answered the queries of the participants and requested to reassemble after lunch to finalize the remaining agenda items, as he was to leave for another urgent meeting after lunch and could not attend the post lunch session.

The post lunch session commenced at 3.00PM. As Chairperson DR VT Jadhav had left for another urgent meeting, Dr. (Mrs.) Jyotsana Sharma, requested Dr. AS Dhawan, Associate Dean and Principal, COA, Omanabad., to chair the session.

As most all the agenda items were over before lunch, Chairperson requested all present to go through the 'Nursery Inspection Proforma' prepared by NRCP and suggest changes, if any. The proforma was found to contain all requisite information to be collected while inspecting nurseries except that, the chairman requested to include query on **mother block source**.



Dr. (Mrs) Jyotsana sharma informed that, DR. VT Jadhav had requested State Horticulture Missions to send list of authorized nurseries in the respective states so that the inspections be carried out with the help of state departments. She also asked the chairperson to decide areas to be covered by participating organizations in Maharashtra, as list of authorized nurseries in Maharashtra as provided by NHMPB, Pune. It was decided by the chairman that the NRCP, Solapur will conduct inspection of nurseries in Solapur, Sangli, Pune, MAU Parbhani will inspect nurseries in Aurangabad, Jalana, Latur, Osmanabad and Parbhani and MPKV, Rahuri in Ahemadnagar, Dhule, Jalgaon and Nashik. He also requested all the coordinating partners to document success stories of farmers and see how best their techniques can be integrated in our scientific schedule.

The meeting ended at 5.00 PM with views of Dr. KK Sharma, Additional Coodinator of the Network Project at NRC on Pomegranate, on successful demonstrations by various organizations and vote of thanks.

(VT Jadhav)



## Annexure 11

# Minutes of the Meeting Held on November 17-18, 2010, At National Research Centre on Pomegranate, Solapur

In pursuance of the decision taken by Dr. S. Ayyappan, Hon'ble DG, ICAR, New Delhi, in the 'National Consultation on Pomegranate,' on Sept. 26, 2010, organized by National Research Centre on Pomegranate (NRCP) at Solapur, a meeting of scientists working on pomegranate was organized on Nov. 17 and 18, 2010 at Meeting Hall, Hotel Lotus by NRCP, Solapur under the Chairmanship of Dr. JH Kulkarni former Vice Chancellor, UAS Dharwad and presently Chairman, Quinquennial Review Team (QRT) for NRC on Pomegranate. The QRT members- Dr. Srikant Kulkarni, Co-chairman and former Prof. & Head, Plant Pathology, UAS, Dharwad, Dr. Dr. V Ponnuswami, Dean, Horticulture College & Research Institute, Tamil Nadu Agricultural University, Periyakulam, Tamil Nadu and Dr. GS Karibasappa, Principal Scientist, National Research Centre for Grapes, Pune along with Dr. VT Jadhav, Director NRCP, Solapur were team experts for the meeting. The meeting was convened to develop a modified package for mitigating bacterial blight of pomegranate. The meeting was attended by researchers from Maharashtra, Karnataka Andhra Pradesh and Tamil Nadu including that of network project on bacterial blight of pomegranate. The list of participants is given in appendix.

The Director, Dr VT Jadhav welcomed the Chairman, experts and the participating pomegranate researchers. In his introductory remarks he mentioned the 'Orchard Health Management (OHM) Schedule' was prepared during Feb. 2007 by the pomegranate workers from all over India, at a high level meeting, under the Chairmanship of DDG, ICAR, New Delhi. Later a network project was sanctioned by the Govt. of India, to see efficacy of the OHM schedule in mitigating bacterial blight of pomegranate in Maharashtra, Karnataka and Andhra Pradesh. On the basis of the research done and demonstration of this OHM schedule in Maharastra, Karnataka and Andhra Pradesh during last 3 years, it was felt that the schedule can be modified and hence a joint meeting of pomegranate researchers from all the three states has been convened to discuss and modify the schedule where necessary.

The Chairman pointed out the concern for bacterial blight management shown by the DG, ICAR in the meeting on Sept. 26, 2010. He said though the earlier schedule has been shown to work well in a network mode in the three states, yet there was always a scope for improvement and modification. He expressed hope that, a good discussion will take place and a good schedule not only for bacterial blight but also for other diseases and pests will be finalized in this meeting. He expressed that community approach should be emphasized for the management of bacterial blight.

Dr. Srikant Kulkarni enlightened the house with the ineffective eradication campaigns taken by the US government against citrus canker caused by *Xanthomonas axonopodis* pv *citri* in Florida. The bacterial blight is not a new disease. It remained obscure till only foliage was attacked, but once it attacked fruits it became prominent and difficult to control. As the pathogen as well as the pomegranate plant is perennial, management of blight is therefore a challenge. He expressed concern for community approach and orchard sanitation, which farmers are neglecting and hence facing problems in its management. He also showed concern over wilt and other diseases which may be of minor importance today, but can become epidemic if not taken care. Hence, a schedule which will allow growers to grow disease free pomegranate with minimal pesticide residues should be formulated. He also cited certain good orchards in Maharashtra and Karnataka where in spite of blight they are taking good harvest through proper management.



Dr. V Ponnuswami, felt that horticultural practices like training, pruning, canopy management, flower regulation, varieties etc. also need attention. Breeding for resistance will be the best solution and efforts to test varieties from other countries should be made. Role of nutrients in development of several diseases is known, hence nutrients /fertilizers should be used judiciously. The possibilities of the production of planting material in non traditional areas of the other states, where there is no disease prevalence may also be explored. The use of recent concepts of molecular tools has to be experienced to mitigate the bacterial blight. The concept today is IDPM (Integrated Disease and Pest Management) and not IDM or IPM, hence proper IDPM schedule for pomegranate with minimal residues should be developed in this meeting.

Dr. G.S Karibasappa, expressed happiness over the recommendations and the research work done in all the three states. He expressed satisfaction that unlike grapes pomegranate due to thick rind is less sensitive to residue problems. Emphasizing on the role of sanitation in disease management, he remembered the times when farmers managed the diseases and pests through sanitation. He also emphasized on the role of hygiene at ground level and nutrition in disease management. He said management involves all branches of horticultural science and not just pathological aspects.

Dr.V.T Jadhav also read the points for discussion received from Dr. RK Jain, HOD, Pl. Pathology, Which were discussed while discussing production of blight free planting material.

After the expert comments of the committee the Chairman requested Dr. Srikant Kulkarni to take the lead in formulating the new schedule. Dr. Srikant Kulkarni, then put forth 8 points and asked all the participants to discuss at length on these points to finalize the management schedule. The points for discussion were: (i) Planting material (ii) Sanitation (iii) Nutrition (iv) Season in different states (v) Rest period (vi) Plant protection, prophylactics, therapeutics and curative sprays (vii) Post harvest problems (viii) Pesticide residues problems of exporters. These points were discussed at length. The original OHM schedule was also discussed point wise. After lot of discussions the modified OHM schedule was developed under the title, 'Integrated Disease and Pest Management (IDPM) Schedule for Pomegranate.' The schedule was again presented before the participants on next day and any changes suggested were made to give it a final approval. The recommended schedule is attached herewith. The participating organizations were requested to print the schedule in the local language of the region with good photographs. In addition to the IDPM schedule the following recommendations need special mention for effectively mitigating bacterial blight:

- 1. All unattended and neglected orchards require government intervention for removal or proper management of the orchard. An act has to be promulgated by the Government of India.
- 2. All orchards in the community should adopt uniform bahar and management schedule to get better results. This should be the responsibility of the block/Taluka Horticultural/Agricultural Officer of respective areas. The concerned SAU's have to be linked for better technical support.
- 3. Some regulation to discourage self proclaimed agricultural doctors should come into force, as farmers who consult such doctors for disease management many a times aggravate the disease.
- 4. The unemployed agriculture graduates/diploma holders in the village should be involved with some incentives to train and educate the pomegranate growers to manage orchard using proper IDPM schedule.
- 5. The possibilities of promoting the nurseries in the non traditional areas where there is no disease at present has to be explored.
- 6. Nursery certification programme should be made effective and needs to be stream lined.

Sd/-

(Jyotsana Sharma) Member Secretary QRT



# Annexure 11a

	List of Participants in the Meeting on Nov. 17-18, 2010 at NRC on Pomegranate, Solapur
1.	Dr. Jagdeesh H Kulkarni, Former Vice Chancellor (UAS Dharwad), Dharwar (Chairman)
2.	Dr. Srikant Kulkarni, Former Prof. & Head (Pl. Path.), UAS Dharwad, Co-chairman)
3.	Dr. V Ponnuswami, Dean, HCRI, Periyakulam, Tamil Nadu (Expert)
4.	Dr. GS Karibasappa, Principal Scientist, NRC for Grapes, Pune (Expert)
5.	Dr. VT Jadhav, Director, NRC on Pomegranate, Solapur (Expert)
6.	Dr. VI Benagi, Prof. and Head, Dept. Plant Pathology, UAS, Dharwad
7.	Dr. MR Ravikumar, Associate Prof, KVK Building, Uttar Kannada.
8.	Dr. C Gopalakrishnan, Pr. Scientist, Dept. of Plant Pathology, IIHR, Bangalore
9.	Dr. K Subramanyam, Sr. Scientist (Plant Pathology), HRS, Ananatpur (AP)
10.	Dr. Kiran Raghuwanshi, Associate Professor, MPKV, Rahuri, Ahmednagar(MS)
11.	Dr. AS Dhawan, Associate Dean and Principal, COA, Osmanabad (MS)
12.	Dr. CV Ambadkar, Assistant Professor of Plant Pathology, COA Osmanabad
13.	Dr. PA Fugro, Prof., Pl. Path. Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli
14.	Dr. DR Patil, Pomology, Hort. Res. Station, Tidagundi (UHS, Bagalkot)
15.	Dr. Vinod N Shinde, Assisstant Professor, horticulture, COA Osmanabad
16.	Dr. ST Yenjerappa, Programme Co-ordinator, KVK, Hagari, UAS, Raichur
17.	Dr. VB Nargund, Professor, Dept. Plant Patology, UAS Dharwad
18.	Mr. N Thammaiaha, Associate Professor, KRC COH, Arabhavi, UHS Bagalkot
19.	Dr. (Mrs.) Jyotsana Sharma, Pr. Scientist (Plant Pathology), NRCP, Solapur
20.	Dr. KK Sharma, Pr. Scientist (Plant Pathology), NRCP, Solapur
21.	Dr. RA Marathe, Sr. Scientist (Soil Science), NRCP, Solapur
21.	Dr. K. Dhinesh Babu, Scientist (Horticulture Fruit Science), NRCP, Solapur
23.	Dr. Ashis Maity, Scientist (Soil Science Pedology), NRCP, Solapur
24.	Mr. Sachin S. Suroshe, Scientist (Agril. Entomology), NRCP, Solapur
25.	Mr. DT Chaudhary, T3, NRCP, Solapur
26.	Mr. Yuvraj Shinde, T3, NRCP, Solapur
27.	Mr. Gogaon Mahadev, T1, NRCP, Solapur
28.	Mr. Solanke, T1, NRCP, Solapur
29.	Mr. Vijay Lokhande, T1, NRCP, Solapur



## Annexure 11b

## Integrated Disease and Insect Pest Management (IDPM) Schedule for Pomegranate

This 'Integrated Disease and Pest Management (IDPM) Schedule' for Pomegranate is a modified orchard health management schedule, developed at a joint meeting of pomegranate researchers from ICAR institutes and SAUs from Maharashtra, Karnataka Andhra Pradesh and Tamil Nadu, in a two day meeting on Nov. 17-18, 2010 at NRC on Pomegranate, Solapur under the Chairmanship of Dr. JH Kulkarni, former Vice Chancellor, UAS, Dharwad and a panel of experts- Dr. Srikant Kulkarni, Co-chairman and former Prof. & Head, Plant Pathology, UAS, Dharwad, Dr. Dr. V Ponnuswami, Dean, Horticulture College & Research Institute, Tamil Nadu Agricultural University, Periyakulam, Tamil Nadu, Dr. GS Karibasappa, Principal Scientist, National Research Centre for Grapes, Pune and Dr. VT Jadhav, Director National Research Centre on Pomegranate, Solapur.

## I. Nursery Raising and Preparation of Planting Material

- 1. The selected mother plants should be maintained by the NRCP, Solapur and relevant genetic/molecular markers should be established for maintaining their varietal identity and purity.
- 2. The progeny orchards should be established from mother plants in different areas free from bacterial blight. This should be regularly monitored by team of experts from ICAR and SAUs of respective regions. Approved/certified nurseries must obtain standardized planting material (air layers/hard wood cuttings/ tissue culture saplings) from the respective progeny orchards (see Annexure 11c for details).
- 3. New planting should be done with certified disease free planting material or tissue culture saplings.
- 4. Suspected propagating material have to be tested through diagnostic symptoms, ooze tests, microscopy and also isolation. For the presence of latent infection testing through molecular technique like PCR is essential.
- 5. The soil used for nursery raising needs to be sterilized through solarisation. Soil solarisation can be done by covering moist soil with 25-75  $\mu$ m thick linear low density transparent polyethylene (LLDPE) sheets for 6 weeks during hot summer months.
- 6. To prepare 100kg of potting material mix 50 Kg soil and 50 Kg compost along with consortium having 1 kg each of local isolates of *Trichoderma viride* or *T. harzianum, Azospirillum,* PSB & *Pseudomonas fluorescens* having cfu 109/g and 5 kg of neem cake. Also incorporate 200g of VAM culture. Planting should be done after 8 days of mixing the above ingredients.
- 7. Apply Bordeaux paste (10%) to the cut ends of the mother plant and air layered cuttings.
- 8. Treat the roots of air layered cuttings with copper oxychloride (COC) @3g/l to protect against soil borne diseases at the seedling stage and plant them in the standard size polyethylene bags filled with above potting mixture.
- 9. Place planting material under 50% shade net. Monthly sprays of streptocycline (0.5 g/l) + COC (2.5 g/l) altered with bronopol(0.5 g/l) + COC (2.5 g/l) in bacterial blight affected areas and only COC in disease free areas should be taken on priority.



- 10. If fungal leaf spots appear use the combi-product like 'Companion' having mancozeb 63%WP+carbendazim 12%WP @ 2g/l or chlorothalonil 75WP (2.0g/l). Repeat the same at 15 days interval if required.
- 11. For sucking pests specially thrips which are a problem in nursery plants spray Thiamethoxam 25WG @ 0.3g/l. Repeat the same at 15 days interval or as and when required. Alternate with Acetamiprid 20SP@ 0.3g/l or Imidacloprid 17.8SL @0.3ml/l to avoid resistance development.

## **II.PLANTING A NEW ORCHARD**

- 1. Select site having light-medium soil for establishing the orchard.
- 2. Make pits 1m deep at row to row spacing of 4.5m and plant to plant spacing of 3.0 m. Keep proper spacing and follow proper pruning and training to develop optimum canopy and to avoid contact of branches with neighbouring plants. This is to ensure proper aeration and interception of solar radiation, which helps in better fruit development and also to reduce the incidence of diseases.
- 3. Pits should be dug at least a month prior to planting and kept open to disinfect the pits by intense solar radiation during the day. Just before filling pits drench the bottom and sides of the pit with 4-5 litres of 0.4% (4ml/l) chlorpyriphos 20EC solution.
- 4. Dust the pits with bleaching powder (a.i.33% Cl) @ 100g/pit before filling.
- 5. Fill the pits with soil having, sand/murrum, silt and clay in equal proportions.
- 6. In each pit mix the following in the top soil (30-50 cm):

FYM	10kg
Vermicompost	1 kg
Neem cake	0.5 kg
<i>Trichoderma</i> formulation	25g
Phosphate Solublising Bacteria (PSB)	25g
Pseu domo nas fluo rescens	25g
Azotobacter formulation	25g
Azospirillum formulation	25g

- 7. Before taking the planting material to the main field spray the plants with COC (2.5g/l) + Streptocycline (0.25g/l).
- 8. Plant two rows of wind breaks like Casuarina (Saru), Greviellea robusta (Silver oak), Sesbania grandiflora etc around the orchard.

## lii.care OF A pre-bearing Orchard (up to first two years of planting)

- One month after planting spray with Streptocycline (0.5g/l) + COC (2.5g/l) in epidemic areas and only COC in disease free areas. Take alternate sprays of Bordeaux mixture (1%). Alternately, COC + Streptocycline sprays have to be replaced with 2-Bromo-2-nitropropane-1,3-diol (Bronopol) @ 0.5g/l+Captan@3g/l.
- 2. Spray interval should be one month in disease free orchards. In orchards where blight incidence is observed spray schedule should be 15 days during dry periods and 7-10 days during rainy days.



- 3. In orchards having blight, one spray of Streptocycline (0.5g/l) + COC (2.5 g/l) after the rains stop is mandatory.
- 4. If fungal leaf spots appear spray the combi-product like Companion having mancozeb 63%WP+carbendazim 12%WP@2g/l or Chlorothalonil 75WP (2.0 g/l) or Hexaconazole 5EC@1ml/l. Repeat the same at 15 days interval if required.
- 5. For sucking pests particularly thrips which attack new flush growth, spray Thiamethoxam 25WG @ 0.3g/l. Repeat at 15 days interval or as and when needed. Alternate with Acetamiprid 20SP@ 0.3g/l or Imidacloprid 17.8SL @ 0.3ml/l to avoid resistance development.
- 6. For mite infestation during dry spell spray Fenzaquin10EC@2ml/l or Dicofol 50WSP@1g/l or 18.5 EC @2.5ml/l or wettable Sulphur 80 WP @3g/l in rotation
- 7. For leaf eating caterpillars Malathion 50EC@ 2ml/l has to be sprayed.
- 8. Follow recommended training and pruning procedures to manage optimum canopy. Three stem based training system should be followed, as it facilitates better microclimate around the trees.
- 9. Monitor regularly for blight symptoms. In case of observance of foliar symptoms, recommended sprays have to be commenced. If blight symptoms are observed on stems, prune and remove infected twigs as and when the symptom is noticed.
- 10. Prune about 2" below the infected area. Bordeaux paste (10%) is applied to the cut ends after pruning. Oil based pastes (COC paint or Chaubatia paste) should be preferred for pasting the cut ends in the rainy season.
- 11. Any severely infected plant has to be removed, burnt and replaced with new disease free plant.
- 12. All sanitation measures (Annexure 7b) are required to be followed strictly.
- 13. Apply recommended fertilizer doses as mentioned in Table 1 under the sub heading 'Nutrient Management,' depending on age of the plant. NPK application should be based on soil test and leaf analysis values.
- 14. Nitrogen is recommended to be applied preferably as urea in black soils and calcium ammonium nitrate (CAN) in red soils, phosphorous as single super phosphate (SSP) and potash through muriate of potash (MOP). At least 1/3rd fertilizers required should preferably be applied through organics, 1/3rd through inorganics and remaining 1/3rd through fertigation.
- 15. During the first year of planting, apply recommended fertilizers in split doses at monthly intervals, preferably dissolved in water or just before irrigation. In the second year the basal dose of FYM besides recommended NPK fertilizers need to be applied in 3 split doses coinciding with growth flushes.
- 16. Follow the recommended irrigation schedules as furnished in Table 2 under the sub heading 'Water Management'. Drip irrigation with four drippers placed in four directions should be practiced.
- 17. The orchard must not be allowed to bear fruits for initial two years to improve the growth of plants and better canopy development.

## IV. Established Orchard (After Second Year)

- 1. In bacterial blight prone areas only *hasta bahar* or late *hasta bahar* crop must be regulated. In bacterial blight free areas, growers may take *bahar* convenient to them.
- 2. Only one crop in a year is recommended.



#### (a) Rest Period

- 1. A rest period of four months is recommended for better plant health, vigour and reduction of pathogen inoculum load if any.
- 2. As the rest period falls during rainy season (for hasta/late hasta bahar crop) sprays at 15 days interval of Bordeaux mixture 1% alternated with sprays of Streptocycline (0.5g/l) + COC (2.5g/l) or 2-Bromo-2-nitropropane-1,3-diol (Bronopol) @ 0.5g/l + Captan @ 3g/l in epidemic areas need to be practiced.
- 3. No manures and inorganic fertilizers are recommended. Minimum irrigation is preferable
- 4. Remove the water shoots regularly.

## (b) Pruning and Bahar Regulation

- 1. In orchards where severe bacterial blight infection is noticed, go for heavy pruning immediately after harvest and remove as far as possible all stems with fresh blight infection.
- 2. Prune about 2" below the infected area. Cankers, if any should be scooped out, till normal wood appears and then pasted/painted. Apply Bordeaux paste (10%) to the cut ends after pruning and to scooped cankers. Oil based pastes [COC paint made by mixing 500g COC + 1 l linseed oil or Chaubatia paste prepared by mixing 1kg red lead(non setting grade) + 1kg copper carbonate + 1.25l linseed oil] are preferred for pasting during rainy seasons.
- 3. Any severely infected plant must be uprooted burnt and replaced with new disease free plant or cut from base 2-3 inches above ground level. New well growing sprouts have to be trained for new disease free plant.
- 4. In disease free orchards, practice need based pruning after rest period
- 5. Spray Bordeaux mixture (1%) immediately after pruning.
- 6. After the rest period defoliate the trees with Ethrel 39% SC 2-2.5ml/l depending on soil moisture conditions. Mix suitable recommended insecticide if some insect attack is observed at the time of defoliation.
- 7. Do light pruning after leaf fall and spray Bordeaux mixture (1%) immediately after pruning.
- 8. Collect all fallen leaves and burn for good orchard sanitation.

Dust the ground below canopy with bleaching powder @100-150g/plant or drench with bleaching powder 25kg/1000 l water/ha and follow all sanitation measures (Annexure 11d) strictly.

#### (c) Nutrient Management

1. About a week after defoliation when all or 85-90% leaves fall down, apply FYM and NPK as detailed below, depending on the age of plant. Remember to adjust the total NPK dose based on soil and leaf tissue analysis values and NPK dose to be applied through fertigation as mentioned at serial number 6 to 8 below.

Table 1: Recommended fertilizer dose/plant

Age of Plant (Years)	FYM (kg)	Nitrogen (g)	Phosphorus (g)	Potash (g)
1	10	250	125	125
2	20	250	125	125
3	30	500	125	125
4	40	500	125	250
5 and above	50	625	250	250



- 2. Apply N and K in 3 split doses, starting at the time of first irrigation after bahar treatment and next at 3-4 weeks interval. Full dose of P should be applied as single dose with first irrigation. Apply fertilizers in shallow circular trenches, 30-45cms away from main stems below tree canopy, up to 8-10cm depth and cover with top soil and irrigate immediately.
- 3. Nitrogen needs to be applied preferably through urea in black soils and calcium ammonium nitrate (CAN) in red soils, phosphorous as single super phosphate (SSP) and potash through muriate of potash (MOP). At least 1/3rd fertilizers required should be applied as organics, 1/3rd through inorganics and remaining 1/3rd through fertigation. NPK application should be based on soil test and leaf tissue analysis values.
- 4. Micronutrients (Zinc, Iron, Manganese and Boron each 25 g per plant or based on plant or soil analysis) should be supplied along with FYM, preferablly through slurry. Apply Vermicompost @1 kg/plant, neem cake @500g/plant.and Phorate @20g/plant for controlling nematodes.
- 5. When flowering starts schedule 15 drip applications of fertilizer N:P:K::12:61:00 @ 8kg/ha/application on alternate days. This provides 19.46g of N and 98.92g of P2O5 per plant.
- 6. When fruit setting is observed, schedule 15 drip applications of fertilizer N:P:K::19:19:19 @8 kg/ha/application, on alternate days. This provides 30.80g of each of the nutrients N, P2O5 and K2O per plant.
- 7. At 100 per cent fruit set starts, again schedule 15 drip applications of fertilizer N:P:K::0:52:34 or mono-potassium phosphate @ 2.5 kg/ha/application, on alternate days for a month. This provides 26.35g of P2O5 and 17.23g of K2O per plant.
- 8. One month before harvesting, schedule 2 drip applications of calcium nitrate 12.5 kg/ha/application at 15 days interval.

#### (d) Water Management

- 1. Avoid excess irrigation. Drip irrigation with four drippers placed in four directions need to be employed.
- 2. Irrigate the crop immediately after fertilizer application in the case of soil application with light irrigation initially and then irrigate at regular intervals.
- 3. Irrigate the plants depending on water requirement of the plant in different seasons as detailed below:

Water Requirement litres/day/plant Cropping season Month 17 January **February** 18 Ambe March 31 April 40 May 44 June 30 Mrig July 22 August 20 September 20 October 19 Hasta November 17

Table 2: Water Requirement of Pomegranate Plant

16

December



## (e) Management of Bacterial Blight and other Diseases, Disorders and Insect Pests

1. The plant protection schedule given in Table 3 for the management of bacterial blight, fungal leaf/fruit spots and rots and most common insect pests during the *bahar* period is to be followed.

Table 3: Plant Protection Spray Schedule from Pruning till Harvesting Period

Spray schedule	Time of spray	Plant protection chemicals to be sprayed
1st	Immediately after pruning	Bordeaux mixture (1%)
2nd	Seven days after 1st spray	Pseudomonas fluorescens talc based formulation @ 2.0g/l with continuous agitation
3rd	Eight days after 2nd spray (New flush stage)	Copper oxychloride 50WP (2.5g/l) + Bronopol (0.5g/l) along with suitable spreader sticker. Also spray Thiamethoxam 25WG @ 0.3g/l for sucking pests
4th	Fifteen days after 3rd spray (at flower initiation)	Streptocycline (0.5g/l) + Carb endazim 50WP (1g/l) + Acetamiprid 20SP@ 0.3g/l for sucking pests + soluble forms of zinc, magnesium, boron and calcium each @ 1g/l for disease control and better flowerinf and fruit growth.
5th	Fifteen days after 4th spray	Captan 50WP(2.5g/l) + Bronopol (0.5g/l) + Imidacloprid 17.8SL @ 0.3ml/l for sucking pests
6th	Fifteen days after 5th spray (fruit setting stage)	Steptocycline (0.5g/l) + Thiophanate Methyl 70WP (1g/l) + Cypermethrin 25%EC (1 ml/l) for fruit borer soluble boron 1 g/lit + commercial micronutrient mixture containing zinc, magnesium, calcium and iron 1g/l + Neem Seed Kernel Extract @50g/l (75g if entire seed is used). Black soils which are rich in magnesium and calcium may not include these elements in micronutrient spray.
7th	Seven days after 6th spray	Pseudomonas fluorescens talc based formulation @ 2.0g/l with continuous agitation.
8th	Seven days after 7th spray	Bordeaux mixture (0.5%)
9th	Fifteen days after 8th spray (50% fruit set)	Steptocycline (0.5g/l) + Carbend azim 50WP (1g/l) + Chloropyriphos 20% EC (2 ml /l) +Neem seed kernel extract @50g/l (75g if entire seed is used)
10th	Fifteen days after 9th spray (100% fruit set)	Bordeaux mixture (0.5%)
11th	Fifteen days after 10th spray	Captan 50WP(2.5g/l) + Bro nopol (0.5g/l)+ Methomyl 40%SP@ 1g/l
12th	Fifteen days after 11th spray	Steptocycline (0.5g/l) + Thiophanate Methyl 70WP + Acetamiprid 20SP@ 0.3g/l
13th	Fifteen days after 12th spray	Bordeaux mixture (0.5%)
14th	Fifteen days after 13th spray	Steptocycline (0.5g/l) + copper hydroxide 77WP (2g/l)+ Neem seed kernel extract @50g/l (75g if entire seed is used) or Azadirachtin 1500ppm @ 3ml/l
15th	Fifteen days after 14th spray (1 month before harvesting)	Pseudomonas fluorescens talc based formulation @ 2.0g/l with continuous agitation or Bordeaux mixture (0.5%)
16th	15-20 days after 15th spray (Fruit maturity and harvesting	Potassium dihydrogen phosphate @5g/l or Potassium nitrate@10g/l or 0:0:50 @10g/l



#### NOTF:

- 1. Under high disease pressure and congenial weather conditions (Temp. between 25-330C, humidity > 80% and intermittent rainfall) reduce spray interval to 8-10 days.
- 2. In orchards having blight one spray of Streptocycline or bronopol (0.5g/l) + COC (2.5 g/l) after the rains cease, is mandatory even if scheduled spray has been taken prior commencement of rains.
- 3. The above sprays take care of most of the fungal spots, if still fungal spots persist spray the combi product like Companion having mancozeb 63% WP+carbendazim 12%WP @ 2g/l or Chlorothalonil 75WP (2.5 g/l) or Hexaconazole 5EC or Difenaconazole 25 EC@ 1ml/l. Repeat the spray at 15 days interval if required.
- 4. On observing first symptoms of wilt in the orchard immediately drench soil with Chlorpyriphos 20EC (2.5ml/l to 4.0ml.l)+ Carbendazim 50WP (2.0g/l) or Propiconazole 25EC(2ml/l) use 5-8 l solution/tree. Also drench at least 2-3 healthy plants on all the four sides around the infected plant/s. Repeat the drenching 3-4 times at 20 days interval
  - Uproot the affected dead wilted plants and burn immediately. While removing the wilted plants from the orchard for burning, protect the entire root zone with cover, as the spores of the pathogen are present abundantly on the roots and they may spread to other healthy plants.
  - For controlling shot hole borer (Xyleborus spp.) which is associated with wilt disease, 10 litres preparation containing red soil (4kg) + Lindane (25g) + Chlorpyriphos 20EC (20ml) + Copper oxychloride (25g) needs to be applied on plant base up to 1-2 ft. from second year onwards
  - For stem borer control, inject in the holes on the trunk with DDVP 2-3 ml and plug the holes with mud.
  - Where nematodes are a problem apply phorate 10G @10- 20g/plant or carbofuran 3G @ 20-40g/plant, in the plant basin, in a ring near root zone and cover it with soil.
  - Plant Tagetes erecta (African marigold) between plant to plant space in a row, or in a ring, on the border of plant basin, these help as a trap crop in reducing nematode population. For effective results these should be grown for more than 4-5 month.
- 5. For fruit cracking avoid long dry spells, maintain required soil moisture through regular irrigation of plants during fruit development stage. Boron sprays recommended above also help in minimizing fruit cracking.
- 6. Maturity indices should be monitored. Delay in harvesting often results in internal break down of arils hence, harvest the fruit as soon as they reach optimum maturity to avoid internal break down of arils.
- 7. To avoid 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%) 2-3 times during the fruit development stage. Covering the fruits, particularly those receiving direct sun light, with paper (preferably butter paper) bags also reduces sunburn.
- 8. For mite infestation during dry spell spray Fenzaquin10EC @2ml/l or Dicofol 50WSP @1g/l or Dicofol 18.5 EC @2.5ml/l or wettable Sulphur 80 WP @3g/l in rotation when required
- 9. For leaf eating caterpillars spray Malathion 50 EC@1.5ml/I when observed.
- 10. For mealy bugs spray chloropyriphos 20% EC (2 ml /l) or Monochrotophos 36EC @1.5g/l when observed



#### **Precautions TO BE FOLLOWED**

- 1. All pesticide concentrations recommended are for high volume sprays.
- 2. Use good quality non-ionic spreader sticker with sprays except with Bordeaux mixture. it improves efficacy of the spray chemical.
- 3. Bordeaux mixture 1% (should have CuSO4 with 26.6% Cu).
- 4. Bordeaux mixture should always be prepared fresh and used on the same day.
- 5. All sprays should be done at recommended doses only, lower doses are ineffective and help in disease development.
- 6. Take only need based sprays, as all sprays without a bactericide may help in the development of bacterial blight and aggravate its incidence.
- 7. People handling diseased plants/orchards should avoid entering/touching disease free orchards/plants without changing clothes and washing.
- 8. All pesticides including weedicides should be used judiciously as indiscriminate use may lead to other physiological problems.
- 9. Pesticides should be used in rotation to avoid resistance development in the pests.
- 10. Cheaper brands of neem cake have impurities, test its quality before purchasing. In order to keep pesticide residues below recommended MRL spray keeping in mind the recommended dose and pre harvest interval (Annexure 11e)



## Annexure 11c

## **Production of Certified Planting Material**

## I. Foundation planting material

- (i) Source of plant material: Identify true to type, disease free mother plants/progeny orchards established in the disease free areas for the production of foundation plant material. Certify these orchards/mother plants for the absence of other diseases/insect pests and nematodes. This should be supervised periodically at 3-4 months interval by the technical team of experts.
- (ii) Type of planting material:
  - Air layers: Thickness at collar level 10-15 mm, height 45-50 cm with minimum of 2 side shoots along with active growing tips.
  - Hardwood cuttings: lignified /matured past season shoots (6-7 month old) select from the bottom/middle portion of the shoot.
    - Thickness:8-10 mm thick at the bottom.
    - Height: 18-20 cm with minimum of 4 nodes.
  - Tissue Culture plants: Shoot tips, axillary/nodal buds and meristems from the mother plants can be used as explants, avoid too many sub cultures prefer only upto 5th subculture). These plants initially raised in trays of 3" pots with appropriate growing medium (1:1::sterile soil:cocopeat) and then shifted to 6" pots and sufficiently hardened for 6 months before planting. It takes nearly 18 months from initial culture to get hardened plants of 12-14" height with 3-4 branchlets, required for planting in the field.

**II. Issue of phyto-sanitary certificate (Mandatory):** Periodical (3-4 months interval) inspection of the specified/nurseries should be mandatory for presence of any disease/insect pests before the planting material is lifted. This may be supervised by the certifying authorities in collaboration with experts from ICAR institutes/SAU's in the region before issuing phytosanitary certificate.

## Annexure 11d

### **Orchard Sanitation**

- 1. Do not leave infected plant parts (leaves, flowers, fruits & twigs) in orchards nor dump near orchard, nor throw in irrigation channels. The orchard should be swept clean to collect all fallen plant parts and burnt.
- 2. Dust bleaching powder (a.i.33% Cl) every 3 months @ 100-150g/plant or drench @ 25 Kg/1000 l water/ha on ground below the canopy in the basin of tree. This will reduce the bacterial inoculum on left over plant debris if any in the orchard.
- 3. Pruning tools secateurs etc should be sterilized after handling each infected tree with sodium hypochlorite (2.5%).
- 4. Keep orchard free from weeds, which may be latent carriers or multiplication ground for several diseases including bacterial blight pathogens and insect pests.



# Annexure 11e

# Pesticides Recommended for the Control of Various Diseases and Insect Pests of Pomegranate for Export to the European Union

Sr. No.	Pesticide recommended for major disease and pest	Nature of pesticide	Dose on formulation basis	EU MRL (mg/kg)	Pre-harvest Interval (PHI in days)
Disease	es:				
Α	Bacterial blight (Xanthomonas axonop	odis pv.punio	cae)		
1	Bordeaux mixture	NS	0.5-1.00%	20	15
2	Copper oxychloride 50% WP	NS	2.5 g/L	20	35
В	Wilt (Fungal complex Ceratocystis firm	nbriata, Fusariu	ım oxysporum)		
3	Propiconazole 25% EC	S	1.50 mL/L (drenching)	0.05	20
4	Carbendazim 50%WP	S	2.00 mL/L (drenching)	0.1	100
5	Tridemorph 80%EC	S	1.00 mL/L (drenching)	0.05	40
C.	Leaf and Fruit Spots ( Alternaria alterna	at a, Cercospoi	ra punicae, Colletotrichum	n sp., Drechs	lera sp.)
2a	Copper oxychloride 50%WP	NS	2.5 g/L	20.0	35
6	Mancozeb 75%WP	NS	2.0 g/L	0.05	90
7	Propineb 70%WP	NS	3.0 g/L	0.05	90
8	Ziram 80%WP	NS	2.0 g/L	0.05	90
9	Copper hydroxide 77%WP	NS	2.0 g/L	20.0	35
10	Captan 50%WP	NS	2.5 g/L	0.02	35
11	Chlorothalonil 75%WP	NS	2.0 g/L	0.01	40
12	Difenoconazole 25%EC	S	1.0 g/L	0.1	45
13	Triadimefon 25% WP	S	0.5-1.0 g/L	0.1	45
14	Sulphur 80%WP	NS	2.5 g/L	50	10
4a	Carbendazim 50% WP	S	1.0 g/L	0.1	100
15	Thiophanate Methyl 70%WP	S	1.0 g/L	0.1	50
D	Fungal Blight ( <i>Phytophthora</i> sp)				
6a	Mancozeb 75%WP	NS	2.0 g/L	0.05	90
9a	Copper hydroxide 77%WP	NS	2.0 g/L	20	35
2c	Copper oxychloride 50%WP	NS	2.5 g/L	20	35
16	Metala xyl 8% + Mancozeb 64% (Metalaxyl MZ72%WP)	S	2.5 g/L	0.05	66
	Cymoxanil 8% + Mancozeb 64% (Curzate M8)	S	2.0 g/L	0.05	66
18.	Fosetyl-Al 80%WP	S	2.0 g/L	2.0	30
19.	Dimethomorph 50%WP	S	1.0 g/L	0.05	66



Sr. No.	Pesticide recommended for major disease and pest	Nature of pesticide	Dose on formulation basis	EU MRL (mg/kg)	Pre-harvest Interval (PHI in days)
Insect	pests				
Α	Fruit Borer ( <i>Deudorix isocrates</i> )				
20	Indoxacarb 14.5%SC	NS	0.5 mL/L	0.02	30
21	Spinosad 45 %SC	NS	0.5 mL/L	0.02	28
22	Cypermethrin 25%EC	NS	1.0 mL/L	0.05	40
В	Stem Borer ( Celosterna spinator )				
23	Chlorpyriphos 20%EC	NS	2.0 mL/L	0.05	40
20a	Indoxacarb 14.5% SC	NS	0.5 mL/L	0.02	30
21a	Spinosad 45 %SC	NS	0.5 mL/L	0.02	28
22a	Cypermethrin 25%EC	NS	1.0 mL/L	0.05	40
С	Shot hole borer (Xyleborus fernicatus )				
23a	Chlorpyriphos 20% EC	NS	2.0 mL/L	0.05	40
20b	Indoxacarb 14.5%SC	NS	0.5 mL/L	0.02	30
21b	Spinosad 45 %SC	NS	0.5 mL/L	0.02	28
22b	Cypermethrin 25%EC	NS	1.0 mL/L	0.05	40
D	Leaf Eating caterpillar ( Achaea janata )				
23b	Chlorpyriphos 20%EC	NS	2.0 mL/L	0.05	40
20c	Indoxacarb 14.5%SC	NS	0.5 mL/L	0.02	30
21c	Spinosad 45 %SC	NS	0.5 mL/L	0.02	28
22c	Cypermethrin 25%EC	NS	1.0 mL/L	0.05	40
E	Mealy bug (Ferrisia virgata)				
23c	Chlorpyriphos 20%EC	NS	2.0 mL/L	0.05	40
24a	Dimethoate 30 %EC	S	1.0 mL/L	0.02	100
25a	Imidacloprid 17.8% SL	S	0.3 mL/L	0.05	60
26a	Thiamethoxam 25% WG	S	0.25 g/L	0.05	40
F	Thrips/Aphids/Jassids/White flies				
24.	Dimethoate 30 %EC	S	1.0 mL/L	0.02	100

## NS= Non systemic, S= Systemic

#### Note

- Recommendation of pesticides for the management of various insect pests and diseases along with their dose, PHI and MRL values
  are of advisory nature for the Good Agriculture Practices and therefore, not covered under any legal scrutiny.
- All the doses mentioned above are for high volume sprayers, where normal spray volume is 1000 L/ha. Spray volume can however
  be changed as per the efficiency of sprayers used. However, the amount of each pesticide (active ingredient) recommended for 1
  ha on the basis of 1000 L spray solution should be strictly maintained to minimize pesticide residues.
- Recommendation of pesticides for the management of various insect pests & diseases along with their doses are based on the recommendations by SAUs, ICAR Institutes & research literature and therefore, not covered under any legal scrutiny.
- PHI and MRL values are of advisory nature for the good agriculture practices and therefore, not covered under any legal scrutiny.

 $\textbf{Source:} \textit{Regulations of Export of Fresh Pomegranates to the European Union through Control of Pesticide Residues} (Oct. 2008) Annexure 5. \\ Agricultural and Processed Food Products Export Development Authority, New Delhi. (website: <a href="https://www.apeda.com">www.apeda.com</a>). pp 30-32. \\ \end{aligned}$ 



Component and year wise budget sanctioned. released and expenditure for NRCP, Solapur Annexure 12

		Sanctioned	Q		Released	pesi		Budgetnot		Expe	Expenditure		Unspent
Head	1 st yr	1styr 2ndyr	Total A + B	1st & Yr	2nd& Yr*	3rd Yr*	Total	Released C-D	1st yr	2 <sup>nd</sup> yr	3rd yr	Total F+G+H	Balance D-I
	¥	В	O		Q	0			ш	g	I	_	ſ
Training	17.40	19.14	36.54	0.0.0	17.40	0.00	17.40	19.14	8.18	12.32	4.62	25.12	(-) 7.72
Demonstrations	6.10	89.9	12.78	6.10	89.9	0.00	12.78	00.00	3.52	22.36	(-)4.78	21.1	(-) 8.32
Survey And Surveillance	12.00	13.2	25.2	12.00	13.20	0.00	25.20	0.0.0	0.78	3.66	4.60	9.04	16.16
Disease Fore casting Unit	4.00	0	4.00	4.00	0.00	0.00	4.00	0.0.0	4.13	1.176	(-)0.09	5.22	(-) 1.22
Contingendes	20.00	22.00	42	20.00	0.00	5.32	25.32	16.68	2.09	4.46	17.67	24.22	1.10
Grand Total	59.5	61.02	1 20.52	42.10	37.28	5.32	84.70	35.82	18.7	43.98	22.02	84.70	0.0
		* he	ad wise relea	ise for 2nd	and 3rd ye	ear comm	unicated v	* head wise release for 2nd and 3rd year communicated vide fax dated March 14, 2011	arch 14, 20	011			

Component and year wise budget sanctioned. released and expenditure for MAU, Parbhani

		Sanctioned	p		Released		Budget not			Expenditure		Unspent
	1st yr	1st yr 2nd yr	Total + B	1 st	2 <sup>nd</sup> Yr	Total	Release d C – D	1st yr	2 <sup>nd</sup>	3rd yr (till March 31, 20111)	Total F+G+H	Balance D -I
	⋖	В	U		Ω		ш	ш	ŋ	I	_	J
	11.14	11.14 12.26	23.40	0.00	0.00	00.00	23.40	1.70	90.0	90.0	1.82	(-)1.82
De mons trations	6.10	89.90	12.78	2.50	3.60	6.10	6.68	1.50	2.90	1.68	80.9	0.02
	1.10	01.21	02.31	0.50	09.0	1.10	1.21	0.23	0.13	0.51	0.87	0.23
Disease Forecasting Unit	4.00	00.00	4.00	4.00	0.00	4.00	0.00	0.00	00.00	0.00	0.0	4
	2.00	2.20	4.20	0.50	1.50	2.00	2.20	1.15	1.62	1.66	4.43	(-)2.43
	2434	2434 22.35	46.69	7.50	5.70	13.20	33.48	4.58	4.71	3.91	13.20	0

Annexure 15



 Component and year wise budget sanctioned. released and expenditure for MPKV, Rahuri Annexure 14

		Sanctioned	pei		Released	р	Budgetnot		Expe	Expenditure		Unspent
Head	1st yr	2 nd yr	1st yr 2nd yr Total A 1st Yr 2nd + B Yr	1st Yr	2 <sup>nd</sup>	Total	Released C – D	1st Yr	2nd y <b>r</b>	3rd Y <b>r</b>	Total F+G+H	Balance D -I
	4	В	U		О		П	ш	Ð	I	_	ſ
Training	26.22	26.22 28.84	55.06	ì	1	ı	55.06	I	1	ı	I	ı
Demonstrations	8.6	8.6 9.43	18.03	8.60	1	8.60	9.43	1	4.91	1	4.91	3.69
Survey And Surveillance	1.1	1.1 1.21	231	2.31	1	2.31	00.0	I	0.51	1.16	1.67	1.04
Disease Forecasting Unit	4	0	4	4.00	L	4.00	00.0	L	4.00	ı	4.00	0.00
Contingencies	2.00	2.00 2.20	42	4.2	ı	4.2	0.00	1	2.00	2.20	4.20	0.00
Grand Total	41.92	41.92 41.682	83.6	19.11	1	19.11	64.49	1	11.42	3.36	14.78	4.73

Component and year wise budget sanctioned. released and expenditure for IIHR, Bangalore Annexure 15

	ent ce		10	7	10		_	~
	Unspent Balance D -l	ſ	3.25	1.07	0.86	0	08.0	5.98
	Total F+G+H	_	10.95	9.61	2.92	0	3.40	26.88
Expenditure	Expected Expenditure from 01.01.2011 to 31.03.2011	I	151	0.72	0.12	0	0.73	3.06
Exp	2nd yr & 3rd yr till December 2010	פ	7.77	7.84	2.61	0	2.52	20.74
	1st yr	Щ	1 .67	1 .05	0.19	0	0.15	3.06
	Budget not Released C –D	ш	Ξ	Ē	Ē	Ē	Ē	Ē
	Total		14.2	10.68	3.78	0	4.2	32.86
Released	2 <sub>nd</sub>	Ω	7.44	5.58	1.98	0	2.20	17.20
<u>E</u>	1st 1		92.9	5.1	1.8	0	7	15.66
70	Total A + B	U	14.2	10.68	3.78	0	4.2	32.86
Sanctioned	1st yr 2nd yr	В	7.44	5.58	1.98	0	2.20	15.66 17.20
S	1st yr	A	9.76	5.1	1.8	0	2	15.66
	Head		Training	Demonstrations	Survey And Surveillance	Disease Fore casting Unit	Contingencies	Grand Total



Annexure 16

- Component and year wise budget sanctioned. released and expenditure for UAS, Dharwad

	Unspent Balance D-I	_	0.031	0.71	1.12	0	0.17	2.03
	Total F+G+H	-	24.42	12.07	1.19	4	4.03	45.71
Expenditure	3 rd yr (till 31 <sup>st</sup> march 2011)	エ	8.60	3.03	0.87	0.00	0.00	12.50
Û	2 <sup>nd</sup> yr	ט	10.11	5.20	0.13	I	2.10	17.54
	1st yr	ш	5.71	3.84	0.19	4.00	1.93	15.67
	Budget not Released C –D	ш	Ē	Ξ	Ē	Ξ̈̈Ξ	ij	Ē
pesi	Total		24.45	12.78	231	4	42	47.74
Released	2nd ≺r		12.81	6.68	1.21	0	2.20	22.9
	1st Yr	۵	11.64	6.1	1.1	4	2.00	24.84
peu	2nd yr Total A + B	U	24.45	12.78	2.31	4	4.2	47.74
Sanctioned	2 nd yr	В	12.81	89.9	121	0	220	22.9
	1st yr	Α	11.64	6.1	1.1	4	2.00	24.84
	Head		Training	Demonstrations	Survey And Surveillance	Disease Forecasting Unit	Contingencies	Grand Total

Annexure 17

Component and year wise budget sanctioned. released and expenditure for Horticultural Research Station (APHU) Anantapur, Andhra Pradesh

		Sanctioned	p	Released	Budgetnot		Exp	Expenditure		
Head	1st yr	1st yr 2nd yr	Total A + B	1st & 2nd Yr	Released C-D	1st yr	2nd yr	2nd yr 3rd yr	Total F+G+H	Uns pent Balance C-I
	A	В	U	D	Ш	ш	g	I	_	ſ
Training	9.64	10.61	20.25	20.25	Ë	4.18	4.80	6.27	15.25	5
Demonstrations	6.10	899	12.78	12.78	<del>.</del>	3.05	7.00	2.73	12.78	0
Survey And Surve illance	1.10	121	2.31	2.31	Z	0.55	1.20	0.56	2.31	0
Disease Forecasting Unit	4.00	1	4	4	ΞZ	ŗ	4.28		4.28	(-) 0.28 (Additional cost)
Contingencies	2.00	220	4.2	4.2	ΞZ	1.00	0.34	2.06	3.4	0.8
Grand Total	22.84	20.70	43.54	43.54	Ē	8.78	17.62	11.62	38.02	5.52





## **National Research Centre on Pomegranate**

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