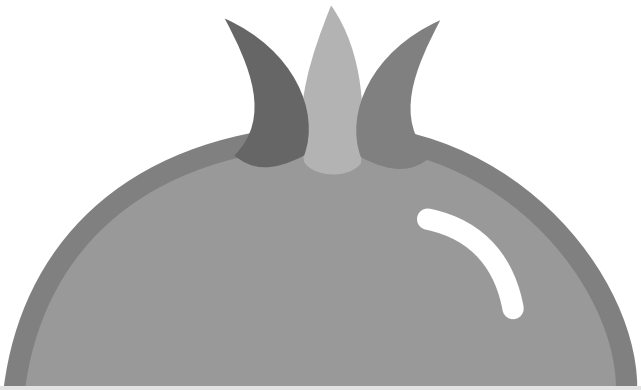
Extension Bulletine:FAQ/ENG/NRCP/2018/1

ICAR-NRCP
2018



Frequently Asked Questions

on Pomegranate

ICAR-National Research Centre on Pomegranate
(An ISO 9001:2015 Institute)
NH-65, Solapur- Pune Highway, Kegaon,
Solapur - 413 255 (MS)

FREQUENTLY ASKED QUESTIONS ON POMEGRANATE

Extension Bulletine:FAQ/ENG/NRCP/2018/1
September 2018

Compilation and Editing
Jyotsana Sharma
Pr. Scientist (Plant Pathology)
K. Dhinesh Babu
Pr. Scientist (Horticulture Fruit Science)
NV Singh
Sr. Scientist (Horticulture Fruit Science)
Ashis Maity
Sr. Scientist (Soil Science-Pedology)
Nilesh N Gaikwad
Scientist (Agril. Structures and Process Engg.)
DT Meshram
Sr. Scientist (Soil & Water Management Engg.)

Technical Support
DT Chaudhari, Technical Officer
Yuvraj Shinde, Senior Technical Assistant

Correct citation
Frequently asked questions on pomegranate
Extension Bulletine:FAQ/ENG/NRCP/2018/1
ICAR-National Research Centre on Pomegranate
Solapur- 413 255 (Maharashtra)

Conact
Website: nrcpomegranate.icar.gov.in
Email: nrcpomegranate@gmail.com

Published by
The Director,
ICAR-NRC on Pomegranate,
Solapur-413 255

Printed By
Kadambari Printing Press, Solapur

INDEX

Frequently Asked Questions On Pomegranate

I. PLANTING MATERIAL

Q1. Which planting material is better- Tissue culture or airlayer/hardwood cutting?

Tissue culture (TC) plants properly hardened, bio-hardened and raised with proper care and specific package of practice perform better or are as good as traditional planting material.

Q2. Tissue culture plants are more susceptible to bacterial blight and other diseases. Is it true?

Tissue culture plants are disease free but not resistant hence, reaction of TC plants to various diseases will be same as that of mother plant. Planting air layer and hardwood cutting- which harbor latent bacterial blight infection- near tissue culture raised orchard will pass on disease to tissue culture plants.

Q3. Which planting material is recommended for planting pomegranate orchard in a new area?

New orchard in new or non-traditional area should always be planted with Tissue culture plants. TC plants are important for restricting entry of bacterial blight pathogen in new area. With traditional planting material blight pathogen (*Xanthomonas axonopodis* pv. punicae) can enter and stay as latent infection in nodes of air layer and hardwood cuttings prepared in blight affected orchards/areas. In traditional areas where blight affected orchards are within 1-2 km away, air layer or hardwood cutting from reliable source is advisable.

Q4. The fruits of tissue culture plants have thinner skin; hence do not have good shelf life. Is it true?

The produce of tissue culture or air layer/hardwood cutting plant from same mother plants will have same thickness. The fruits if harvested at right maturity will have same skin thickness as of mother plant.

Q5. The tissue culture produce is not acceptable for export. Is it true?

Many farmers are exporting tissue culture produce and getting higher rates because of uniform size, colour and shine. Following specific package of practices and harvesting at right maturity should not have such issues.

Q6. Which diseases can be transmitted/spread through planting material?

Bacterial blight can be transmitted through latent infections in nodes of hardwood cuttings or air layers and wilt pathogens (fungal pathogens, insect pests and nematodes) in unsterilized soil.

Q7. What are different methods of soil sterilization for potting mixture?

Steam sterilizing moist soil at 100°C for 1 hour for 3 continuous days (process called tyndallization) kills all soil microorganisms.

Q8. Is NRCP supplying the planting material? If yes tissue culture or air layer/hardwood cutting? Please tell procedure of booking and rates.

ICAR-NRCP provides bio-hardened (hardened with plant beneficial microbes) tissue culture plants of Bhagwa with the help of private partners who have taken our tissue culture technology (HU Gugle Agro Biotech, Ahmednagar) for mass production, the cost per plant as on Sept. 2018 is Rs.30/- excluding transport cost. The address of the firm is available on website-nrcpomegranate.icar.gov.in

Q9. Can you provide contact details of good traditional nurseries and tissue culture companies producing pomegranate saplings?

We are not certifying agencies, however, based on our surveys some nurseries can be suggested, information on which can be obtained from concerned scientists in the office.

Tissue culture plants are sold by Jain Irrigation Systems Ltd. Jalgaon, HU Gugle Agro Biotech, Ahmednagar, ABC Biotech, Pune and Cadila Pharmaceuticals, Ahmedabad. These can be explored for availability (By this reply we do not endorse these companies)

Q10. Can farmer make his own planting material?

If your orchard and neighboring orchards are at least 1 km away and blight/disease free and you have polyhouse or shade net facilities then you can make your own planting material through air layer or hardwood cutting.

Q11. What important precautions I need to consider before purchasing planting material?

In the absence of stringent certification and sale procedures, it is recommended to check the mother plants in the nursery for growth and blight infection especially during June-October months, as blight infection cannot be seen in new nursery plants for at least 5-8 months. Second, the nursery plants to be purchased should have used sterilized soil for potting mixture and have good vigorous growth. It is advisable to purchase at least 2-3 months old air layer/gooty with good rooting or 5-6 months old plant in bags. Always prefer bio-hardened planting material if available.

Q12. Which diseases and insect pests can come in orchard through planting material?

Bacterial blight, wilt and nematodes are the major diseases and insect pests that are transmitted through infected planting material and its potting mixture.

II. PLANTING NEW ORCHARD

Q13. Which is the best time for planting a new orchard?

Best time of planting is just after rainy season when there is good moisture in soil and temperatures are also low. The plants grown in this period will establish and become hardened before next rainy season. Never plant just before rainy season, as new plant twigs are tender and will catch infections of blight and other diseases, most of which are severe and easily spread in rainy season.

Q14. What are the practices and precautions to be taken at planting to establish a healthy disease free orchard?

The first thing is to check if the soil is suitable for pomegranate orchard. Shallow, sandy loam soil is the best for pomegranate. Black soil should be avoided or reclaimed for the purpose. Get soil tested for nutrients pH and salinity etc. so that measures can be taken accordingly. Sterilize the soil for 6 weeks in hottest months of the year in your region using transparent plastic mulch of 50-100 microns. Alternatively keep the pit or trench open to sun for atleast 2 hottest months. Plant on beds 2ft width on both sides from stem & 1ft above ground. Plant in pits when soil depth is less than 3ft. Plant just after rainy season never before rainy season.

Taking a crop of African Marigold, Sunhemp, Sesbania (dhaincha), sweet corn, Sorghum (Jowar) or wheat before planting a new orchard is also beneficial. Green manure crops Sunhemp and Sesbania (dhaincha), if taken can be buried in the soil after growing for 8-10 weeks in early flowering stage. Use good organic manures and reliable bioformulations at planting. Plant with disease (bacterial blight and wilt) free planting material.

III. PRODUCTION

Q15. What is the ideal age for taking fruit after planting?

It is advisable to regulate flowering (bahar) after 3years of planting; however, it can be taken after 2 years if plant growth and vigour is very good.

Q16. Which season is good for flower regulation (bahar) treatment in pomegranate?

In tropical and sub tropical areas pomegranate can flower throughout the year, hence depending on the availability of water resources flowering (bahar) can be regulated in May-Jun for rainy season (mrig bahar), Sept-Oct for winter season (hasta bahar) and Jan-Feb for summer season (ambia bahar). If your orchard has bacterial blight or other diseases, hasta bahars hould be preferred for atleast 2-3 years.

Those not having assured irrigation water should prefer mrigbahar.

In temperate areas Feb-Mar is the best flower regulation time so that you can harvest the fruits before onset of winters in Sept- Oct.

Q17. Which flower regulation period or bahar is most profitable and why?

If your orchard has no major issues, rainy season and late ambia bahar have better flowering and fruit set and yield better quality and quantity of fruits thus fetching more price and profit.

Although hasta bahar crop is better due to lower diseases and insect pest incidence, hence less sprays, better colour and TSS development. However, due to extended rains till October, hasta bahar flower regulation is sometimes delayed. Thus delaying harvesting period beyond March, which may result in lower prices. Current trend since last 3 years is that market prices for pomegranate generally drop in September to January due to main harvesting period, in such areas one can get higher prices from February to August. Nevertheless, market scenario is continuously changing hence, one should decide based on their local weather and market situation. For export flower regulation for late rainy season and hasta bahar crop is preferable.

Q18. How to regulate flowering in pomegranate orchard?

Orchard that has been given proper rest and stress will flower best. After harvest rest period should be of 2-3 months followed by 1month stress in light soil and 1.5-2 months stress in heavy/black soils.

In **rest period**, soon after harvest main pruning is done to remove criss-cross branches, dead and dried shoots and shoot tip. The plants should be given ½ dose of FYM, ½ dose of potash,½ phosphorous and 1/3rddose of nitrogen of recommended doses of manures and fertilizers, followed by light irrigation at regular intervals for nutrient uptake and survival of plants.

In **stress period** stop irrigation till leaves start turning yellow and start dropping. Irrigation may be resumed with optimum moisture content. In heavy soils the roots may be slightly exposed using khurpi for accelerating stress. Light pruning/tipping top 10-15 cm twigs is done followed by defoliation with ethephon 39% @ 1-2 ml/l depending on stress achieved. More stress achieved less ethephon to be used. If almost all leaves have fallen then 0.5ml ethephon is sufficient for flower induction. DAP @ 5gm/l used along with ethephon gives best results. The defoliation treatment ensures uniform flowering.

If all conditions are ideally met flowering initiates within 22-28 days and completes by 45-50 days of defoliation.

Q19. How to induce flowering in pomegranate during hastabahar?

Do not irrigate for 20-30 days after rains stop. Take double ethephon 39% spray first spray of 0.5ml/l and second spray after 7-10 days depending on yellowing using ethephon 39% @ 1.0 to 2.0ml +DAP @5g/l after 21-28 days of defoliation NAA is useful to induce flowering in pomegranate take1foliar spray of growth regulator-Naphthalene 3 acetic acid (NAA) @ 1g/100 liters. (i.e.10ppm). If required second

spray of NAA may be taken after 7-10 days. Also take 1 spray of micronutrient mixture having iron, manganese, zinc, boron,molybdenum. If necessary Gibberellic Acid (GA3) Technical grade may be taken @25ppm (25 mg/l). Please note NAA (1g) has to be thoroughly dissolved in sufficient quantity (2-4ml) of ethanol and volume made to 100 liters of water.

Q20. There is no flowering even after 2 months of leaf drop due to heavy rains during/ soon after leaf drop. What should I do?

Heavy rains soon after defoliation result in high moisture in root zone for long time. This results in high uptake of several nutrients resulting in nutrition and hormone imbalances. The result is heavy foliage growth and sparse or no flowering. This is more common in black cotton soils. Do not irrigate after rains unless required. If this phenomenon is common, change of season and reclamation of black soil are the best alternative.

Q21. How many fruits per tree should be taken in pomegranate?

Do not take any crop till the plants are of 2 years. From third year onwards only one crop should be taken in a year. Depending on your tree canopy size and vigour, allow only 40-60 fruits/plant in the first crop (plant age 3 yr.), 60-80 fruits/plant in the second crop (plant age 4 yr.) and 80-100 fruits/plant in the third crop (plant age 5 yr.). Later when plant age is 6 yr. and above), one can allow 100-150 fruits/plant.

Q22. I got good flowering/fruit set but all flowers/fruit are dropping. Why?

In the beginning 80% flowers that come are male flowers. As the male flowers are meant for pollination, all male flowers will drop after pollination period. The unfertilized bisexual flowers will also drop due to lack of pollination. This is natural and one need not worry.

In general if organic carbon is good flowering issues are not observed. Sometimes, dropping of fertilized flowers and fruitlets occur within 2-4 weeks of fertilization. Foliar spray of growth regulator 2,4-Dichlorophenoxyacetic-acid (2,4-D) **Ethyl Ester 4.5 % GR** @10ppm is useful in checking the drop. Second spray may be taken after 3-4 days only if required.

Q23. What are the reasons for poor or no flower induction and how to overcome it?

Improper pruning and imbalanced plant nutrition (low organic carbon, high nitrogen and low phosphorous) leading to hormonal imbalances results in no or poor flowering and fruit set. Excess nitrogen can be leached out through excess irrigation. For increasing phosphorous fertigation using water soluble P (12:61:00) may be done in pre-flowering period. Sufficient organics are required for microbial activity to solubilize soil nutrients for plant uptake and for maintaining proper soil pH. Sunshine, temperature and humidity are other factors responsible for flowering and fruit set. It requires bright sunshine, temperature around 30 to 35^{o}C, low irrigation and moderate atmospheric humidity to flower best. Though pomegranate has all types of flowers in same tree yet cross pollination (due to insects including honey bees, wind etc.) improves fruit set and fruit quality to 15-20%.

Q24. What should I do to get good flowering and fruit set?

See answers to Q17, Q18, Q19 and Q20 above

Q25. How can I increase fruit setting/How can I get more hermaphrodite/(called female by farmers) flowers?

Keep your organic contents high by giving organic manures at least twice a year. Give one micronutrient spray $ZnSO_4$@0.3%, $MnSO_4$@0.6%, Boric Acid (17% B)@0.25% or Solubor (20% B) @ 0.25% before flower and bud initiation i.e. 15-20 days after defoliation when new flush of leaves emerge. NAA may be given as directed in answer to Q19.If required. GA_3 may be sprayed @25ppm (25mg/l) at flower bud initiation stage.

Q26. How can I prevent sun scald/scorching?

Sun scald/scorching is a problem in hot dry months. Maximum sunscald is in terminal fruits on outer canopy. Proper pruning to avoid terminal bearing, so that fruits are set in axils in shade of foliage, gives best protection from sun scorching. Irrigate regularly to maintain humidity in the orchard which lowers the scorching effect. Bagging or covering fruits exposed to sun is the best option. White butter paper bags or good quality non woven polypropylene bags may be used. Do not use newspaper, brown paper bags as they reduce colour development. If desired sprays of kaolin (inert clay) may beused first at 5% and next 2 sprays of 2.5% at 15-20 days interval, however, cleaning fruit surfaces after harvest is time consuming.

Q27. Why are some arils discoloured brown in fruits that apparently look healthy? What is the remedy?

This is called aril browning or internal breakdown. It is common in hot dry months. It is more common in over mature fruits, hence harvest at right maturity. Nutrient deficiencies may result in increased incidence; hence apply recommended doses of all nutrients at right stage.

Q28. What conditions and nutrients give fruit and aril deep red colour?

Hot days and cool nights with high humidity give good red colour to the fruits and arils.It is suggested to take *mrigbahar*crop for proper color development of arils, if bacterial blight and other diseases are not a major problem in the orchard. Foliar application of 0:52:34 (potassium dihydrogen phosphate -KH_2PO4) @ 10g / liter, twice at 15 days interval may be taken one month before harvesting for improving aril colour to some extent.

Q29. What nutrients are required for quality fruits having big size and deep red rind and arils?

Nutrients required for increasing size of fruit are: Phosphorus, Manganese and Zinc.

Q30. There is no flowering even after 2-3 months of leaf drop, should I defoliate using Ethrel again?

Ethrel (Chemical name-**Ethephon 39%SL)** is a hormone. Never use excess hormone sprays as they may adversely affect plant physiology and growth, resulting in other negative effects. Unbalanced nutrients and irrigation result in several hormonal, carbon-nitrogen or other nutrient imbalances in plant which result in inhibition of flowering. Orchard with good organic carbon is prerequisite for all flowering problems.

Put more organic manures/slurry etc. and take sprays as directed in answer to Q19.

Foliar application of KH_2PO_4 @ 10 g l^{-1} and $MnSO_4$@ 6 g l^{-1} three times at 15 days interval will increase fruit size. Enhancing available P in soil through use of phosphate solubilizing bio-fertilizer also contribute to increase in fruit size Boric acid @ 0.25% three sprays one spray before flower bud initiation and rest two after fruit set at 30 days interval increases fruit yield.

Soil application of Ca in the form of gypsum @ 250g/per plant at 60 and 120 days after full bloom improves fruit color. For *Ambiabahar* crop, bagging of fruits with butter paper or polypropylene non-woven bag, improves fruit color.

Q31. Has NRCP released any new variety of pomegranates?

Two hybrid varieties 'Solapur Lal' for table and processing purpose and 'Solapur Anardana' for processing have been released in 2017.

Q32. How is Super Bhagwa different from Bhagwa?

Super Bhagwa matures 15-20 days early to Bhagwa and has better size and improved colour than Bhagwa, however, Super Bhagwa at NRCP and some farmers fields was not found to be significantly different from Bhagwa.

Q33. What are your views on the performance of Variety "Wonderful" in India?

"Wonderful" is one of the oldest variety of Pomegranate from USA. It has many variants/landraces spread across the temperate as well tropical world (Wonderful, Pome Wonder, Early Wonderful, Israeli Wonderful, P.G.101-2, etc). Temperate types 'Wonderful' do not flower in hot arid and semi arid regions of India. Hence not suitable for cultivation in these areas. Nevertheless, the variety 'Wonderful' has very large fruit size weighing around 500 g, TSS 17-18°Brix attractive red peel and arils but high acidity (1-1.5% in comparison to only 0.4 % in Bhagwa) and has hard seeds compared to soft seeded 'Bhagwa'. It is suitable for processing.

Q34. Is Wonderful better than Bhagwa? Is it resistant to bacterial blight?

Wonderful is not suitable for Indian markets as Indians like sweet taste and soft seed like that in Bhagwa. The Wonderful plants at NRCP now more than 2 years old have not flowered so far but foliage is highly susceptible to bacterial blight.

Q35. What is the recommended spacing for pomegranate plantation?

Spacing of 4.5 m (15 ft.) X 3 m (10 ft.) which accommodates about 296 plants per acre is recommended. Trials for HDP are in progress at NRCP.

Q36. What intercrops can be taken and which should be avoided in pomegranate?

Sunhemp and other green manure crops help improve natural beneficial micro flora and should be preferred as inter-crop and later buried in soil. Maize, wheat, sorghum, bajra, mustard also reduce nematode population. Planting *Tagetes erecta* (African marigold) varieties 'Pusa Basanti Gainda' and 'Pusa Narangi Gainda' for continuously 6-7 months is beneficial for reducing nematode population in infested orchards. For effective results these should be grown for at least 6-7 months continuously.

Crops like onion, tomato, chili, potato, capsicum, carrot, gram, legumes (tur, urd, lentil, rajmash, beans, soybean etc., cucurbits (cucumber, melons), Gerbera, Gladiolus etc. aggravate nematode infestation and hence should be avoided as intercrop. Cucurbit crops increase insect problems also, which in turn transmit and spread several pathogens, hence should be avoided. Several fruit crops are hosts of fruit borer (*Deudorix isocrates)* and other insect pests, hence avoided. Similarly thrips are common on horticultural crops vegetables, ornamentals as well as fruits, hence, avoid taking them as inter-crops. Vegetables and ornamentals serve hosts to several insect pests and should in general avoided as inter-crops.

Q37. What is the perfect pruning procedure to get good flowering and fruit set? How many times in a year pruning should be practiced?

Prune twice a year to maintain proper canopy and fruit set (i) Main pruning just after harvest (ii) Light (upper 10-15 cm) pruning at flower regulation. Never prune during rainy season. Remove all shoots upto 30-60 cm above ground depending on plant height. Avoid too heavy pruning, confine pruning during dormant stage to previous year growth. Allow set of new shoots to develop every year on all sides of the tree.

Q38. When to do harvesting of pomegranate fruits?

As pomegranate fruits are non-climacteric in nature, the fruits should be harvested after attaining maturity on the plants. The maturity period from fruit set is about 6 months for Bhagwa and 5 months for Ganesh. Depending on the climatic conditions and management practices the period may vary by few weeks.

Q39. What operations have to be followed during rest period?

The recommended fertilizer doses (as in Q18) have to be applied and light irrigation has to be given to maintain proper rest conditions, Heavy pruning has to be done soon after harvest. Based on the requirement insect pests and diseases management schedule has to be followed. Otherwise atleast Bordeaux mixture 1% or other copper sprays should be taken at 10-15 days interval.

Q40. When should we start training of new planation?

Ideally plants are trained between 3-6 months or when they are around 3ft. height with good growth.

Q41. What are pruning procedures for plants of different age?

In new plantation, during pre-bearing period (upto 2 year), the juvenile plant may be pruned by removing the criss-cross branches, water shoots etc. Pruning is also done to regulate flowering and fruiting of pomegranate plants of bearing orchard (Above 2 years age). In general, a light pruning is given by removing 5-6 inches of shoot tips at flower regulation. After harvesting, dead and dried shoots, criss-cross branches, water suckers are removed & basal fertilizers dose is applied for rest period.

IV. SOIL AND NUTRITION

Q42. We have black cotton soil, is it advisable to grow pomegranate?

No, it is not advisable to grow pomegranate in black cotton soil. If you don't have any alternative, you need to apply high amounts of organic manure and need to have provision for easy drainage. For induction of flowering, you need to withhold irrigation for longer period (say 3 to 4 months) of time.

Q43. Can I do amendments to make black soil type favorable for pomegranate?

Though not advisable to grow pomegranate in black soil, yet if you want to grow in black soil, add sufficiently high quantity (40Kg/plant/year) of organic manure and grow green manure crops every year, followed by mixing with soil in presence of sufficient moisture for decomposition. This will improve the porosity of soil there by improving the drainage condition of soil. Put plants to stress for at least 3-4 months in order to induce good flowering.

Q44. I am giving all nutrients but plant growth is not good. What should I do?

You should get your soil tested for pH and EC. If the pH is above 8.5, you need to check exchangeable sodium percentage (ESP), if it is more than 13% it indicates sodicity of soil, then you need to apply Gypsum according to gypsum requirement (estimated in laboratory) through soil analysis followed by leaching with good quality water. if the soil is not sodic, then you should apply sufficiently high quantity of well decomposed organic manure /humic acid etc.

If roots have nematode infestation then also plant growth may be affected, hence, suitable nematode control treatments should also be followed.

Q45. Tell me easiest way to understand the type of soil I have and methods to rectify the problematic soils.

Moistened the soil slightly and roll it into a ball on your palms, if-

(i) No ball formed and soil crumbles through fingers easily, it is a **sandy soil**. Add lot of organic manure.

(ii) Soil feels sticky, rolls up easily, and forms into a ball, then it is a **clay soil**. Add 50% sand and organics and mix.

(iii) Smooth, partly gritty, partly sticky ball that crumbles easily is **loam soil**. This is ideal soil type for planting add recommended organic and nutrients

Among other soil types are:

Saline soil: A white layer/coating on the surface of the soil below drippers means you have saline soils. Leaf tip burn, especially on young leaves also is seen in saline soils. Leaching of salts with irrigation water and planting should be done on the middle position of slant surface of ridge and not on the top of ridge.

Sodic soils: Soil containing excess exchangeable sodium (Na) are sodic soils, the soil becomes water logged and later when it dries you can see upper layer of soil peeling off in thin layers. Application of gypsum at 50% of gypsum requirement (assessed through laboratory analysis) followed by leaching of salt with irrigation water is recommended.

Q46. What is the proper method for fertilizer application?

Apply fertilizers in ring during rainy season and below drippers in other seasons.

How can we increase Calcium (Ca) content in fruit?

In calcareous soil

1. Apply sufficient quantity well decomposed farmyard manure followed by irrigation.

2. Apply elemental S @ 20-30 g per plant in root zone and thoroughly mix with the soil.

In non-calcareous soil

1. Apply gypsum @ 500 700 g per plant depending on the pH of soil.

Q48. Can we apply Calcium and Boron together to prevent fruit cracking?

For best results boron should be applied through foliar spray while soil application of gypsum is most effective in enhancing calcium content in fruit.

Q49. I have applied all nutrients still the fruit size is not increasing. The skin appears hard. What should I do to?

Sometimes, fruit skin get hardened due to excessive use of copper based pesticides especially in acidic PH, or due to intense heat, low humidity and irrigation water. Always check pH of ready to use spray solution which should be between 6.5-7.0 pH. All copper sprays should be done at 7 pH You can go for three foliar application of KH_2PO_4 @ 10g/l and $MnSO_4$ @ 6 g/l at 15 days interval starting from 60 days after flowering for increasing the fruit size.

Q50. Is fertigation useful under saline soil conditions?

Fertigation should be avoided under saline soil condition in order to prevent further salinization. Use of water soluble fertilizer enhances soil salinity.

Q51. How can we reduce soil pH in the rhizosphere for enhancing availability of cationic micronutrients?

Use of gypsum in non-calcareous alkaline soil and elemental S in calcareous alkaline soil according to gypsum requirement will reduce localized soil pH and enhance availability of micronutrients. (See answer to Q.47)

Q52. How to reclaim saline soil for better plant growth?

Saline soils can be reclaimed by leaching salt from the root-zone with poor quality irrigation water diluted with good quality fresh water in 2:1 ratio and using 60-70 kg well decomposed farmyard manure per plant. Growing of plant on the middle of the slant of inverted V-shaped ridge avoids salt accumulation in the root-zone.

Q53. Can micronutrients be applied through soil?

If soils are found to be deficient in particular micronutrients, those micronutrients can be mixed with well decomposed farmyard manure and incubated for 14 days in shade with slight humidity, then it can be applied to the root-zone for reclaiming micronutrient deficiency.

Chelated Fe (Fe-EDDHA) can be used for soil application in high pH soil while other micronutrients like Zn, Mn, Cu and B are more effective in foliar application of their inorganic water soluble salts (i.e. $ZnSO_4$, $MnSO_4$, $CuSO_4$, and H_3BO_3 respectively)

Q54. Is EDTA chelate of Zn or other fertilizers more effective than inorganic salt of Zn ($ZnSO_4$)?

No, foliar application of inorganic salt of Zn is more effective in enhancing Zn content of fruit than EDTA chelated Zn. Same is true for other fertilizers. The size of EDTA molecule is bigger than stomatal aperture; hence its absorption is prevented through plant surfaces.

Q55. Is slurry application beneficial?

Slurry application is highly beneficial if it is made from well decomposed cow-dung manure, as it facilitates better penetration of nutrient and other growth promoters to the root-zone.

Slurry of fresh cow-dung should not be used as it immobilizes nutrients from the rhizosphere As a result,

Q56. Are inorganic fertilizers needed even if I am using lot of organic fertilizers?

Yes, it is needed in order to have higher productivity. With only organic fertilizers, it is very difficult to maintain high productivity as they contain low amount of nutrients per unit weight as compared to inorganic fertilizers, integrating inorganic fertilizers with organics is the best option for enhancing productivity and quality.

Q57. Is excessive application of nitrogen harmful?

Yes, excessive application of N is harmful to plant. High nitrogen promotes excessive plant vegetative growth, so the plant produces less number of flowers and fruits. Moreover, plants become more susceptible to diseases and insect pests especially bacterial blight.

Q58. Which nitrogen fertilizers should be used under different soil types?

Neem coated urea can be used in calcareous soil. However, ammonium sulphate is the best source of N for pomegranate although it is costly. In non-calcareous soil Calcium ammonium nitrate (CAN) can also be used.

Q59. How nitrogen (N) can be managed in pomegranate?

Nitrogen should always be applied in split doses. One-third N of recommended dose as per age should be applied just after harvest of fruit in previous cropping and remaining 2/3rd can be applied in two equal split one at 60 days after full bloom and another at 120 days after full bloom.

Q60. Can we use zinc sulphate ($ZnSO_4$), manganese sulphate ($MnSO_4$), boric acid and bactericide together for foliar application?

Yes, they can be used together for foliar application without any interference of each other.

Q61. Is potash (K) application required in soil rich in K?

Yes, you need to apply potash after every harvest as per soil and leaf analysis test reports. Pomegranate removes maximum of K with the harvest, so it should be replenished in order to maintain sustainability of production. Moreover, applied K does not get lost from the system as with N. So it will be available to the plant in due course of time.

Q62. Which source of K is good for improving storage life and quality of fruit?

Sulphate of potash (K_2SO_4) is the good source of K in pomegranate for improving storage life and quality of fruit.

Q63. What is the role of salicylic acid in pomegranate? How and how much has it to be used?

Salicylic acid is an important plant defense molecule involved in multiple physiological processes. It imparts resistance to plants against many diseases. In pomegranate only 4 applications of 300 ppm (0.3g/l) at 30-40 days interval starting from pre flowering are advised. If higher doses are used or more applications are taken, then it will disturb and affect other physiological pathways involved in plant growth and development.

V. BIO FERTILIZERS & BIO FORMULATIONS

Q64. Is application of bio-fertilizers/bioformulations advised through drip irrigation system? What is the right procedure?

No, never apply biofertilizers/bioformulations through drip irrigation system. The organisms in bioproducts available in market are made dormant for the convenience of long term storage. These organisms should be mixed with well decomposed farm yard manure (FYM) and incubated for bringing them in active growth stage for better multiplication and build up of active population for successful establishment before they can be applied to the rhizosphere.

The right procedure is to mix 1(or more as per instructions on pack) kg or liter pack in 1 ton of well decomposed FYM. Mix and moisten the FYM and cover it with polythene sheet in 1ft high heaps in the shade for 10-15 days. Rake up the heap once every 1-2 days and add more water if required to maintain required humidity of around 50-60%. Apply in root zone after 10-15 days and mix with soil and irrigate.

Q65. Can bio-fertilizer/formulation and inorganic fertilizer/formulation be applied together?

No never mix bio-fertilizer/formulation and inorganic fertilizer/formulation.

Bio-fertilizers have living organisms; they should not be mixed with any chemical as chemicals may have direct or indirect negative effect on the microorganism's growth and survivability. They should be applied at least 20-30 days after chemical application.

Q66. Which bioformulations available in market are good for pomegranate?

Bio formulations containing *Arbuscular mychorrhizal fungi* (AMF) with *Rhizophagus irregularis* Syn. *Glomus irregularis*, *Aspergillus niger* AN27, *Trichoderma viride* and *Trichoderma harzianum*, *Paecilomyces lilacinus* and *Verticillium spp.* are good for soil application against wilt and growth promoters. *Bacillus subtilis*, *Pseudomonas fluorescens*, *Trichoderma sp*. are good for foliar sprays against foliar diseases. However, count of the organism in the formulation should be atleast 10^{-7-8}/g or ml formulation when used and should purchase reliable tested brands and stored properly.

Q67. Is application of bio-fertilizers/bioformulations advised through drip irrigation system? What is the right procedure?

No, never apply biofertilizers/bioformulations through drip irrigation system. The organisms in bioproducts available in market are made dormant for the convenience of long term storage. These organisms should be mixed with well decomposed farm yard manure (FYM) and incubated for bringing them in active growth stage for better multiplication and build up of active population for successful establishment before they can be applied to the rhizosphere.

The right procedure is to mix 1(or more as per instructions on pack) kg or liter pack in 1 ton of well decomposed FYM. Mix and moisten the FYM and cover it with polythene sheet in 1ft high heaps in the shade for 10-15 days. Rake up the heap once every 1-2 days and add more water if required to maintain required humidity of around 50-60%. Apply in root zone after 10-15 days and mix with soil and irrigate.

Q68. Can bio-fertilizer/formulation and inorganic fertilizer/formulation be applied together?

No never mix bio-fertilizer/formulation and inorganic fertilizer/formulation

Bio-fertilizers have living organisms; they should not be mixed with any chemical as chemicals may have direct or indirect negative effect on the microorganism's growth and survivability. They should be applied at least 20-30 days after chemical application.

VI. IRRIGATION

Q69. What is the proper method of irrigating in pomegranate?

Drip irrigation with single lateral and two drippers till first two years and 2 laterals and 4 drippers from 3rd year to 4th year and there after if tree size is huge 2 laterals and 6 drippers. Place laterals below shaded areas.

Q70. How much water should be given to plant during different stages of plant growth and production?

The water requirement for pomegranate depends on plant age; plant stage bearing/non bearing, quantity of fruit load; season and soil type (less in black more in sandy) and may vary from 2-70 lit./plant/day depending on above mentioned factors. The best way is to standardize water requirement of your plot as per answer in Q69 below. Avoid too much water in rest period and till fruit set during crop period, increase water gradually during fruit enlargement period till 1 month before harvest and then reduce gradually till harvest.

Q71. What is the easiest method to understand water requirement of my plants?

The water requirement for pomegranate depends on plant age, plant stage bearing/non bearing, quantity of fruit load, season and soil type (less in black more in sandy) and may vary from 2-70 liter/plant/day. Therefore, best and easy way to standardize water for your orchard is:

(i) Irrigate the crop say for 1 hour.

(ii) Next day after 24 hrs check soil moisture at 15-20 cm depth in root region by taking soil from this region in your fist and close your fist to compress the soil.

(a.) If it remains loose and does not compress to form mould : Water is deficient, irrigate the crop

(b.) If it forms a mould, throw it on the ground:

- If it loosens after falling- water is perfect; irrigate next day after checking
- If it remains in mould without much dispersing- water is excess: No irrigation is required, check regularly and standardize time and interval when irrigation is required in your orchard and irrigate accordingly.

Q72. What are the reasons of clogging of emitters in drip irrigation systems?

The clogging of emitters can be (i) physical due to sand and silt particles, (ii) biological due to growth of fungi, bacteria or algae or (iii)chemical due to mineral deposition. Fertigation can potentially cause clogging of drip emitters due to chemical interactions and high mineral concentrations, exceeding their solubility limit. In general biological and physical clogging agents are present in surface irrigation water, while chemical clogging agents are due to high mineral concentration in ground water.

Q73. How can I prevent clogging in emitters?

In surface irrigation water clogging of emitters will most probably be due to biological and physical clogging agents. An adequate filtration system based on the quality of the water can prevent physical plugging of drip systems. Proper chlorination using bleaching powder and disinfection procedures are the key to control biological clogging of drip irrigation systems. At the end of growing period inject sulphuric acid solution at pH 5 into the lateral and leave the solution overnight and flush it out the next morning.

Acid injection, to reduce irrigation water PH, can prevent chemical clogging of drip emitters. Nitric acid is a most efficient solubilizer although sulphuric, hydrochloric and phosphoric acids can be used too. Flushing line for one hour with PH 4.5 acid solution is usually effective enough. However, you can leave the solution overnight if you have a particularly tough precipitate build up. Flush the lines with water afterward.

Preventive measures should be preferred rather than drastic measures at the end of season. Regular maintenance including checking and cleaning of emitters, filters and laterals at least once in a month. Running the system at least for 10 minutes even during rainy days increases the operation period and lowering the clogging.

VII. DISEASES, DISORDERS AND INSECT PESTS

Q74. Are there any effective chemicals to check bacterial blight completely?

There is no single chemical which can check bacterial blight completely, however integrated approach including cultural, nutritional and plant protection operations can completely check bacterial blight. The IDIPM schedule given on NRCP website (nrcpomegranate.icar.gov.in) can effectively reduce disease by 50-80% in first year and 70-100% in second year. However, the effective chemicals include bactericide 2-bromo-2- nitropropane-1, 3-diol 95% (Bronopol) @0.5g/l; antibiotic streptomycin sulphate 90%+tetracycline hydrochloride 10% @0.5g/l ; copper oxychloride 50% WP @3g/l, copper hydroxide 53.8%WP @2g/l and Bordeaux mixture 0.5-1%. These need to be taken in alteration as in IDIPM. Four sprays starting pre-flowering, at 1 month interval of salicylic acid 0.3g/l and micronutrient sprays increase disease resistance in plants and also improve fruit yield and quality. During rest peiod Bordeaux mixture 1% or other copper sprays should be taken at 10-15 days interval.

Q75. Is the IDIPM schedule for bacterial blight affected orchards only?

The IDIPM schedule is for management of all commonly appearing diseases and insect pests in pomegranate. This schedule can be used in general for getting disease and insect damage free yield in any season, however, farmers should not use Streptocycline (streptomycin sulphate 90%+oxy tetracycline 10%) and Bronopol (2-bromo, 2-nitropropane-1, 3-diol) if their orchards are free from bacterial blight and are in bacterial blight free areas.

Q76. In spite of taking so many sprays why we are unable to control bacterial blight?

Sprays of recommended bactericides when sprayed at lower doses are ineffective in checking the disease. Too many sprays (spraying everyday or alternate days) with one or the other spray solution results in increase in bacterial blight, because the sprays without bactericide or lower doses of bactericide are ineffective in killing the blight bacterium on one hand and provide much needed water and humidity to the bacterium for its multiplication, plant to plant spread and entry to new areas, on the other hand. Hence, you do not require too many sprays but proper chemical at right dose to check blight.

Q77. What all precautions we need to take while taking sprays?

1. Take only need based sprays at recommended doses, too many sprays increase the disease.
2. Always remove and destroy blight or rot affected fruits before starting any spray.
3. Do not dump affected fruits in or near your orchard, they are source of infection in your field, burry them in pit, cover with soil and allow decomposing.
4. Keep spray interval of 7-14 days depending on weather conditions. Depending on compatibility combine insecticides, fungicides or micronutrient sprays with bactericidal sprays. Mixture should not form precipitate or cause phytotoxicity on plants.
5. In affected plots take without fail, additional spray with a bactericide after the rains -when plant surfaces dry up.
6. Always (rains or no rains) mix good quality non-ionic spreader sticker with sprays. DO NOT USE SPREADER STICKER WITH BORDEAUX MIXTURE.
7. Always prepare Bordeaux mixture fresh and use on the same day.
8. To prepare spray mixture, prepare dilute solutions of each chemical separately and mix to make total volume. If precipitate is formed, either mixture chemicals are not compatible or pH is not proper.

9. The spray solution should have a pH of 6.5 -7.0 for good results.
10. In case no rains are there for long duration or blight is not increasing, sprays can be taken at 10-15 days interval instead of 7 days
11. The active ingredients (a.i.) in Streptocycline are streptomycin sulphate 90% + oxy tetracycline 10% and in Bronopol '2-bromo, 2-nitropropane-1, 3-diol 95%.' Both streptocycline and bronopol are available with different trade names from different companies. Check if a.i. is less then increase the dose accordingly.
12. Do not buy products which do not mention percent active ingredient/chemical on the packing.

Q78. When blight affected fruits are removed blight incidence increases. Is it true?

No, it is completely wrong. If you continue spraying with blight affected fruits you cannot get the desired results. When you do not remove blight affected fruits, you are not able to easily identify new affected fruits because of infection on many fruits all around and you think infection has not increased, but when you remove blight affected fruits before each spray and if you get new infection you are able to see it easily and you feel removing fruits has increased blight infection.

Q79. We are unable to get any produce since last 2-3years due to bacterial blight. We have cankers on stems. Is it possible to control the disease now or should we remove the orchard?

There is no need to remove orchard affected with blight. The blight infection is a localized infection restricted to tissues around entry point and is not a systemic disease. Therefore the bacterium is not inside the plant system and trees can be rejuvenated with IDIPM schedule to give good yield. There are several such examples where farmers are getting normal yield in spite of cankers on the main stem.

Q80. Is there a permanent remedy for controlling bacterial blight?

Developing disease resistant variety is the only long term solution to control bacterial diseases in any crop. As on date there is no pomegranate variety/germplasm resistant to bacterial blight, IDIPM is the only solution which can give almost 90-100% control.

Q81. Why has NRCP not developed any blight resistant variety so far?

NRCP has screened all available germplasm (more than 375), seedling population and hybrids developed; all are susceptible to blight to varying degree. Moreover, blight is low in the germplasm and hybrids with undesirable fruit character (small size, sour in taste, hard seed or devoid of red colour). Hence, we are working at genetic level to overcome this hurdle so as to get both blight resistance variety with good fruit quality.

Q82. What are the most important environmental conditions for severe blight attack?

Factors favorablefor blight development are mainly favorable temperature and humidity for 10-16 hours. Blight starts above RH>30.0% and develops at a fast rate above 50% if temperatures between 25.0°C to 35.0°C exist. Rainfall of 0.1 mm or our sprays are sufficient to provide required water for its development and wind speed 3.5m/sec along with rain help in spread and entry in new locations.

Factors not favorable for blight development include long durations of temperature below 20°c or above 35°C and RH below 30%.

Q83. Is there any relation of nutrients with bacterial blight disease severity?

Yes, balanced use of nutrients is most important for protecting plants not only from bacterial blight but also other diseases and disorders. The nutrients like Ca, Mg, Fe, Mn, Zn & Cu when used in balanced proportions, reduce the bacterial blight disease severity while excess of N enhances the disease severity. Based on nutrient analysis of fruits of different varieties it was observed that varieties with higher K content in the fruits were more susceptible to bacterial blight.

Q84. What are the most important steps to keep your orchard free from bacterial blight?

1. Plant with assured disease free planting material
2. Plant soon after the rains never before the rains.
3. Use recommended manures and fertilizers at right time and right dose. Give lot of organics from planting and avoid inorganic fertilizers for the first two years till first crop regulation
4. Sanitation of orchard should be maintained.
5. Do not allow people coming from affected orchards for pruning or visit in your orchard
6. Allow plants to grow at least for two years before taking first crop.
7. Do not take too many fruits per tree. Take optimum number depending on age and plant vigour.
8. Give proper rest to the crop and apply basal dose of organic manures, micronutrients, potash and phosphorous soon after harvest in rest period with minimum irrigation.
9. Unattended affected orchards near the orchard should be removed
10. Take prophylactic sprays throughout the year: crop season, rest period and after rains.
11. Bordeaux mixture (0.5-1%) freshly prepared on the day of use is the best broad spectrum bactericide and fungicide.
12. Do not spray anything and everything blindly. Use genuine chemicals.
13. Do not use **Streptocycline (streptomycin sulphate 90%+oxy tetracycline 10%)** in blight free orchards/areas.

Q85. What are the most important steps to manage bacterial blight once it is seen in the orchard?

1. Shift to hasta/early hasta bahar crop once disease is observed
2. Give proper rest to the crop
3. Adopt uniform bahar and management schedule in your locality
4. Unattended affected orchards should be removed
5. Sanitation of orchard should be maintained
6. Use recommended manures and fertilizers at right time and right dose. Give lot of organics.

Taking proper spray schedules at recommended doses throughout the year (crop season, rest period and after rains). Do not spray anything and everything blindly. Use genuine chemicals which mention active ingredient (a.i.) percent or declare ingredient details with percent of each.

Q86. Are there any alternate hosts for the bacterial blight pathogen?

No there are no alternate hosts for bacterial blight pathogen *X. axonopodis* pv. punicae. Neem is reported as alternate hosts by some, but has other bacteria causing blight symptoms on them.

Q87. Bacterial blight is caused by only bacteria or some other organism is also involved?

Bacterial blight is caused only and only by bacterium *Xanthomonas axonopodis* pv. punicae, no other organism is involved with it.

Q88. How do we identify the bacterial blight disease in early stages?

The first symptoms on leaves are small water soaked (oily) spots on the under surface of leaves, which can be seen clearly against light. On fruits, first symptoms are water soaked/oily spots on the outer skin. On twigs, water soaked grey tissue around nodes is seen usually on new/ young twigs. These later turn black brown with water soaked margins in active lesions.

To confirm samples take to nearest laboratory, where laboratory ooze test can confirm bacterial blight instantly. The bacterial spots on fruits and stems will feel sticky to touch with a drop of water and rubbing the finger on it.

Q89. Once it enters the plant after how many days, the disease symptoms can be seen?

In a newly established orchard if the planting material is carrying hidden infection of the bacteria (generally axils/dormant buds carry bacteria), the blackening of nodes just above ground level appear in scattered plants, generally after 5-7 months age, depending on environmental conditions.

In a blight infected orchard new infections can be seen between 4-7 days under favourable weather conditions after the bacteria enters the leaves/fruits, when water through rains or sprays is available.

Q90. What measures are required to establish a disease free new orchard of pomegranate?

Bring planting material from a disease free area/orchard and constantly monitor the orchard for nodal infection, because of reasons given in Q3. It is wise to uproot such infected plants immediately and burn them. Immediately take protective sprays of Streptocycline (5g/10 l) + Copper Oxy chloride (25g/10 l) or Copper hydroxide 53.8% (20g/10 l) alternate with Bordeaux mixture (0.5%) at 10 -15 days interval or immediately after rains.

Q91. Does bacterial blight spread through air? How long can it travel in air?

Bacterial blight spreads through air only when rain storms are there or there is high humidity in air, because the bacteria die in dry air. In air it can travel generally short distances infecting neighboring plants up to few meters, however rain storms may carry them up to long distances.

Q92. What are the different methods of its spread?

It can spread through infected planting material, plant to plant contact, rains, run off water and rain/ spray water splashes, wind blown rain splashes, person handling the plants, contaminated tools, visiting insects.

Q93. Is bacterial blight organism present in soil and if yes, for how long? Can soil be a carrier of blight bacteria?

It is present in soil below the blight affected plant or where blight affected plant debris is buried. It can not remain without pomegranate tissue (leaves, fruits or stems) for more than 30 days. Hence, 25-30 days after plant tissue decomposes in soil blight bacteria *Xanthomonas* will die. Therefore soil is not important for spread of bacteria if plant tissue has decomposed.

Q94. I have a badly blight affected pomegranate orchard, I want to remove and plant new orchard. After how much time of removing blight affected orchard can I plant new orchard?

As per explanation given in answer to Q93 you can do planting after two months of decomposition of all plant tissue left outs in soil. Remove all plant debris especially affected fruits and stems from orchard and destroy them as these do not decompose easily and take long time. Rake the soil several times for tilling and exposing the soil to sun rays. Best time to do this is in hottest months of the year. Then grow some green manure crops like Dhaincha etc. just before the rains start. Plough it in the soil after 50-60 days then plant after the rains when there is good soil moisture and cooler day temperatures for better and disease free establishment of new plants.

Q95. Unable to control *Colletotrichum* rot (also called plague by farmers)

It attacks fruits in hot humid conditions and results in heavy losses even by itself. Remove affected fruits and destroy/burn/decompose them, do not dump in or around orchard nor throw else where. Take sprays at 7 day interval of (i) Tricyclazole 18%+Mancozeb 62% WP @2.5- 3g/l (ii) Propiconazole1ml/l + Chlorothalonil 75% WP @2g/l. One systemic and one contact fungicide should be taken per month as preventive from pre flowering stage. If it is around pin prick holes, then fruit sucking moth is the main cause, control fruit sucking moth as in Q101.

Q96. How to differentiate fruits rots caused by *Colletotrichum* and *Phytophthora* during fruiting stage? What are the control measures?

Colletotrichum (anthracnose) rots are brown hard rots with no sporulation on surface and *Phytophthora* rots are tan colour rots that are not hard but soft and mushy. It is fast spreading covering entire fruit in 2-3 days. White fungus can be seen in later stages on fruit surface.

Q97. What are the causes of plant wilt?

The fungal pathogen *Ceratocystis fimbriata* is the major cause of wilt and species of *Fusarium, Rhizoctonia, Sclerotium, Macrophomina, Phytophthora* are occasionally associated. In some sandy soils root knot nematode *Meloidogyne incognita* may be the major cause. Shot hole may be associated with C. fimbriata or may independently result in damage resulting in wilt. Partial or complete plant may also die due to stem borer. Apart from this water scarcity or water logging can also lead to temporary or permanent wilt.

Q98. Is there any foolproof remedy for wilt management?

If wilt is due to fungal pathogen and it initiates or damages more than 25-30% plant canopy it is difficult to save plants with chemical treatment. Prophylactic method such as use of promising bio-agents described in Q 66 at every 6 months is the best solution?

Q99. What is package of practices for wilt management?

Use of good bio-formulations as described in Q66, right identification followed by correct management practices is the key to successfully avoid or control wilt problems. Please follow detailed wilt advisory on website: nrcpomegranate.icar.gov.in

Q100. When I removed wilt affected plant, I could see that more plants were infected? Some say removing wilt affected plants increases wilt. Is it true?

No it is not true. Not removing wilt affected plants with precautions leads to more wilted plants. Dry wilted plants should be removed and burnt; they should not be kept dumped in the orchard for firewood. The pathogen can survive for several years in the dead plant and soil or infected plant debris can spread through wind and rain infecting new plants in the orchard. While removing the wilted plants from the orchard for burning, if entire root zone is not protected with cover/ gunny bag etc., the soil on root having wilt pathogens falls and spreads in orchard leading to wilting of more plants in the orchard after few months. Treat the plants as advised in the wilt advisory available on website: nrcpomegranate.icar.gov.in.

Q101. How can I control fruit sucking moth apart from common method of catching and killing the moth after sunset?

Fruit bagging with butter paper or polypropylene non woven bag is the only promising solution for fruit sucking moth. Remove Gulvel (*Tinospora sp.*) in vicinity of orchard as it is host for larval stages of fruit sucking moth. Do not remove pierced fruits as moth attacks such fruits again and again. Collect and destroy the fallen fruits on the ground, take fungicide spray to avoid rot. Banana or guava baits in Nylon bags may be hanged at multiple spots in orchard as moth prefers these fruits. The moth damage is seen from August to November after rains. Change of season is the other alternative. Collect and destroy fallen fruits on the ground.

Q102. What are the benefits of bagging?

Bagging improves fruit colour and quality, avoids sun scorching and gives protection against fruit sucking moth and fruit borer if done at proper time and stage of fruit development.

Q103. What bagging material should be used? What is the cost of bagging per fruit?

White butter paper and polypropylene non woven bags are best. The cost (excluding labour) with these materials comes around Rupee 1 per fruit.

Q104. What are the recommendations for bagging?

Bagging should be done only as per need. For fruit sucking moth bag the fruits as soon as first attack is observed, generally in August end or September. For sun scald bagging is required starting from February to May after fruit becomes lemon size. Just before bagging take a spray of fungicide+bactericide +insecticide on fruits. Do not bag fruits in rainy season and in blight, fruit rot and mealy bugs affected orchards. Bagged fruits become more prone to bacterial blight, rot and mealy bugs.

Q105. Can Bordeaux mixture be mixed with other fungicide, insecticide or micronutrients?

No, mixing of other chemicals in Bordeaux mixture is not recommended, it reduces efficacy of the Bordeaux mixture.

Q106. How to make proper Bordeaux mixture and Bordeaux Paste?

I. Bordeaux mixture: Bordeaux mixture if prepared properly is a very effective broad spectrum fungicide. To prepare a good Bordeaux mixture follow the steps below:

(A) Composition:

Chemical	Quantity
Copper Sulfate ($CuSO_4.5H_2O$)	1.0 Kg
Quick lime/Calcium Oxide (CaO) or Calcium hydroxide $Ca(OH)_2$ [Use fresh stocks]	300-400 g Depending on Purity
Water	100 Liter
*For 0.5%, reduce the quantity of Copper Sulphate and lime to half	

(B) Method

- Dissolve copper sulphate overnight in half the quantity of water (suspend in a jute bag to facilitate dissolving).
- Slake the lime (Calcium oxide); suspend in remaining half quantity of water, and strain through a fine sieve. If quick lime is not available, hydrated lime ($Ca(OH)_2$) can be used.
- The two solutions are then poured together through a strainer into a third vessel or spray tank, constantly stirring vigorously with wooden stick.
- This gives the most finely divided precipitate.

(C) Tests for Bordeaux mixture:

- **Iron Test:** The Bordeaux mixture prepared should not have excess copper in it, as it is toxic to plants. To test this, dip an iron knife or a nail in the upper layer of the solution for a few minutes. A brick red or rusty brown deposition on the metal surface indicates presence of excess copper in the mixture. In such a situation add more lime solution to the mixture till no rust appears on the iron knife.
- **PH Test:** To test the pH of mixture, use portable pen type pH meter of good quality and check for pH 7. If pH is below 7 add more lime and if above pH7 add copper sulphate to bring it to pH 7.

(D) Points to Remember:

- Use mixture for spray immediately after preparation.
- Do not use iron or galvanized vessels for the preparation of copper sulphate solutions. Use plastic vessels, earthen or wooden barrels.
- Do not mix Bordeaux mixture with other chemicals or pesticides.
- Always strain the mixture through a sieve before adding it to spray tank.

II. Bordeaux Paste (10%): Use 1kg of copper sulphate, 1kg hydrated lime for 10 liters of water. Use the same procedure as above for preparation except no need to check pH or do Iron test.

Q107. Can we apply copper fungicides during hot dry months? Can copper cause phytotoxicity?

Copper fungicides during hot dry months can be applied at pH 7. Not more than 2 applications (preferably 1) per month during crop season are recommended in general. The copper remains as suspension in spray solution, dries and remains on plant surfaces as deposits. As and when these deposits get free water copper ions are released slowly under acidic conditions to kill micro organisms that come in contact. Excessive use and low PH (below 6.0 to 6.5) leads to phytotoxicity during slow drying (wet and cool) conditions because of consistent wetting of surface due to rains, night dues or sprays.

What are the reasons for fruit cracking and what is the remedy?

Q108. Fruit cracking can be due to abiotic (water) reasons as well as biotic reasons (bacterial blight or severe attack of other pathogens). The major reason for abiotic fruit cracking is sudden fluctuation of soil moisture and drastic differences in day and night temperatures. Application of irrigation or rain after long dry spell and fluctuation of soil moisture content owing to sudden rainfall leads to fruit cracking. The remedy includes:

- Three foliar spray of boric acid @ 0.25 to 0.3% and $ZnSO_4$@ 0.3% starting from flower bud initiation at 60 days interval.
- Application of gypsum @ 250 g per plant once at 60 and 120 days after full bloom.
- Use of plastic or organic mulching.

  Regulating fluctuation of soil moisture content during fruiting.

Q109. Whether growth regulators prevent fruit cracking?

Paclobutrazol 300 ppm (0.3g/l) or GA_3 80ppm (0.08g/l) two sprays 2 and 8 weeks after full bloom have been reported by some workers from Egypt to significantly reduce fruit cracking, however they may affect yield or fruit quality.

Q110. How to overcome bird damage during fruiting stage?

By covering fruits with polypropylene bags or covering the plants/plots with nets.

VIII. POST HARVEST MANAGEMENT

Q111. What are the optimum conditions for the storage of pomegranate fruits?

The pomegranate fruits should be stored at 5^0C and 90-95 % RH.

Q112. What are the different processed products that can be developed from pomegranate?

The pomegranate can be processed into juice, ready to serve beverage (RTS), minimally processed arils, wine, seed oil, peel powder etc.

Q113. What qualities of fruits are suitable for juice processing?

Grade II and III fruits without rotting can be used for juice processing.

Q114. How many/much fruits are required for extraction of 1 liter of juice?

Around 2.5 Kg (25 No. of 100g fruits) of pomegranate fruits of cv. Bhagwa will yield 1 liter of juice

Q115. My pomegranate fruits cracked due to water shortage, can I make 'Anardana' /juice from the arils?

For 'Anardana' purpose highly acidic varieties like Daru, 'Amlidana', 'Solapur Anardana'etc.should be preferred. It should not be prepared with Bhagwa or other table purpose varieties having low acidity. However, you can extract juice from such fruits.

Q116. What will be the cost of establishment for small scale unit for pomegranate based juice and RTS development, packaging and storage?

The juice processing unit of capacity 100 lit./h. can be established with an investment of approximately Rs. 50-60 lakhs

Q117. Which product will be most suitable for cottage scale processing of pomegranate with minimal investment at village level?

The pomegranate based RTS beverage can be processed at cottage scale with low investment.

IX. EXPORT

Q118. How can I produce export quality pomegranate?

To produce export quality pomegranate you need to follow the norms laid down by APEDA available on their website under Traceability/HORTINET (http://traceability.apeda.gov.in/hortinet)

Q119. What is the procedure to register for export of pomegranate?

You need to register through the State Horticulture/Agriculture Department (Anarnet) and follow their norms available on APEDA website http://traceability.apeda.gov.in/hortinet)

X. TRAINING AND TRANSFER OF TECHNOLOGY

Q120. Does ICAR-NRCP impart training to farmers, officers, field workers *etc*. on different aspects of pomegranate cultivation.What is the procedure and whom to contact?

ICAR-NRCP conducts short trainings of 3.-4 days on pomegranate cultivation for various groups of farmers, state agriculture officers and other NGOs. The boarding lodging charges and training fee charges are to be borne by the trainees or sponsors of the trainees. You may write a letter to the Director for training as a representative of a group. Farmer Associations, KVKs, ATMA or State Govt. officials in their regions may sponsor farmer groups for training. You may write a letter to the Director, ICAR-NRCP, giving the details of the group requiring training and aspects on which training is required at NRCP.Traing on specific aspect for different durations can be given on similar terms and conditions.

Q121. Can I get training for making pomegranate products on commercial scale?

Yes you can get the training on all aspects of pomegranate processing. Follow the procedure as given in answer to Q118.

XI. NEW VARIETY: SOLAPUR LAL

Q122. What are the specialty characters of the new NRCP variety 'Solapur Lal'?

The variety 'Solapur Lal'is a biofortified variety with high iron (5.6-6.1mg/100g arils), zinc (0.64-0.69 mg/100g arils), anthocyanin (385-395mg/100garils) and Vitamin C (19.4-19.8mg/100g arils) contents, is dark red, has high TSS (17.5-17.7°B), high fruit yield (23-27 t/ha) with bold arils and hence highly suitable for both processing and table purposes. Solapur Lal matures in 165 days after anthesis. Under different climatic and cultural practices the values may vary.

Q123. What do you mean by saying that 'SolapurLal' is a bio-fortified variety?

A variety that has high nutritional value viz., vitamins, minerals etc. in its edible part is known as bio-fortified variety, Biofortified varieties play important role in alleviating malnutrition in human beings.

Q124. Are the newly released varieties resistant to bacterial blight & wilt diseases?

No, the newly released varieties of pomegranate viz., Solapur Lal and Solapur Anardana are not resistant to bacterial blight & wilt diseases.

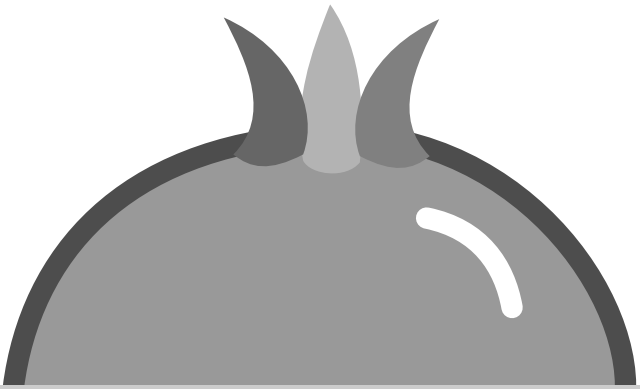
Q125. What is the procedure for purchasing sapling of new variety?

To purchase the saplings of pomegranate variety 'Solapur Lal', one has to submit the online application in the website of ICAR-NRCP i.e., nrcpomegranate@icar.gov.in during the time of availability of saplings. Those who have applied online would be allotted booking number on first come first serve basis and would be informed to collect the saplings from ICAR-NRCP during the time of availability.

Q126. How "Solapur Lal" is different from Bhagwa?

The variety 'Solapur Lal' is a biofortified variety and in comparison to Bhagwa, is darker red, has higher TSS, fruit yield, iron, zinc, anthocyanin and Vitamin C content with bold arils and hence suitable for both processing and table purpose. Solapur Lal matures in165 days after anthesis which is 15 days earlier compared to Bhagwa which matures in 180 days.

Solapur Lal



हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch

ICAR-National Research Centre on Pomegranate
(An ISO 9001:2015 Institute)
NH-65, Solapur- Pune Highway, Kegaon,
Solapur - 413 255 (MS)