- *Punica granatum* L.

Scientific classification

Kingdom	:	Plantae
Division	:	Magnoliophyta
Class	:	Magnoliopsida
Subclass	:	Rosidae
Order	:	Myrtales
Family	:	Punicaceae
Genus	:	*Punica*
Species	:	*granatum*
Binomial name	:	***Punica granatum***

Common Names: Pomegranate, Granada (Spanish), Grenade (French), Anar (Hindi)

Origin: The pomegranate is native of Iran

Adaptation:

- Altitude – 1850m MSL
- Semi-arid with cool winter and hot summer
- Deciduous or Evergreen
- Hot and dry climate during fruit development and ripening
- Optimum temperature – 38^0C
- Sweetness ∞ temperature
- Deep loamy to alluvial soil

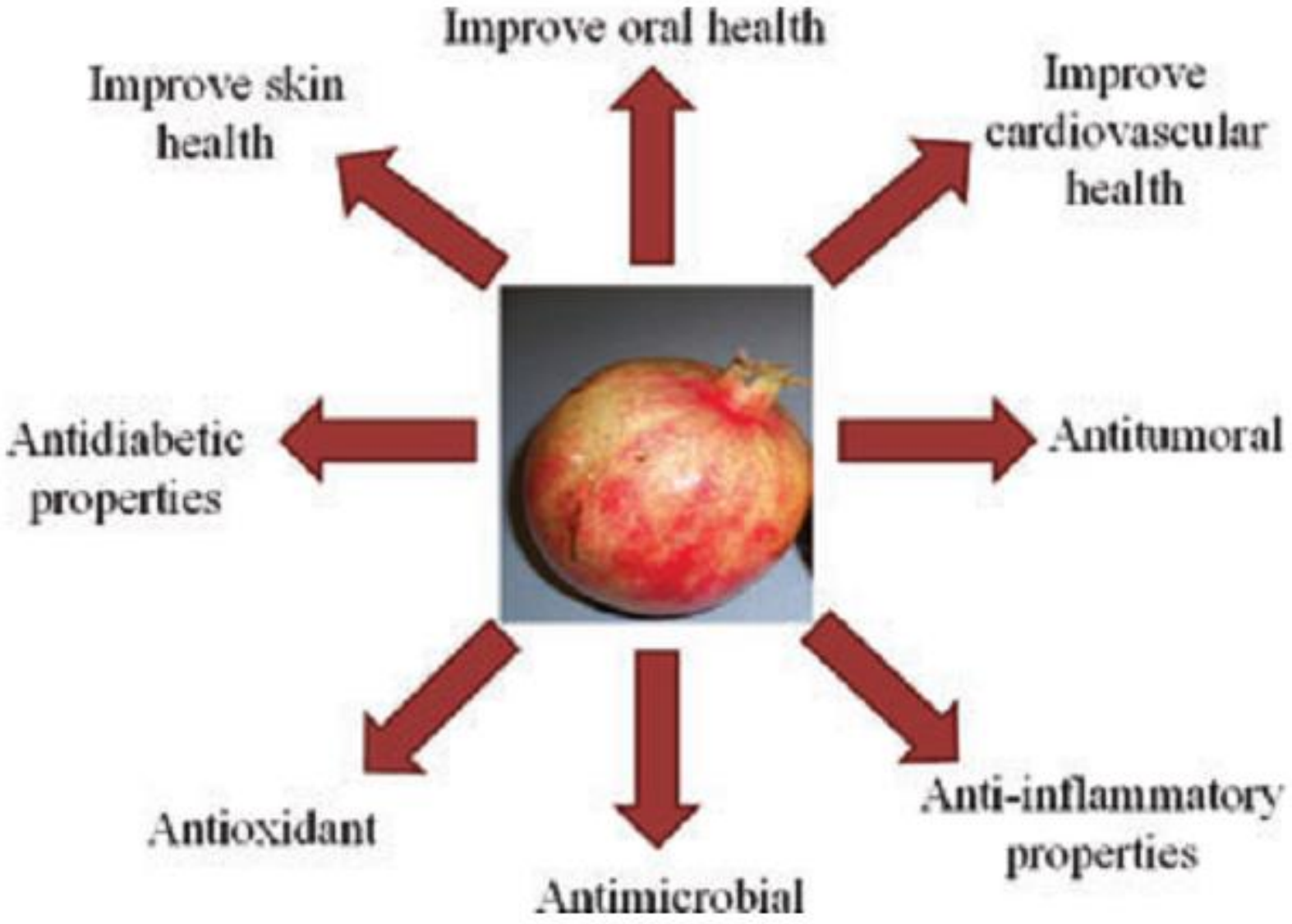
World Scenario

- Popular in Eastern as well as Western parts of the world
- Mediterranean region, Spain, Iran, India, Turkey, South East Asia, Afghanistan, tropical Africa, parts of USA etc
- It is grown for its fully luscious grains called 'Arils'; the fruits are very attractive with sweet acidic taste
- The fruits are mainly used for dessert purposes
- The fruits are also processed to make juice, syrup, jam, jelly, wine, to flavour cakes, baked apples, etc
- Of late, its nutritional and medicinal values are given ample importance

Health Benefits of Pomegranate

- Super food
- Rich in antioxidants
- Good for heart
- Reduce blood sugar levels
- Reduce blood pressure
- Eliminate free radicals
- Harmonize immune system
- Slows down ageing

Plant component	Constituents	Reference
Pomegranate juice	Anthocyanins, glucose, organic acid, ascorbic acid, EA, ETs, gallic acid, caffeic acid, catechin, quercetin, rutin, minerals	Poyrazoglu and others (2002); Ignarro and others (2006); Lansky and Newman (2007); Heber and others (2007); Mousavinejad and others (2009); Jaiswal and others (2010)
Pomegranate seed oil	Conjugated linolenic acid, linoleic acid, oleic acid, stearic acid, punicic acid, eleostearic acid, catalpic acid	Ozgul-Yucel (2005); Fadavi and others (2006); El-Nemr and others (2006); Sassano and others (2009)
Pomegranate peel	Luteolin, quercetin, kaempferol, gallagic, EA glycosides, EA, punicalagin, punicalin, pedunculagin	Van Elswijk and others (2004); Amakura and others (2000); Seeram and others (2005b)
Pomegranate leaves	EA; fatty acids	Ercisli and others (2007) Lan and others (2009)
Pomegranate flower	Polyphenols, punicalagin punicalin, EA	Kaur and others (2006) Aviram and others (2008)
Pomegranate roots and bark	Alkaloids, ETs	Neuhofer and others (1993) Gil and others (2000)


Improve oral health
Improve skin health
Improve cardiovascular health
Antidiabetic properties
Antitumoral
Antioxidant
Antimicrobial
Anti-inflammatory properties

species

Two species:

- ***Punica protopunica***
  - found wild in Socotra Island(Yemen)
- ***Punica granatum***: 2 subspecies
  - *Chlorocarpa* - found in Trans Caucasus
  - *Porphyrocarpa* - found in Central Asia

سطح زیرکشت، میزان‌تولید و عملکرد محصولات باغی (دایمی) کشور
به تفکیک محصول در سال ۱۳۸۷

ادامه جدول شماره ۲-۱ ((واحد: تن – کیلوگرم))

نام محصول	تولید			عملکرد	
	آبی	دیم	جمع	آبی	دیم
پرتقال	۲۱۳۹۰۹۳	۴۸۰۶۴۲	۲۶۱۹۷۳۵	۱۷۸۲۳,۲	۱۵۲۲۸,۴
نارنگی	۵۲۳۹۴۸	۵۷۷۸۶	۵۸۱۷۳۴	۱۶۰۳۶,۱	۱۸۹۸۰
لیموترش	۳۳۶۱۵۶	۲۳۴	۳۳۶۳۹۰	۱۱۶۱۹,۵	۱۲۷۳۴
لیموشیرین	۳۵۶۹۱۵	۱۵۴۸	۳۵۸۴۶۴	۲۲۳۰۲,۸	۱۳۴۴۰,۷
گریپ فروت	۴۵۸۸۸	۴۵	۴۵۹۳۳	۲۳۳۶۳,۷	۱۶۹۵۲,۱
نارنج	۴۳۱۶۱	۹۸۶۴	۵۳۰۲۵	۱۲۹۷۸	۱۶۱۹۸,۳
سایر مرکبات	۲۹۲۸۴	۸۸	۲۹۳۷۲	۱۲۷۷۹	۱۶۳۶۸,۶
انار	۳۸۴۲۱۹	۱۲۷۶۵	۳۹۶۹۸۴	۱۰۸۳۸,۱	۷۷۳۵,۲
خرمالو	۹۵۴۷	۱۱۷۹	۱۰۷۲۶	۹۹۳۲,۵	۱۴۸۹۶,۲
کیوی	۲۲۰۷۹۴	۹۵۲	۲۲۱۷۴۶	۲۷۳۴۰,۱	۱۴۷۰۰,۲
چای	۳۵۳۶	۱۳۷۶۲۴	۱۴۱۱۶۰	۸۸۱۷,۹	۵۸۰۵,۱
زیتون	۳۹۶۹۴	۲۷۷۳	۴۲۴۶۷	۱۳۳۴,۱	۹۴۳,۴
موز	۱۱۳۳۶۶	۰	۱۱۳۳۶۶	۲۹۱۴۵	۰

	وزن ۱۰۰دانه g	وزن ۱۰۰ هسته	رنگ دانه	قند	اسید	طعم	آبداری دانه	وزن 10ccآب میوه	ماده خشک۱۰cc آب میوه	درصد وزن دانه به میوه	pH	طول دانه	قطر دانه	طول هسته	قطر هسته
ملس ترش	٤١/١٦	٣/٦٩	٠/٦٨٤	١٧/٩٤	١/٤٣	١٢/٥٤	آبدار	١٠/٥٩	١/٨٨	٦٣/٧	٣/٣٣	١١/٥٣	٧/٧٤	٦/٨٧	٢/٦٤
تبریزی	٤٩/٩٦	٤/٤٠	٠/٦٠٦٠	١٨/١٦	١/١٦	١٥/٦٥	آبدار	١٠/٥٣	١/٧٧	٥٥/٩١	٣/٣٧	١٢/٢٤	٨/١٤	٧/٢٤	٢/٨٥
ملس شیرین	٤١/٧١	٣/٩	٠/٥٦١	١٧/٧١	٠/٤٨	٣٦/٨٩	معمولی	١٠/٤٦	١/٧٥	٥٩/٨١	٣/٧٣	١١/٣٠	٨/١٦	٦/٤٠	٢/٦٣
آقا محمد علی	٤٨/٥٠	٣/٥	٠/١٦٠	١٦/٦٦	٠/٤٦	٣٦/٢٢	معمولی	١٠/٥٣	١/٧٠	٦٣/٢١	٣/٨٤	١٢/٣٤	٨/٥٧	٧/١٥	٢/١٤
آلک پاییزی	٣٦/٥٣	٤/١٣	١/٩٧٣	١٨/٥١	١/٦٦	١١/١٥	آبدار	١٠/٦٢	١/٩٤	٥٤/٦٢	٣/١٨	١٠/٥٦	٧/٦٣	٦/٦٢	٣
آلک ترش تاکستان	٣٦/٧٣	٣/٢٨	٠/٩٨٣	١٨/٣	٢/٠٧	٨/٨٤	آبدار	١٠/٦٥	١/٩٩	٥٦/٧٨	٣/١١	١٠/٥٦	٧/٥٧	٦/٦٥	٢/٦٥
اردستانی	٣٣/٠٥	٣/٤	٠/٥٢٤	١٨/٨٣	٠/٥٣	٣٦/٢١	معمولی	١٠/٥٩	١/٩٣	٥٨/٤٢	٣/٨٣	١١/١٠	٧/٥٢	٦/٨٣	٢/٦٤
سفید جنگلی	٣٥/٧١	٤/١٢	٠/٢٧٧	١٨/٢٣	٢/٣٧	٧/٦٩	معمولی	١٠/٥٣	١/٨٣	٥٥/٠	٢/٩٢	١٠/٦٢	٧/٩٦	٦/٢٩	٢/٧٤
سیاه	٤٩/١٢	٤/٤١	٠/٣١٦	١٧/٨٠	٠/٤٤	٤٠/٤٥	کم آب	١٠/٤٥	١/٧٨	٥١/٠	٣/٩٥	١١/٨	٨/٥١	٦/٦٦	٢/٩٧
آلک قمی	٢٩/٠٣	٣/٢٩	٠/١٨٤	١٨/٥٦	٢/٣	٨/٠٧	آبدار	١٠/٦٥	١/٩٣	٥٠/٤	٣/٠٥	٩/٨٤	٦/٩٣	٦/٤٦	٢/٤٧
آلک شیرین تاکستان	٣٨/٨٤	٤/٠٩	٠/٧٦٤	١٧/٦٣	٠/٤٣	٤١/٠	کم آب	١٠/٣٦	١/٧١	٥٢/٠٧	٣/٩٥	١١/٣٣	٨/٣٧	٧/١٠	٢/٩٣
شاهوار	٥٠/٥٧	٤/٧٧	٠/٢٠٢	١٧/٦٠	٠/٥٠	٣٥/٢	معمولی	١٠/٥١	١/٧٤	٥٩/٢	٣/٧٨	١٢/٢١	٨/٥١	٦/٩٠	٢/٧١
بیدانه	٣٩/٢٧	٣/٠٨	٠/٠٧٦	١٧/٠٤	٠/٥٢	٣٢/٧٧	کم آب	١٠/٤٣	١/٧٣	٦٥/٥٨	٣/٧١	١١/٧٠	٧/٦٠	٦/٨٤	٢/١٩
انار ساوه	٤٢/١٤	٤/٢٢	١/٤٦٥	١٩/٠٨	١/٦٥	١١/٥٦	معمولی	١٠/٥٩	٢/٠٠	٥٥/٠٥	٣/٢١	١١/٨٥	٧/٥٩	٧/٣٧	٢/٨٠
ملس سیاه	٣٨/٩٤	٣/٦٥	١/٧٥٤	١٩/٤٥	١/٦٣	١١/٩٣	معمولی	١٠/٥٣	١/٩٢	٥٥/٠	٣/٢٥	١١/٣٥	٨/٣٥	٦/٧٠	٢/٩٠
سفید شیرین	٤٤/٩٤	٤/٢٤	٠/٣٠٥	١٦/٩١	٠/٤٥	٣٧/٥٨	کم آب	١٠/٤١	١/٦٩	٥٩/٩١	٣/٧٧	١١/٥٤	٨/٢١	٦/٩٤	٢/٧٤
آبدندان	٥٨/٨٦	٤/٥٤	٠/١٠٧	١٨/٠	١/٠٧	١٦/٨٢	خیلی آبدار	١٠/٥٢	١/٧٩	٥٩/٦٦	٣/٣٧	١٣/٠١	٩/٢٦	٧/٨٧	٢/٨٠
سفید ترش	٣٩/٣٩	٤/٢٥	٠/٤٢٥	١٨/١٥	٢/١٥	٨/٤٤	معمولی	١٠/٥٣	١/٧٩	٦٠/٥٢	٣/١	١١/٢٨	٨/١٢	٦/٧٢	٢/٧٢
سفید یزدی	٣٥/٨٠	٣/٨٣	٠/٣٨٣	١٨/٥٠	١/٧٠	١٠/٨٨	معمولی	١٠/٤٤	١/٨٢	٥٧/٢٤	٣/١٨	١١/٠٢	٧/٧٧	٦/٨٠	٢/٩٨
انار ترش تابستانی	٥٣/١٣	٤/٠٢	٠/٤٣٣	١٧/٠٧	١/٧٧	٩/٦٤	خیلی آبدار	١٠/٥٣	١/٧٠	٦٨/٨٣	٣/٢٠	١٢/٣٨	٨/٢٠	٧/٠٥	٢/٣٣


انار آلک شیرین ساوه - استان مرکزی


ملس نرش ساوه


انار زودرس و تابستانی ساوه - استان مرکزی


انار ملس پوست قرمز درجه یک اصفهان

انار ملس محلی قشمه (شهرضا) - اصفهان


انار پوست سیاه شیرین اردستان - اصفهان


انار نیلاسیه دانه قرمز کاشان - اصفهان


انار شیرین پیش رس نجف آباد - اصفهان


انار خانوری پوست قرمزنظنز - اصفهان


ترش نار در منطقه مرزی گیوارو - بانه - کردستان


انار بوانسی پوست قرمز نشاء خرم آباد - لرستان


انار گاو دماغ گراب - تنگ سیاب کوهدشت - لرستان


رقم فاروق استان فارس


الايكي استان فارس


رقم اقدس فارس


رباب استان فارس


رقم رباب استان فارس


ملس استان فارس


انار مزارع چمستان گناباد - خراسان


انار شیرین شهوار پوست نازک کاشمر - خراسان


گل نقت برد


پوست پیناه برد


حسینک شهریار برد


قصر دشت ابرکوه برد

Cultivars

Ganesh:

- Selection from **'Alandi'**
- Developed by **Dr. Cheema** at **Pune**
- Prolific bearer, fruit very large, rind yellowish red, pinkish aril with soft seeds
- Commercial cultivar of Maharashtra
- The average yield ranges **from 8-10 kg per tree**.

Phule Arakta:

- Pre-released in the year 1989, now released as 'Phule Arakta' by MPKV, Rahuri
- Heavy yielder, fruits are bigger in size
- sweet with soft seeds, bold red arils
- It also possess glossy, attractive, dark red skin
- High yield (30-35 kg/tree)
- Fruits are ready for harvesting within 120-135 days (Early variety)

Mridula:

- Ganesh X Gul-E-Shah Red
- This variety has all the characters of the Ganesh variety except the arils are dark red in colour
- The colour of the arils in 'Ambe' bahar and 'Mrig' bahar is dark red in colour while it is pink during the 'Hasta' bahar
- The average fruit weight is 250-300 grams

Bhagwa:

- The fruit is glossy red in colour with soft seeds and high TSS

Botany

- Shrub with multiple trunks and has a bushy appearance
- Grows upto 5m when domesticated and more than 7m under wild condition
- Deciduous tree
- Young branches are polygonal (quadrangular) and round when mature
- Stiff angular branches often spiny
- Leaves oblanceolate, obtuse and acuminate

Wonderful week 1

Wonderful week 1

Wonderful week 2

Wonderful week 3

Flowers

- Flowering occurs 1 month after bud break
- Bears in both season growth on spurs
- Terminal flowers are in cluster while flower on spurs are mostly solitary
- Flower are red in colour with 5-8 crumbled petals
- Three types: Hermaphrodite flowers (vase shaped) , male flowers (bell shaped) and intermediate
- Cultivars with higher vase shaped to bell shaped ratio will have higher yield potential
- Stigma receptive one day before anthesis and continues upto the second day. Anthesis completed in 3-5 hours
- Self pollinated and cross pollinated
- Heterostyly- hermaphrodite (pin) and male flowers (thrumb)

Monoecious
Male and hermaphrodite "female" flowers
Borne terminally or laterally

One to several flowers/ twig
One terminally, other laterally

Flowers mostly on tips of new growth coming out of last year's growth.
Some cultivars flower on spurs
Flowers are single or in clusters
Can bloom from early May into Fall
Most from mid May thru June
Flowers in late summer are fertile but fruit will not mature

Male and Hermaphrodite Flowers

Stigma receptivity is only 2-3 days

Some cultivars may develop an intermediate type - seldom fruitful, or only develops defective fruit

Can:
Self-pollinate
Cross pollinate from another flower
Cross-pollinate from another tree

Do added bees increase set?
Don't know for sure
Probably increasing the cross pollination from another tree
Bees will work pomegranate flowers

All of the male flowers and any un-fertilized female flowers will naturally drop after bloom. This is not cause for alarm.

Three flowering season:

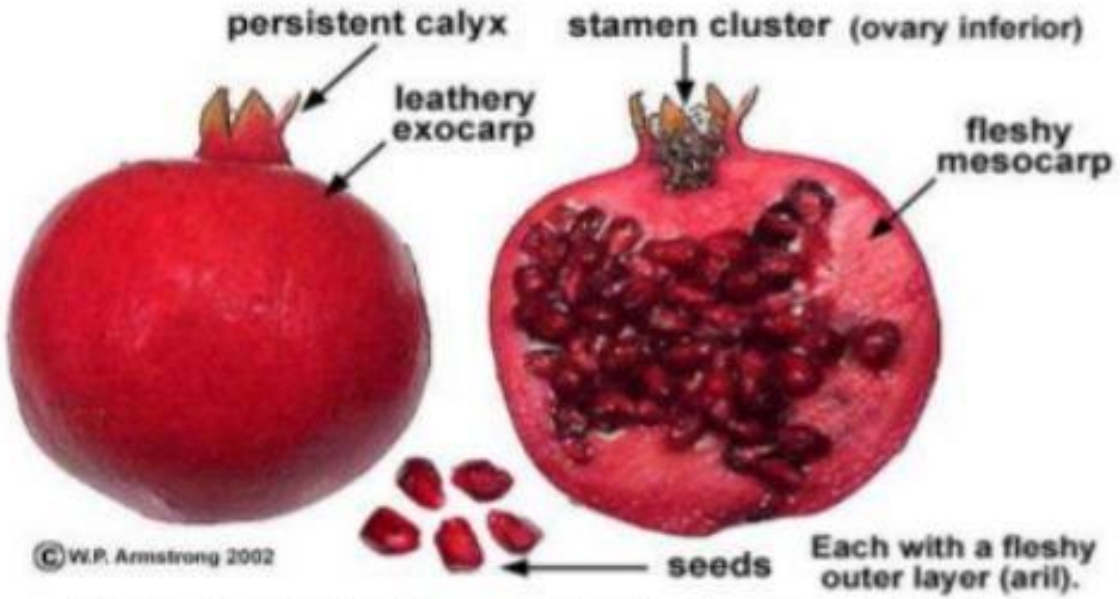
- *Ambe Bahar* (February-March)
- *Mrig Bahar* (June-July)
- *Hasta Bahar* (September-October)

Details of arrival pattern of pomegranate according to bahar treatment

S.No.	Bahar	Flowering Time	Period of Harvest
1	Mrig	June-August	November-March
2	Hasta	October- November	February-May
3	Ambe	January-February	June - August

Fruit

- Develops from the ovary and is a fleshy berry
- Fruit is crowned by a prominent calyx
- Connected to the tree with a short stalk
- After fruit set, sepals change colour from orange red to green
- In later stage of maturation colour changes again until final characteristic colour is obtained



Pomegranate (*Punica granatum*): A many-seeded berry.

- The multi-ovule chambers (locules) are separated by membranous walls (septum) and fleshy mesocarp
- The chambers are organized in a nonsymmetrical way
- Usually the lower part of the fruit contains 2 to 3 chambers while its upper part has 6 to 9 chambers
- The chambers are filled with many seeds (arils)
- The arils contain a juicy edible layer
- Colour of the edible layer vary depending upon the variety
- The arils vary in size and the seeds vary in hardness
- The fruit ripens in 5-8 months

Seed is surrounded by a fleshy receptacle called an aril
Depending on cultivar:
Seeds can be soft or hard; vary in color, vary in juice content
“Seedless” cv. have seeds that are very soft
Principle acids are malic and citric
Maturity standards set by packer or processor

Fruit ripen 6-7 months after flowering

Most difference in harvest dates among cv is due to time from flowering to ripening, not due to difference in flowering date.

Common to pick 1-3X for fresh and third for juice
Or wait and pick 1-2X for juice

Some experimenting with mech harvesting for juice

Splitting is the last stage of normal ripening
At least partly genetically controlled
Early splitting worsened by a rain near end of a dry period
Research has looked at gibb sprays and increasing Boron to reduce split (CA soils may already be high)
Too little or excess irrigation can cause splitting (Turkey)
May be reduced by maintaining even moisture (drip)

Propagation

Seedlings:

- Variation in characters
- Low yield
- Poor quality fruits

Air layering:

- treatment with 10000ppm IBA in lanolin as carrier was found to improve rooting.

Cutting:

- Hardwood cutting is most common
- One year old fully mature wood are utilised or
- Suckers which arise from the base of the stem
- Cuttings are 20-25cm long
- IAA 200ppm or IBA 50ppm increased the rooting percentage
- Set in beds with 1-2 buds above the soil for 1 year

Micropropagation

- Depends on factors such as genotype, explant, season, media and growth regulators
- Mahisi *et.al.* (1991)- shoot tip as explant
- Drazeta (1997)- apical vegetative bud as explant
- Yang and Ludders(1993)- nodal leaf and stem as explant
- Complete protocol for in vitro regeneration using cotyledonary nodes reported by Naik *et.al.* (2000)

Planting and Plant density

- Square or hexagonal system
- Pit size: 60cm^3
- Spacing: 5 x 5m
- Planting density is the yield contributing factor
- Investigation at MPKV, Rahuri showed that increased plant density also increased yield per hectare without affecting fruit quality
- 1000 plants(4x2.5m) gave 2.30 time higher yield and 2.44 times more profit than normal density of 400 plants(5x5m).

Training and pruning

Training:

- Multiple stem training
- Main stem is pinched at a height of about one metre from the ground surface
- 4-5 well distributed branches are allowed to grow on all sides
- The desired shape is obtained within 2-3 years

Training on a single stem is not advocated since

- Tree produces suckers
- Highly susceptible to stem borer

Plants are allowed to grow as a bush with a number of main shoots arising at ground level

- Too many stems also hinder interculture operations
- Maintenance of 3-4 stems per plant is recommended

Pomegranate orchard

Pruning:

- Removal of suckers (water sprouts), dead and diseased branches
- Developing a sound framework
- Limited pruning of the bearing tree
- Annual pruning during winter should be confined to shortening of the previous season's growth

- Pruning delays bud sprouting, flower appearance and harvesting
- Highest yield from unpruned trees
- Pruned trees gave-
  - ✓Better quality
  - ✓Increases fruit size,juice content and TSS
  - ✓Reduced sun scorched and internal breakdown

Pomegranates have a relatively short juvenile period compared to other tree fruits and nuts

Low vigor site: may want to limit cropping first and second years and put energy into root system.
First year fruits may be smaller
Fruit on young trees tends to mature later

Natural tendency is to grow as a bush with many shoots from crown area
We adapt them to a variety of training systems

4-5 multiple trunks

4-5 multiple trunks

Long trunk similar to a nut tree
2-4 scaffolds

Short trunk similar to a fruit tree
3-5 scaffolds
Common in Israel

Trained flat using training wire(s) to accommodate mechanization
2-3 trunks from ground
Or 1 Short trunk branching higher

Irrigation:

- regular irrigation during initial phase
- Also from flowering to ripening of fruits
- Drip preferred over traditional check basin system

Manuring and fertilization:

- FYM – 20kg per tree at the onset of monsoon
- N- 1000g, P_2O_5- 1000g K_20- 1500g per tree
- Foliar spray of 0.25% $ZnSO_4$, $FeSO_4$, and $MnSO_4$ and 0.15% boric acid increased yield

Flower thinning:

- Sevin (carbaryl) and NAA

Fruit growth and development:

- Single sigmoid growth pattern
- Linear increase in size, diameter, volume and weight except specific gravity which decreased gradually
- Color changes from greenish to deep pink with red and yellow patches at maturity
- Aril/rind and TSS/acidity ratio increases

Hand-thinning may be needed in some cases for fresh market

Does it pay?

Practiced in Israel to get larger and more uniform fruit

Harvesting and Yield:

- Ready in 5-7 months after the appearance of blossoms
- Skin turns slightly yellow
- The fruit gives a metallic sound when tapped
- Tree starts yielding from 4^{th} year onwards giving 20-25 fruits per tree
- 10^{th} year 100-150 fruits per tree
- Average yield : 200-250 fruits per tree
- Economic yield : 25-30 years

Ripening and storage

- It is a non climacteric fruit
- Can be kept well for 2 months at 0°C, one month at 4.5°C and 15 days at room temperature
- Bavistin @0.2% enhanced shelf life upto 30 days at room temperature and prevents post harvest fungal rot
- RH: 80-85%
- CA storage with 6.0:3.0%(CO_2:O_2) showed minimal quality and weight loss