

**POMEGRANATE PRODUCTION GUIDELINES
2013**

BACKGROUND

In old Latin, the name *Malum punicum* literally translates to “Apple of Grain” or multi-grain, in reference to the multiple seeds in the fruit but the current Latin name *Punica granatum* L. is derived from “Pomuni granatum,” a name traced back to the Middle Ages, which translates to “seeded apple.” Domestication of the pomegranate is believed to have started in Central Asia and Persia nearly 4,000 years ago, and then spread east and west through hot, arid regions of India, Asia Minor and the Mediterranean coast. Spanish settlers first introduced the fruit to North America. The plants are long-lived and bear fruit for decades.

This recent production increase in pomegranates worldwide on commercial scale is largely in response to increased demand for the fruit by consumers. Global production has increased substantially in the past decade, and pomegranate is being consumed not only as a fresh fruit, but also as juice or as a freshly prepared product.

South African production was initiated in the early 2000’s and currently SA is an international role player in production and exports from the southern hemisphere to various northern hemisphere countries. **Pomegranate production requires specialised agricultural practices and growing of this new crop for commercial purposes is advised to be done by experienced fruit producers.**

**1. PRODUCTION AND GROWING
REQUIREMENTS**

1.1 Climate

Pomegranate production is especially suitable in Mediterranean environments with colder winters and hot summers, but can also be grown in sub-tropical area, given suitable production practices are applied. Special care should be taken in areas with high summer rainfall and high relative humidity, as fruit quality may be affected as well as high incidence of fungal diseases may occur.

Pomegranate trees are especially sensitive to wind and extremely windy areas should be avoided when planning production sites.

The mature tree can tolerate frost when fully dormant, but will be injured especially during the first three years after establishing, when frost occurs early or late winter when green

growth is still present. In fully dormant trees, temperatures of –10°C could be tolerated.

High summer temperatures of up to 38°C + can be an advantage to good ripening and developing of fruit to its optimal size (and colour). Extreme high temperatures though could lead to sunburn injury on fruit.

1.2 Soil

Pomegranate can successfully be grown on a wide range of soils. The trees can tolerate fairly alkaline soils and also grow in soils with a certain amount of salinity. Optimum growth conditions though, will be achieved in deeper well-drained loam soils with good moisture and nutrient retention and a pH ranging between, 6.5 to 7.5. Trees will also grow in light-sandy soils - provided that the orchard is well irrigated.

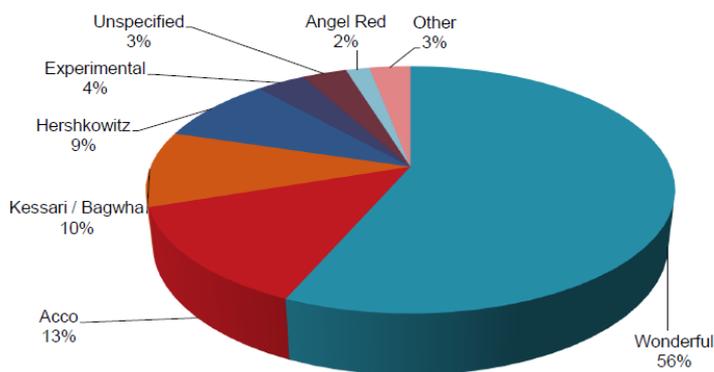
The recommended active lime is between 12 – 15%. Planting on ridges in certain potential problematic soil conditions could improve growth

and yields. Avoid the growing of pomegranates on poorly drained and soils with a high clay content as this might lead to root rot.

1.3 Cultivars

Pomegranates are one of the oldest known cultivated fruit and there are hundreds of natural cultivars (selections) worldwide. Breeding programs also now exist and new varieties are lately registered for Plant Breeders Rights. The selection of the most suitable variety depends on the production area and how you intend to use the fruit. It is important to base cultivar selection on, besides fruit characteristic, also on storage ability.

Cultivars vary with respect to fruit size, external colour (ranging from yellow to purple/black, internal aril colour (ranging from nearly white to red), and hardness of the seed, juice content, acidity and sweetness.



The most popular varieties planted in South Africa are indicated in Fig 1. :

Fig. 1 Cultivars and planting volumes in South Africa

2. ORCHARD PLANNING

2.1 Nursery trees

Use trees from registered nurseries (www.POMASA.co.za). The industry in is in the process of investigating the implementation of a Plant certification scheme for nurseries. Plant material imported from other countries is subject to the obtaining of an import permit from DAFF as well as a post importation quarantine evaluation period at the official Plant Quarantine Station at DAFF.

2.2 Site Selection and Preparation

Aside from soil type and drainage, site selection should also take into consideration sun exposure and air circulation. Pomegranates require at least six hours of direct sunlight a day in order to ensure good fruit colour and productivity. Aligning the orchard rows and planting slopes according to optimum sun exposure (but minimize sunburn) is important. Soil drainage is as important as row orientation and trees should be planted in best possible position related to these factors.

2.3 Frost protection

Frost could be a real threat to young pomegranate plantings and special care should be taken to reduce the danger of frost in certain areas. Trees planted in open lower areas and trees exposed to cold prevailing winds are most likely to suffer frost damage

2.4 Soil preparation and soil corrections

Prior to planting, the soil pH should be adjusted to 6.5 with dolomitic limestone and Phosphorus should also be incorporated in the soil if levels are low.

If small plants are planted, a small amount of non-corrosive, controlled-release fertilizer is recommended to assist with proper establishment.

It is Important to collect a representative soil sample in the orchard, and If, according to the soil analysis, corrections need to be made – it should be done prior to planting

Depending on the soil profile and if any compaction layers are observed, the soil need to be ripped, and to a depth of at least 1m. On one hand the fertilizer needs to be mixed in the soil, and ripping also assures good drainage of the soil. It is important to keep in mind that for this crop with production life span of at least 30 years, the only opportunity to work the soil to a good depth and incorporate the lime and Calcium etc. will be prior to establishing of the plants. This will ensure that a good root system will develop that again will support the tree in terms of water and fertilizer uptake. Good practice is to start with the soil preparation well in advance - at least 4 - 5 months prior to planting.

2.5 Weed control

Weed control in pomegranate orchards is important as it creates competition for water and fertiliser and in the case of newly planted trees – sunlight. Weeds could also host insect pests that could create problems in the orchard. Weeds can be managed by mowing, cover crop in the inter-row space or application of weed killer chemicals. Weeds are controlled mainly with pre emergence weed killers while after germination, in the plant rows, glyphosate can be applied throughout the season but special care should be taken to avoid applications on windy days. Consult label for application instructions.

Cover crops could be considered to get rid of competing weeds and act as host for natural enemies of potential pests.

3. ORCHARD ESTABLISHMENT

3.1 Nursery trees and planting

Rooted hardwood cuttings are planted as bare root trees (without soil) in late winter or early spring. Plants from bags can be planted all year round, but trees will perform better when planted during spring or early summer. Pomegranates, on own root, can be placed directly in-the ground. A mulch can be used to prevent weed invasion and to preserve soil moisture content around the young plant.

Prepare planting holes of 0.5m x 0.5m x 0.5m in size. Manure or compost can be used in planting holes. Make sure that the soil is not too wet as the sides of the holes could become a restrictive layer to root development. Newly planted trees will require irrigation shortly after planting, making the installation of a suitable irrigation system compulsory prior to establishing of the orchard. Only trees from registered nurseries should be planted and special attention should be paid to plant variety and origin of mother material.

3.2 Tree Spacing

Optimal tree spacing has yet to be determined for production in South Africa. Traditional spacing for an orchard is 5x3 or 4.5x2 and 6x4 - depending on cultivar, soil, etc. The tree density should permit adequate sunlight penetration for

developing of proper fruit colour, adequate airflow between trees and efficient movement of implements and people during harvest. Higher density plantings have been done with some degree of success in some regions; however, this practice should be approached with caution as they will require proper management in order to not have an adverse effect on yield once the orchard reaches maturity.

3.3 When and how to plant

If trees are supplied by the nursery as bare root plants, the ideal planting time is late winter, as soon as the frost risk is low. Normally from mid-August to end September. Important to mention that one must assure that the soil preparation is finished, and the irrigation is laid out and water is available. It is important that one must be able irrigate the plants immediately after planting. The water is essential to make sure that the soil compact around the roots to prevent the drying out of the root.

3.4 Planting Design: row direction, spacing and slopes.

Generally the trees are single trunked with fruit produced all around the tree. In a high density orchard, production could be lowered, and fruits are set only at the top of the trees, colouring is not optimal and difficulty is experienced with chemical applications.

4. ORCHARD MANAGEMENT: Taking care of a mature orchard

4.1 Tree Shape

The shape and size of the mature trees should be influenced the orchard design. Generally a tree will have a single or few trunks (3-5) in modern orchards. The trees are trained to grow as an open vase, in such a way that light penetrates the trees from between the rows as well as from the inside of the trees. New branches which appear as suckers at the base of the tree can be removed or sprayed with "paraquat". For renewing old trunks, new branches can be left (one per trunk) and they can replace a trunk within 2-3 years of

growth. The light penetration from between the rows depends on the distance between the rows and on the height of the trees. The ideal tree height should not exceed 3.0-3.5 m.

4.2 General guidelines for pruning pomegranate trees and Training systems

There are two common approaches for training a pomegranate plant: single or multi-trunked. The single-trunk plant has a short (50 – 60 cm) trunk with five to six major branches diverging to form a vase-shaped structure. The single-trunk approach has the advantages of easier orchard floor maintenance and reduced costs associated with pruning suckers

The multi-trunk plant has three to six of the strong branches developed directly from the ground.

To grow a single stem tree - at planting, reduce each plant to a single stem and shorten this to about 50 cm above ground level. In some cases, trees are provided from the nursery as a multi stemmed tree and these plants could be planted and not trimmed for at least the first season. A short stake may be needed for support until the stem becomes rigid. Subsequently, select three to five shoots arising from the upper half of the stem to provide the main framework. These will be shortened at each winter pruning to produce a strong compact frame. Several secondary branches should be allowed to develop from each main branch, but excessive growth which would lead to overcrowding should be removed, as should any suckers which develop from the base of the tree.

Short fruiting spurs appear primarily on two- or three-year-old wood, and are found growing mostly on the outer perimeter of the canopy. Light annual pruning encourages growth of new fruit spurs, while more aggressive pruning will significantly impact yield. Pruning of the fruiting tree will consist mainly of removal of excessive overcrowded growth, deadwood and suckers. Adequate fruit-bearing wood should be retained. In order to achieve the desired shape (including height) of trees they are pruned in the winter. Broken, bent, and interfering branches are removed. In order to keep the interior of the tree open during growing season, summer pruning can be carried out.



Fig. 2. Single Stem pomegranate trees

4.3 Fertilizing

Pomegranate being a perennial crop, producing huge quantity of biomass generally demands specific amounts of nutrient elements. Depending on the soil analysis results, about 200 kg/hectare nitrogen is given annually. As for other macronutrients, phosphorus and potassium need only be applied if soil tests or leaf analysis indicate a deficiency. One of the few common deficiencies found in pomegranate is zinc, which appears as unusual yellowing of the leaves. If required, a foliar zinc application in the spring after fruit set is recommended. .

It is recommended to reduce the N: P to the minimum closer to fruit ripening, to insure good development of the colour and accumulation of sugars in the arils.

It is important to get advice from an expert on most suitable fertiliser programs for you orchard.

4.4 Irrigation practices

Although pomegranates are very drought tolerant, ensuring adequate soil moisture will result in a substantial improvement in plant vigour and fruit yield. Most commercial pomegranate orchards are irrigated and drip irrigation is normally recommended (one or two lines of drippers per row). Micro sprinklers can also be used and irrigation specialists should make recommendations to growers in this regards. Overhead irrigation is not advisable as it will increase the spread of field pathogens and may also result in reduced fruit as flowers are highly sensitive to humidity and moisture.

Care should be taken, as excessive soil moisture in the summer can lead to an abundance of vegetative growth, but the fruit produced will tend to be softer, resulting in poor postharvest quality.

Trees are irrigated according to an irrigation schedule developed for the specific soil and climatic conditions in the orchard. A generic guideline for irrigation water requirements for pomegranates would be 15 m³/hectare/day in the spring and a daily amount to 50 m³/hectare/day in the summer. The total amount of water per season is estimated at about 6000 m³/hectare.

The providing adequate irrigation throughout the growing and fruiting periods of the tree will also ensure that fruit cracking is limited to the minimum (especially closer to harvest).

After harvest very little irrigation is applied to the trees.

4.5 Flowers

Pomegranate trees are self-fruitful: self-pollinating. It was found though that bees (or other insects) could have a positive effect on the crop, by increasing the yield by 15 – 20%. Bloom begins in October and continues through to December, either in a continuous manner or in three to four flushes (variety dependent).

There are two types of flowers: hermaphroditic and male. The hermaphroditic fruit-bearing flowers can be identified by their fuller, more rounded base, which appears somewhat peanut or bell-shaped. The majority male non-fruit-bearing flowers will be more narrow and vase-shaped and will drop.

Fig 3. The vase-shaped male (left flower) and peanut-shaped hermaphroditic (right flower)

4.6 Fruit colour



The mature pomegranate fruit is a complex fruit which consists of the edible internal part (arils) and the external skin. The red skin colour of the fruit is mainly as a result of the pigment anthocyanin. Variety as well as external factors such as temperature and light plays a role in skin colour of the fruit.

4.7 Thinning of fruits

Too many fruit on trees may have a negative effect on the following season's yield and will also impact on the current season's fruit size. To avoid this, thinning of fruits 4 – 5 weeks after flowering could be useful. It is also important to thin fruit in clusters as fruit clusters usually create an ideal environment for insects to survive and thrive!

A general rule will also be to thin out the fruits borne on weak spurs, deformed and damaged fruits.

Generally the early flowers will result in the larger fruit, and a warmer spring will enhance larger fruit sized for that season.

4.8 Sunburn protection

Pomegranates mainly grown in the warmer areas where summer air temperatures normally rise above 40°C. Exposure of the fruit to intense sunlight can cause sunburn damage in the form of large black spots on the fruit skin, which render the fruit unmarketable. Fruit from young trees are especially sensitive to sunburn as a result of insufficient leaf coverage on the tree. Pomegranates are picked in late summer to early autumn and exposing the fruit to high temperatures are thus throughout the summer. As a result, the incidence of sunburn damage can be high causing grower losses that may exceed 30% of the harvested fruit. Several approaches could be taken to reduce sunburn incidence such as bagging of fruit (paper bags), adjusting of fertilization and irrigation regimes as well as orchard covering (netting) or application of UV protection agents on fruit.



Fig. 4. Sunburn symptoms on fruit and bagged fruit in orchard

5 PLANT PROTECTION

There is still a limited amount of research been done in South Africa on pomegranate pests and diseases and POMASA is currently focussing on establishing research programs in this field. Information that is available so far has mostly been obtained from problems observed in orchards and harvested fruit, and the mentioned research programs will also be able to indicate the economically importance of the respective problem areas. The lack of suitable registered products for the control of pests and diseases on pomegranates in South Africa is also a concern and currently addressed by POMASA and DAFF.

5.1 Pests

Pests of pomegranate include false codling moth (FCM), aphids, mealy bug, scale, thrips, mites, whitefly, nematodes etc.



Fig.5 Mealy bug and FCM on pomegranates

5.2 Diseases

The most important diseases of pomegranate include Phytophthora spp., Botrytis (crown rot), Alternaria (including black heart), Cercospora, Bacterial blight, etc.



Fig. 6 Alternaria rot and Crown Rot on pomegranates

5.3 Physiological disorders

Important physiological disorders include internal breakdown, fruit cracking, chilling injury, husk scald and deformed fruit.

6. HARVEST AND POST-HARVEST HANDLING OF FRUIT

6.1 Maturity

Harvest maturity is normally determined by sugar and acid contents, sugar: acid ratio and the colour development of the fruit. With experience, proper harvest maturity can also be determined from previous season's observations. Currently a maturity indicator of 13 Brix (sugar measurement) is accepted in the National Quality Standard for SA pomegranates.

Rind and aril colour will vary with season and area and should only be used in combination with other maturity tests.

6.2 Harvesting methods

Compared to other similar crops, a pomegranate are easy to harvest and if trees are properly trained, minimal ladder work is required. Fruit are harvested by clipping them with shears – as close to the fruit as possible to prevent a sharp point of wood from piercing and rubbing against other fruit in the bin. Fruit are placed directly into picking trays or bins in the orchard. Pomegranate Fruit are quite sensitive and should be handled with care in order to minimize bruising or scuffing.

6.3 Post-Harvest Handling and Storage of Fruit

After harvest, fruit are transported to a sorting and packing facility with or without pre-cooling of fruit after harvest. Fruit will benefit from being

placed into cold storage as soon as possible after packaging. Fruit destined for the fresh market could be washed with a chlorine or anti-fungal agent (registered in SA), rinsed with water and sorted by pre-determined quality standards as published in the Government Gazette, R 707. Quality criteria such as cracks, defects, insects presence or damage, rot, colour, size and weight are the most pertinent criteria used during the sorting process. Fruit could also be treated with a postharvest fungicide especially if they will be subject to longer-term cold storage.

Pomegranate fruit destined for the export markets are usually packed in 4kg (Class I and 2) or 15 kg (fruit for processing) cartons.

Fruit can be stored for up to six weeks in normal cold storage facilities, or up to five months using controlled atmosphere storage (CA). To ensure optimum quality during storage, the lowest temperature used should be 5°C for short-term storage (less than three weeks); 7°C is more appropriate for longer-term storage.

Cold damage (or chilling injury) can be observed as the browning of the white interlobular membrane and arils. Arils will also soften, resulting in higher levels of rot and could occur if fruit are stored at too low temperatures for long periods - Differences in cold storage temperature regimes are also observed within different cultivars.

References

1. Horticultural Reviews, Volume 35 Edited by Jules Janick, Copyright & 2009 John Wiley & Sons, Inc.
2. Pomegranate Production. *Dan MacLean, Horticulture; Karina Martino, Food Science and Technology; Harald Scherm, Plant Pathology; and Dan Horton, Entomology* University of Georgia Cooperative Extension Circular 997
3. University of California cooperative extension, 2010 sample costs to establish and produce Pomegranates.
4. Personal interviews – Pomegranate industry SA, Israel (Netafim)

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