

Evaluation of Super High Density Planting of Stone Fruits Cultivars at TADCO, Tabuk, Saudi Arabia

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ABSTRACT

Due to the increasing cost of fruit production in traditional agriculture (400-500 trees/Ha) and in order to raise the productivity per unit area, the global horticulture businesses had gone towards intensive farming adapting high density and later Super High-density planting (1000-1660 trees/ha). As per the strategic plan of Tabuk Agriculture Development Co. (TADCO), a field trial was conducted in 2009 and 2010 on six plums cultivars, three apricots cultivars, three round type shape and two flat type shape nectarines cultivars; and one flat type peaches cultivar. Most of these stone fruit cultivars originated from South Africa, three apricots cultivars from France and one plums cultivar from USA.

Field observations of the research unit on the trial during the period 2010 to 2013 had shown vigorous trees growth, high yield and high quality of some cultivars under the influence of the selected rootstocks, good soil preparation with the deep ripping and reclamation of the soil after the addition of gypsum and sulfuric acid before planting. It had been noted that the selected rootstocks for the stone fruits cultivars were suitable in the calcareous alkaline salty soil except Mariana rootstock as we observed loss of the cultivars budded on this rootstock: 40% of Black Splendor plum, and 16% of Alba plum cultivar. All the rootstocks encouraged vigorous trees growth and did not reduce the size of the trees of the different cultivars to fit the intensive super high density planting system with the central leading system in plums, peaches and nectarines or the open center system (Vas shape) in apricots.

The obtained results shown two plums cultivars Black Splendor, Pioneer and two nectarines cultivars Crimson Blaze, Royal Gem were suitable for Tabuk area. None of the tested apricots cultivars were suitable to this area.

INTRODUCTION

Due to the increasing demand for the consumption of healthy fresh fruits, cultivation of temperate fruit trees started in the regions of the northwest of Saudi Arabia mainly at Tabuk in 1983 ^[1] and later at Al-Jouf and Hael regions due to suitable semi-Mediterranean climate, suitable soil for fruits production and availability of high water quality. As per the Saudi Agriculture Group (SAG) records ^[2] in 2007, cultivated areas increased rapidly over the years and reached over 1.887.215 fruit trees producing over 37030 M.T of fresh fruits including stone fruits, pome fruits, grapes and dates. Tabuk Agriculture Development Co. (TADCO) is one of the leading companies in Saudi Arabia in crops production of field crops, vegetable crops under centre pivot irrigation system and fruit trees thanks to professional business management, skilled production managers, and skilled labors. Over the years, TADCO gained the expertise to produce and market profitable fruit crops such as stone fruits, grapes, pears as they excluded the production of non-profitable fruit crops such as apples, almonds, figs, citrus, pomegranate and persimmon. As per TADCO records in 2010 ^[1], there were 805500 fruit trees planted in 650.9 Hectares which produced 13680 M.T fruits including 3600 M.T grapes, and these figures increased significantly in the last seasons.

Horticulture Department started to import new cultivars of fruit trees & grapevines since the year 2001 to update the existing TADCO fruit trees cultivars; some of the imported cultivars were found not adapted to TABUK climate. To save the cost for the introduction of new cultivars, top management directed Fruits Business Unit (FRBU) and Research Department in coordination with Business Development Unit (BDU) in 2009 to test and evaluate more cultivars of fruit trees on small scale areas, and the successful marketable cultivars to be grown on large scale areas. The imported new cultivars of stone fruits were originated from the famous nurseries in Spain, South Africa & France such as Orero, Planasa, ARC, Escande etc.

TADCO old stone fruit cultivars ^[3] were planted at an average tree spacing 6 X 5 meters had been successful, but they were difficult to manage due to limited water supply and difficult logistic services. Examples of the old stone fruits cultivars ^[3]:

Peaches: Florida Star, Florida King, Desert Gold, Tropic Sweet, Hermicillio and Bonita.

Nectarines: Armking, Maybelle, Sunred and 81-17N.

Apricots: Sayeb, Kati, Canino, Bulida, Palastyn, Quardi and Amal.

Plums: Santa Rosa, Royal Red, Black Beauty, Black Amber and Wicson.

In 2004, TADCO introduced high density planting of plums cultivars with tighter tree spacing 6.1 X 3 meter in limited hectares area using trellis system for the cultivars Larry Ann, Laetitia, Santa Rosa, Black Amber and Songold. In 2008, early maturing stone fruit cultivars were introduced adapting High Density trellis system with tree spacing 5X3 meter for Apricots, Peaches & Nectarines. The results of both introductions were with varying degree of success. Example of stone fruits cultivars of 2008:

Peaches: Honey Blush (4.5 X 3 M), Plawhite, Flored and UF Gold.

Nectarines: Viowhite

Apricots: A-35, Charisma and Super Gold.

By the end of 2010 season, the board of directors directed TADCO top management to expand the cultivated area of fruit crops and grapes by planting current successful stone fruits and grapes cultivars into the vacant wheat pivots in the extension area. As a result of this decision, two pivots (80Ha) were planted in 2011 with different stone fruits cultivars of peaches, nectarines and apricots following circular planting rows with tree spacing 4.9 X 2 meters; another three pivots (120 Ha) were planted in 2011 with grapes cultivars following straight rows planting with tree spacing 3 X 2 meter.

MAIN OBJECTIVES

TADCO top management put plans in their strategy to introduce new cultivars of stone fruit trees from famous nurseries to replace the old cultivars for the following objectives:

1. To get new stone fruits cultivars adapted to Tabuk climate.
2. To get more early maturing cultivars and late maturing cultivars.
3. Fruits of the cultivars were desired by the end user.
4. Profitable new cultivars were characterized by high productivity & high quality with low chilling hours requirement. This object was achieved through adaption of new technologies on stone fruit trees cultivation & management.

LAND PREPARATION AND PLANTING

Small area at Orchard 2, Blk. 16C of about 0.5 Ha. was allocated for the trial. Land preparation was totally executed by Orchard 2 personnel as follows:

1. Collect representative soil samples from depth 0–30, 30–60 cm & clods, then send to the lab for analysis. Results in **Table 1** had shown that the soil texture is loamy with high salts level as the EC reached 36.6, 5.8, 16.70 mS/cm at the two depths & clods respectively. The level of sodium, chloride & bicarbonate salts was very high & not suitable for growing stone fruits trees; also, the level of calcium was high. Soil fertility was okay for potassium & magnesium, but phosphorous level was low. So, a plan was prepared for land preparation & reclamation of the soil before planting the trees as mentioned in the next steps.
2. Scrap the soil surface to remove unwanted objects or trees to level the soil surface.
3. Deep cultivation in two directions to a depth of 90-120 cm using shank cultivator. The second cultivation was with an angle of 45° of the first cultivation.
4. Spread gypsum powder at the rate of 5 M.T./Ha. After the first chiseling to reclaim the soil from sodium salts.
5. Disc cultivation of the soil surface to break the soil aggregates followed by leveling using disc cultivator.

6. Design the irrigation lines, and then allocate the location of the trees in each line using lime marker in the direction of North to South.
7. Excavate the holes of 50 x 50 cm for the trees at a depth of 50 cm and at 150 centimeter distance.
8. Replace the excavated soil with a mixture of sand, soil, organic manure (1:1:1/2); add 100 gram NPK 14-38-10 granular fertilizer and place it at the bottom of the hole & mix it with the soil of each hole before adding the soil mixture into the hole.
9. Install dripper lines equipped with water drip outlet every 50 cm (7.5 liter/hour) and irrigate for one week to leach the salts before planting the trees. Plant the trees in each line at the proper depth in each hole and support the trees using wood stalk or wire lines to promote upright growth of the tree with a central leader.
10. Planting the stone fruit cultivars, each cultivar in one line, each line is planted with 30 trees/cultivar and the distance between the trees is 1.5 meters and 4.75 meters between the rows.

Table 1. Analysis of Soil Samples collected from Orchard 2, Blk. 16C before starting the fruits cultivars trial.

Test Parameter	Sample Depth 30 cm.	Sample Depth 30 - 50 cm.	Sample Clods
pH (0-14)	7.2	7.74	7.66
Ec (mS/cm)	36.8	5.8	16.7
Calcium, ppm	2,587	2,861	2,871
Magnesium, ppm	208	179	177
Potassium, ppm	237	105	183
Sodium, ppm	509	490	412
Phosphorous, ppm	9	7	4
Chloride, ppm	14,200	2,000	5,600
Bicarbonate, ppm	534	153	305

Super high density orchard training system

1. Training system: The Super High Density orchard training system ^[4,5] requires a trellis for central leader training. Most of the orchards use 2 - 5 wire lines along the planting line to support the trees tied with wood posts of 2.5 meters height along the row with one post every 30 meters. The young trees were tied to the wires every 40- 50 cm. and was not pruned in the first 2 years, except to maintain the central leader. At the end of the 2nd year, the lower 60 cm branches and any suckers were removed along with any excessive vigorous lateral branches that might interfere with the central leader.
2. Installing the wire lines in the trellis system helped to support all of the line, each tree was tied with rubber clip from central leader. This step was required in Super High Density orchards for the following reasons:
 - a) To support the trees straight upright development.
 - b) To protect the trees from the stormy and strong wind coming in winter and summer. 2 - 5 wire lines were arranged along the tree row at proper heights 60, 120, 170, 210, 240 cm. respectively as shown in **Figures 1 and 2** ^[4,5].



Figure 1. Super High Density Planting, Plum cultivar Lady Red Nov. 30, 2010 (Four Wire Lines).



Figure 2. Super High Density Planting, Apricot cultivar Spring Blush Nov.30, 2010 (Two Wire Lines).

Cultivars/Rootstocks arrangements

To study the interaction of the rootstock with budded cultivar & tree shape: Different rootstocks were included in the new cultivars trial. The desired rootstocks are with low to medium chilling hours requirements and should confer compatibility with the budded cultivars. Selection of these rootstocks was based on their tolerance to soil conditions such as wet soil after heavy rain, salts and drought, resistance to root knot nematodes & soil fungi. The selected cultivars/rootstocks are shown in **Table 2**.

Plum trees pollinators were planted in the trial lines as follows:

- a. Latitia cultivar, Line 4A: tree # 1, 9, 16, and 21.
- b. Sapphire cultivar, Line 6B: tree # 7, 13, 17, and 21.
- c. Pioneer Cultivar, Line 4B: three trees in between Gamonal trees.

Table 2. List of the selected cultivars/rootstocks planted in 2009 & 2010 seasons.

Cultivar	Rootstock	Line #	Tree #	Spacing	Year of Planting
Peaches/ Paraguayo Delfin (Flat Type)	Cadaman	1A	30 Trees	4.75 X 1.5 M.	2009
Nectarine/Oreola (Flat Type)	GXN 15 (Garnem)	2A	30 Trees	4.75 X 1.5 M	2009
Nectarine/ Mesembrine	GXN 15 (Garnem)	3A	30 Trees	4.75 X 1.5 M	2009
Plum/Lady Red	GXN 15 (Garnem)	4A	30 Trees	4.75 X 1.5 M	2010
Apricot/ Big Red	Myrobalan 29C	5A	30 Trees	4.75 X 1.5 M	2010
Apricot/Spring Blush	Myrobalan 29C	6A	30 Trees	4.75 X 1.5 M	2010
Nectarine/ Crimson Blaze	GXN 15 (Garnem)	7A	30 Trees	4.75 X 1.5 M	2010
Nectarine/Ruby Sweet	GXN 15 (Garnem)	8A	30 Trees	4.75 X 1.5 M	2010
Plum/Alpa	GF 8-1 (Mariana)	1B	30 Trees	4.75 X 1.5 M	2009
Plum/Black Splendor	GF 8-1 (Mariana)	2B	30 Trees	4.75 X 1.5 M	2009
Plum/Pioneer	GF 8-1 (Mariana)	3B	30 Trees	4.75 X 1.5 M	2010
Plum/Gamonal	GF 8-1 (Mariana)	4B	30 Trees	4.75 X 1.5 M	2009
Apricot/Pink Cot	Myrobalan 29C	5B	30 Trees	4.75 X 1.5 M	2010
Plum/Ruby Red	GXN 15 (Garnem)	6B	30 Trees	4.75 X 1.5 M	2010
Nectarine/Royal Gem	GXN 15 (Garnem)	7B	30 Trees	4.75 X 1.5 M	2010

Rootstocks profile

We investigated scientific information on the rootstocks of the different cultivars [6-8] and found the following:

Cadaman: The origin of this rootstock is France, and it is widely used in Europe. It is a hybrid between peaches *Prunus persica* and the Chinese peaches *Prunus davidiana*. It is characterized by green leaves color. Cadaman rootstock is a patented Hungarian French-bred vegetative peach. It is drought resistant, resistant to wet soil (asphyxia), medium tolerance to chlorosis, suitable for growing in all types of soils including clay soil. It is resistant to root knot nematodes, but susceptible to the lesion nematodes, partially resistant to crown gall *Agrobacterium* bacteria, *Armillaria* and *Rosellinia* fungi.

High cropping efficiency and vigor with peach and nectarine cultivars under Mediterranean climatic conditions. It is suitable as rootstock for peaches, Nectarine, Almond & plum. It can be propagated by green cutting or wood cutting or tissue culture.

GXN 15 (Garnem): The hybrid progeny (GxN) is a cross of Garfi Almond (*Prunus amygdalus*) with Nemared peaches (*Prunus persica*). It is characterized by red leaves, easy propagation & good nursery performance. It is compatible with peaches, Nectarine, Almond & some plum cultivars.

This rootstock is adapted to calcareous soils, resistance to lime-induced chlorosis & water deficiency, trees budded on this rootstock are significantly with higher vigor than trees budded on peach seedling rootstocks, performs well in replant situations. Fruit production slightly higher, it is with broad resistance against root knot nematodes including *M. arenaria*, *M. incognita*, *M. javanica*, and *M. hispanica*; In addition, it is resistant to crown gall. However, it is susceptible to the lesion nematode, *Agrobacterium* bacteria, *Armillaria* and *Rosellinia* fungi.

Myrobalan 29C: It is originated from the Chinese peaches. It is easily propagated by micro propagation, and it is compatible with plum cultivars & some apricot cultivars. Usually well anchored, but somehow shallow with vigorous root system, prone to suckering. It is a good choice for hard soils. It is resistant to wet soil (asphyxia), and somehow drought tolerant, tolerant to chlorosis. It is immune to root knot nematodes and susceptible to the lesion nematodes, moderately resistant to crown gall *Agrobacterium* bacteria & *Armillaria* fungi.

It is with good vigor performance, not considered a dwarfing rootstock and do not effect on ripening periods. It is not used or recommended for commercial peach plantings, normally, unless wetter poorly drained soil conditions warrant.

Mariana G.F. 8-1_(p): Virus free clone rootstock obtained in France by INRA. It provides high vigor to the cultivars and it provides homogeneity, affinity and size to the fruit. It is the most resistant rootstock for root asphyxia for trees with superficial roots. It has proven resistance to the roots parasitic fungi (*Armillaria* & *Rosellinia*), and also resistant to root knot nematodes. It adapts to all types of soil: sandy, lime and clay.

Cultivars profile

We get agronomic information on some of the different cultivars from the nurseries suppliers ^[6,9,10] as shown in the following **Table 3.**

Table 3. Agronomic information on some of the different cultivars from the nurseries suppliers.

Cultivar	Crimson Blaze Nectarines	Ruby Sweet Nectarines	Royal Gem Nectarines	Big Red Apricots	Spring Blush Apricots	Lady Red Plums	Black Splendor Plums	Pioneer Plums
Owner	ARC, South Africa	ARC, South Africa	ARC, South Africa	Escande, France	Escande, France	ARC, South Africa	USDA, Available to Orero	ARC, South Africa
Rootstock	GF 8-1	GXN 15	GXN 15	Myrobalan 29C	Myrobalan 29C	GXN 15	Mariana	GF 8-1
Growth	Vigor & Strong	Moderate Vigor	Moderate Vigor	Vigor & Strong	Good vigor	Moderate Vigor	Moderate Vigor	Vigor & Strong
Chilling Hours	Medium (400 – 600) hours	Medium – low (200 – 400) hours	Medium – low (200 – 400) hours	400 – 700 hours	400 – 700 hours	Medium – low (200 – 400) hours	Low < 300 hours	Low ≥ 200 hours
Frost Susceptibility	Affected	Affected	Affected	Affected	Affected	Affected	Affected	Affected
Full Bloom Date	March 15, week 11	Mid Feb, week 8	Mid Feb, week 8	March 20, week 12	March 25, week 13	March week 13	Early March week 10	Feb 20, week 8
Harvesting Date	May week 21	May week 19	May week 20	May week 20	Early May, week 18 – 19	July week 29	May week 21 -22	June week 22 - 23
Fruit Texture	Firm, Non-Melting	Melting	Melting	Firm & Juicy	Firm & Juicy	Melting, semi free	Melting, cling stone	Melting, cling stone
Skin Color	Red blush (above 71% colored)	Red blush (above 71% colored)	Red blush (above 71% colored)	Dark Orange	Orange	Red blush (above 71% colored)	Blue/Black with mahogany color on shoulders.	Red blush (above 71% colored)
Flesh Color	Orange-Yellow, with red skin	Yellow, with red skin	Yellow, with red skin	Orange Background	Yellowish	Yellow	Beet Red Flesh with tart flavor	Light Yellow,
Eating Quality	Good, well balanced sugars and acids	Excellent	Good, well balanced sugars and acids	Very Good	Good	Moderate	Good with little sour taste	Good, well balanced sugars and acids

Sugars (TSS °B)	13	11	12	14	13	15	13.2 -15.6	13
Fruit Size & Weight	64 mm, 135 gram	60 mm, 95 gram	67 mm, 115 gram	56 mm, 37.3 gram	56 mm, 33.6 gram	54 mm, 83 gram	56 – 63 mm, 70 – 124 gr	55 mm, 60 gram
Storage ability	Good (≥ 4 weeks)	Reasonable (≥ 4 weeks)	Good (≥ 4 weeks)	Two weeks + two weeks handling	Two weeks + two weeks handling	(≥ 4 weeks) Dual Temperature	Good (≥ 4 weeks)	Good (≥ 4 weeks)
Production/tree	>20 kg in Super High Density	11 - 20 kg in Super High Density	>20 kg in Super High Density	20 kg in Super High Density	20 kg in Super High Density	above 20 kg in Super High Density	above 20 kg in Super High Density	11 - 20 kg in Super High Density
Pollinators	Self Fruitful	Self Fruitful	Self Fruitful	Tom Cot Apricot	Tom Cot Apricot	Laetitia or Sungold	Pioneer	Self Fruitful

Trees maintenance

Daily operations for the trees maintenance were carried out by the FRBU Orchard 2 Supervisor and operations personnel to manage the trees needs in reference to trees age, stage of trees development, season, weather conditions: this included irrigation, fertilizer application, pests, disease & weeds control, training and pruning the trees to fit central leader shape & support the trees with the wire lines. Research Unit record their observations on blooming, fruits setting, date of maturity of each cultivar, incidence of pests, diseases & nutrients deficiencies. Records on the yield kg/tree were taken from the FRBU harvest records of Orchard 2.

Criteria for evaluating the agronomic performance of stone fruits cultivars/rootstock combinations

During the period of the trial, the following parameters [8] were studied to evaluate the suitability & profitability of growing new stone fruit trees cultivars budded on new rootstock under Super High Density system:

- Compatibility of the rootstock with the budded cultivar.
- Reasonable reduction of the tree size under the effect of the rootstock to fit Super High Density planting system.
- Resistance of the rootstock to root knot nematodes & soil diseases.
- Tolerance of the rootstock to salt & drought conditions.
- Suitability of the rootstock to the soil type of the orchard.
- No difference in the chilling hours requirements between the rootstock & the budded cultivar.
- Date of blooming & Fruit setting.
- Trees vigor and productivity.
- For early cultivars it was desired to start production by the mid of April.
- Fruits quality are good externally & internally and desired by the end user.

Criteria for evaluating stone fruits quality

Quality is a combination of attributes that give value in terms of human food. Factors affecting stone fruits quality [11,12] are shown in the following **Table 4**.

Table 4. Factors affecting stone fruits quality.

External appearance	Background color Amount and brightness of over color or red blush, Fruit size, shape and smoothness Presence of defects, injuries and disease
Internal appearance	Flesh color and uniformity (characteristic of cultivar) Presence of translucent or brown flesh or stone cavity Overall impression of juiciness
Flesh texture	Melting flesh, not stringy Juicy, not dry, mealy or leathery

Flavor	Sweetness (total soluble solids concentration (TSS) Balance (soluble solids/acid ratio) Characteristic flavor volatiles Astringency (tannins) Objectionable flavors (e.g. acetaldehydes or alcohols)
Nutritional value and safety	Levels of calories, vitamins, minerals and fiber Freedom from toxins from any source

As fruit matures and ripens, color changes from green to red or yellow dependent on the cultivar; also, the flesh color changes to red or yellow according to the cultivar. Changes in background color of the fruit are not affected by the sunlight, and thus it is a measure more dependable on maturity. However, this test is less effective on some of the newer cultivars that have been bred to appear well colored. The red pigmentation obscures the background color change. Although skin color is probably the most common method of assessing fruit readiness to harvest, it is not considered the most accurate indicator of maturity. However, experienced growers often use background color as a means of assessing harvest maturity of peaches and nectarines. Excessive quantities of nitrogen can have a deleterious effect on skin color as well as internal/keeping quality.

Attaining a specific size is one index of maturation, but it cannot be used alone since fruit size for any one cultivar may be influenced by crop load, climatic conditions, and cultural practices. Fruit shape or fullness of cheeks indicates maturity. When fruit shoulders and suture are well developed and filled out coupled with complete color, stone fruits are considered mature.

Total Soluble Solids (TSS), is a measure of the sugar, organic acid and other soluble components in the juice of the fruit. TSS is measured using a refractometer to determine the percentage of pure sucrose; the major constituent in fruit juice is expressed as ° Brix. Cultivar and cultural practices affect TSS; TSS% is important because it tells you when the fruit is sweet enough to eat. It can be used with other indices, such as firmness.

Flesh firmness can be a very good indicator of maturity. This also relates closely to the eating experience for the consumer. Peaches harvested with pressure readings too high will generally display a dry, mealy texture when consumed. Stone fruit firmness is affected by cultivar, crop loads, nutrition, pruning and seasonal conditions. Flesh firmness is measured using a penetrometer with an 11-mm diameter plunger. The resistance required to drive a plunger through the flesh measured in kilograms or pounds.

Growers and shippers are concerned about good appearance and few visual defects, but to them a good cultivar must score high on yield, disease resistance, ease of harvest and shipping quality. To receivers and intermediate handlers, qualities of appearance and firmness are important as well as long storage life. Consumers see good quality as good appearance, firmness, good flavor, and nutritive value. Although consumers buy on the basis of appearance and feel, satisfaction and subsequent purchase depend on good eating quality.

Tabuk climatic factors affected the productivity of stone fruits cultivars

Productivity of Stone Fruits cultivars was affected by the following local climatic factors: number of chilling hours, frost injury in spring, incidence of heavy rainfall, and the incidence of sandstorm during the blooming & fruit setting.

Number of chilling hours: It is the most important factor limiting the productivity of stone fruits cultivars in a particular growing area as the trees need to experience the required chilling hours during dormancy period to produce normal crop.

TADCO succeeded growing early stone fruit cultivars with low chilling hours requirements of 200-300 hours in addition to cultivars with medium chilling hours requirements 300-500 hours. Stone fruit trees enter the stage of dormancy during the autumn & winter months ^[13]. During dormancy, the trees stops growing and the buds do not open until the trees experience the required chilling hours of temperatures range 0-7.2°C (32-45°F). The trees could stand temperatures below zero during the dormancy period without any damage to the trees since they are dormant. If the trees did not receive the required number of chilling hours it will not produce normal crop. The symptoms of chilling hours deficiency are manifested into: many buds are killed & fall down, delay in blooming, inconsistent blooming and the flowers may experience unsuitable conditions during pollination period like high temperature, and irregular or delay in the leaves cover of the trees, so the branches shall appear free from leaves with less & short branching and short spurs as shown in **Figures 3A and 3B**.

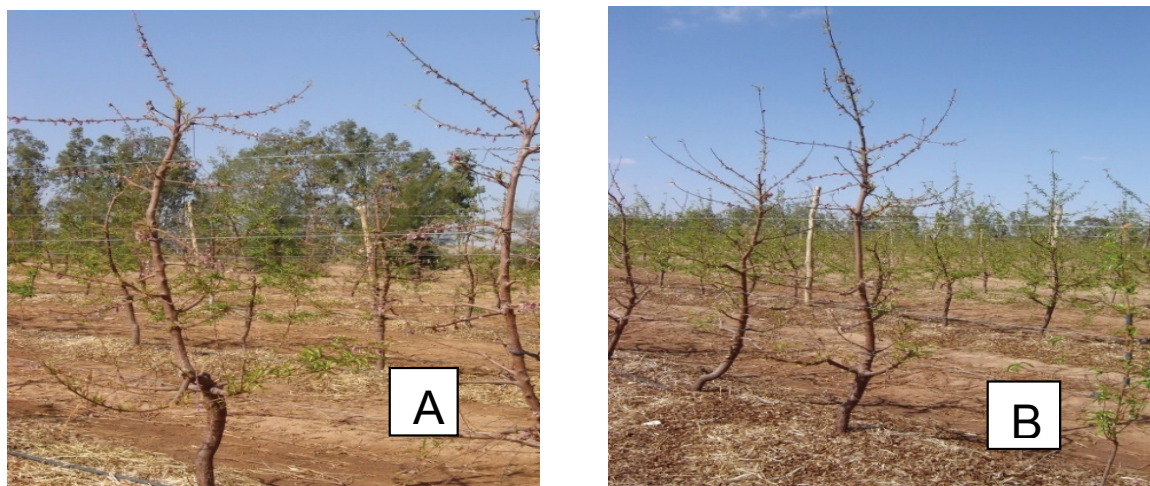


Figure 3. (A) Symptoms of chilling hours deficiency on Plawwhite Peaches and (B) Viowwhite Nectarine at Orchard 2 in March 2010.

The number of chilling hours shown in Table 5 and Figure 4 varied in each year, and it was cold years in 2007, 2008, 2012 and this may have affected the yield negatively in case of the onset of spring frost. In the other hand the productivity increased in the years with moderate number of chilling hours such as 2011 & 2013 in conjunction with Dormex application.

Table 5. Number of the chilling hours at TADCO over the years 2007 – 2013

Year	2007	2008	2009	2010	2011	2012	2013
Number of Chilling Hours	760	764	528.8	219.4	311.1	749.3	340.4
Rainfall (mm)	14.1	16.42	19.9	43.2	-	12.8	15

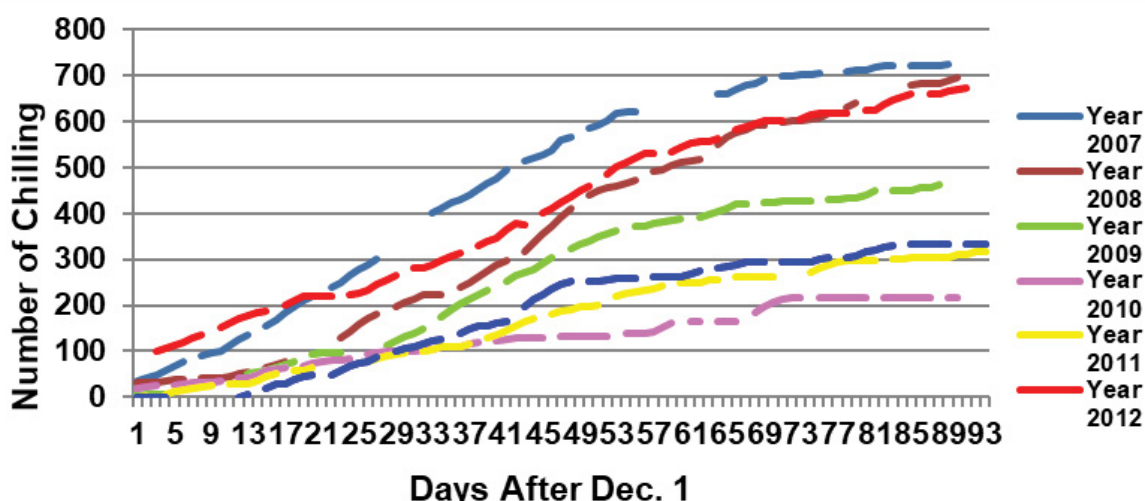


Figure 4. shows the curves for the number of chilling hours during the years 2007 – 2013.

Sudden heavy rainfall: Sudden heavy rainfall may affect dormancy, the trees health & productivity as we observed when heavy rain (42.5 mm) occurred in January 18, 2010 in less than 24 hours during dormancy. This caused break of dormancy in stone fruits trees earlier than expected leading to early fruit setting & start early harvesting stone fruit crops three weeks earlier, but the productivity was 50% less than normal years.

The combined effect of heavy rainfall & inadequate chilling hours on peaches Plawwhite & Nectarine Viowwhite at Orchard 2, Blk 15 on March 2010 is shown in Figure 3A and 3B.

Frost injury in spring: We observe every year frost damage in the spring months on late blooming cultivars of plum and early grapes cultivars as it occurred on March 18, 2010 & March 19, 2012. In the spring of 2012, there was significant effect of spring frost damage on stone fruits cultivars manifested into low productivity per tree and the load of the tree was concentrated on the tree tops while low branches of the trees was with less or nil productivity.

Incidence of sand storms: The incidence of sand storms during the blooming & fruit setting affects the productivity of fruit trees. Sand storm with warm air blown from the Sahara of North Africa on March 15, 2013 caused damage on the pollination & fruit setting of fruit trees and this effect was observed at TADCO orchards on late pollinated plum cultivars like Sapphire and on pears cultivar Ercolini.

FIELD OBSERVATIONS IN 2010 & 2011

The growth rate of the trees over the period 2010- 2011 varied from good to very good dependent on type of: fruit crop, rootstock, and the interaction of the rootstock with the scion and the training shape. Summary on the status of the stone fruits trees trial at Blk 21C during 2010 season are shown in **Figures 5, 6 and Table 6**.



(5a) Plum Pioneer



(5b) Plum Lady Red



(5c) Apricot Big Red



(5d) Apricot Pink Cot



(5e) Flat Type Nectarine Oreola



(5f) Round Type Nectarine Crimson Blaze



(5g) Apricot Spring Blush



(5h) Plum Gamonal

Figure 5. (a–h) The trees growth of the of the different stone fruits cultivars in June 2010.

Summary of the observations results on the different stone fruits cultivars in June 2010 are shown in the following **Table 6**.

Table 6. Summary of the observations results on the different stone fruits cultivars in June 2010.

Cultivar	Rootstock	No. of Trees	Planting Year	Fruit Shape	No. of Trees With Incompatibility	No. of Declined trees	% Damaged	Trees Growth
Peaches/ Paraguayo Delfin	Cadaman	30	2009	Flat type	0	0	Nil	V. Good
Nectarine/Oreola	Garnim (GXN - 15)	30	2009	Flat type	0	0	Nil	V. Good
Nectarine/ Mesembrine	Garnim (GXN - 15)	30	2009	Flat Type	0	0	Nil	V. Good
Nectarine/ Crimson Blaze	Garnim (GXN - 15)	30	2010	Round Type	0	0	Nil	Good
Nectarine/Royal Gem	Garnim (GXN - 15)	30	2010	Round Type	0	0	Nil	V. Good
Nectarine/Ruby Sweet	Garnim (GXN - 15)	30	2010	Round Type	0	1	3.3	Good
Apricot/Pink Cot	Myrobalan 29C	30	2010	Round Type	0	2	6.7	V. Good
Apricot/ Big Red	Myrobalan 29C	30	2010	Round Type	0	0	Nil	V. Good
Apricot/Spring Blush	Myrobalan 29C	30	2010	Round Type	0	0	Nil	Good
Plum/Alpa	Mariana (GF-81)	30	2009	Round Type	0	5	16.6	Good
Plum/ Black Splendor	Mariana (GF-81)	30	2009	Round Type	1	12	40	Good
Plum/ Pioneer	Mariana (GF-81)	30	2010	Round Type	0	0	Nil	Good
Plum/ Gamonal	Mariana (GF-81)	30	2009	Round Type	4	0	13.3	medium
Plum/Ruby Red	Garnim (GXN - 15)	30	2010	Round Type	0	2	6.7	Good
Plum/Lady Red	Garnim (GXN - 15)	30	2010	Round Type	0	1	3.3	Good

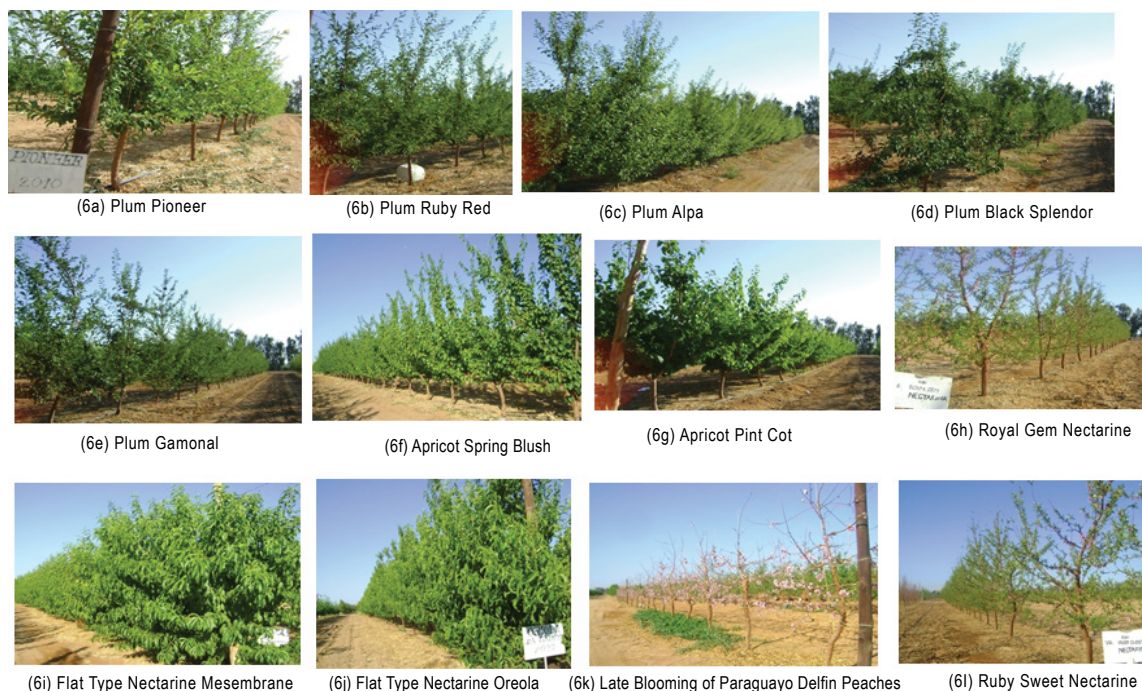


Figure 6. (a-i) The trees growth of the different stone fruits cultivars in June 2011.

Comments on field observations in 2010 & 2011

Trees were allowed to grow during 2010 with minimum pruning and most of the trees shown vigor growth during the summer months; the trees training shape was not decided yet. In 2011, most of the trees shown vigorous growth, and the trees shape in Plum, Nectarine & peaches cultivars were with central leading shape, while in Apricot cultivars were in open vase shape as shown on **Figures 5 and 6**.

There were some trees with serious problems as described in the following:

Incompatibility: It refers to the ability of the scion and the rootstock to form a functional long-term graft union, complete fusion of the adjoining cambial tissues is critical for effective translocation of water, nutrients and growth regulators. Areas that do not join shortly after grafting never fuse and such gaps leave weak points that provide sites for invasion by various pests and disease-causing agents. Four trees of plum crop, cultivar Gamonal shown incompatibility of the scion with the root stock GF 8-1 as shown in **Figure 7**; also one nectarine tree, cultivar Ruby sweet shown incompatibility with GXN 15 rootstock.



Figure 7. Incompatibility of Gamonal Plum budded on (GF-81) rootstock.



Figure 8. Silver leaf on Pink Cot Apricot.

Silver leaf: We observed the appearance of silvery leaves on Black Splendor Plum & Pink Cot Apricot on November 2011 as shown in **Figure 8**. The cause of this disease is the fungus *Chondrostereum purpureum*^[14,15]; this is a serious disease on stone fruit trees if not controlled. Following the appearance of the silvery sheen on the leaves, the affected branches died. When the branches are cut across, an irregular dark stain may be seen in the Centre. The application of copper fungicides such as Kocide during dormancy stopped the appearance of this disease in the following years.

Trees decline: The cause of trees decline could be mainly due to transplant problem or disease problem. We observed trees decline on different cultivars as follows:

- (12) Trees of Black Splendor Plum & five trees of Alpa Plum: both cultivars are budded on Mariana plum rootstock.
- (2) Ruby Red Plum trees budded on GXN-15 rootstock.
- (2) Pink Cot Apricot trees budded on Myrobalan 29C rootstock.
- (1) Tree on each of the cultivars: Lady Red Plum & Ruby Sweet Nectarine.

Incidence of gummosis disease: It was observed gum exudates at the trunk base of Black Splendor Plum Cultivar **Figure 9**. Gums are complex polysaccharides that are normally found in the vascular bundles of the plant parts^[15,16], the color of the gum varies: white, amber or brown. Gummosis occurs due to stresses caused by environmental conditions or organism attack on the plants, the gum become hydrated and causes the bundles to rupture. When this happens, the gums accumulate in pockets or are

exuded through weak points in the tissue. Most stone fruit diseases show gum deposits on the infected plant parts such as the bark surface or buds or fruits.

The application of copper fungicides such as Kocide during dormancy protects the trees from damages of this disease.

Incidence of crown gall: It was observed at the trunk base of Black Splendor Plum & Pink Cot Apricot **Figure 10**. Crown gall is an abnormal outgrowth on roots or trunk near ground level of fruit trees, sometimes it is found on the trunk and main scaffolds. The cause of this disease is *Agrobacterium tumifaciens* bacteria ^[15,16], usually it enters the roots through the wounds caused by machinery during cultural practices or wounds caused by soil insects or nematodes. Initially galls are creamy colored and soft, become roughened and crack as they get older. Tops of severely affected trees are weak and stunted, leaves are pale in color, tinted with red, then leaves fall and tree will die. Old trees may develop secondary fungus wood rots with weekend limbs above diseased area. The development of galls can occur in a few weeks or a few years depending on various environmental factors including host & temperature.

The pathogen spreads from the contaminated soil to new sites and plants by irrigation water, tools, wind, insects and plant parts used for propagation, and it survive in the soil indefinitely.

Control: Avoid planting infected plant material and use disease-free seedlings. Soak the trees roots before transplanting in a solution of the biological agent *Agrobacterium radiobacter*.



Figure 9. Gummosis at the base of Black Splendor Plum.



Figure 10. Crown Gall at the base of Pink Cot Apricot.

STONE FRUITS CULTIVARS PERFORMANCE IN 2011 & 2012

The most consistent plant characteristics and performance as observed in the Super High Density Trial of Stone Fruits crops in 2011 & 2012 are described in the following text.

PLUM CROP

Introduction

Plum crop is the most extensively distributed of the stone fruits crops, most varied in native and cultivated kinds, and most adapted to a wide range of soils and climatic conditions [13]. Plum flowers belong to the Rosaceae family which has simple five petals. The fruits show a wide range of size, flavor, color, and texture. They are widely eaten fresh, cooked, or baked in pastries. In full bloom, plum trees are covered with densely packed, showy flower clusters. The smooth-skinned fruit has a fleshy, juicy exterior and a hard interior stone or pit. Plum cultivars that can be or have been dried without resulting in fermentation are called prunes. Plums fruits are contributors of food energy, and have the potential to contribute greatly to human nutrition because of their richness in fibers, minerals, antioxidants and vitamins such as A and C.

Plum fruits range in shape from oval to round, and they are classified according to fruits size into:

Large size fruits: ≥ 50 mm

Small size fruits: ≤ 49 mm.

The color of plum fruits can be yellow, green, red, and purple. Plum according to their origin can be divided into two categories: Japanese and European. Japanese plum (which actually originated in China) is the larger of the two and has a juicier, softer flesh. European plum is good eaten fresh but is particularly well suited to drying and cooking.

The major factors limiting the shelf life of plums [11,12] are softening (overripe), fungal decay, reduced flavor quality (too low acidity, no aroma) and less favorable appearance (lack of freshness, shriveling or bruising). New cultivars should have fruits that stay firm during marketing and resistant to fungal diseases and have a fresh appearance; they should also have good flavor even after several weeks in the marketing chain.

Summary on the comparative quality parameters of the observed plums cultivars in 2011 and 2012 are shown **Table 7**.

Table 7. The comparative quality parameters of the observed plums cultivars in 2011 and 2012.

Parameter	Plums Cultivars									
	Gamanol		Black Splendor		Pioneer		Ruby Red		Alpa	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Harvest Qua. / Kg	47		85.6	375	6.4	190	5.88		2.9	0
Productivity Kg/tree	1.74		4.3	18.75	0.2	6.3	0.2		0.1	0
Firmness (lbf)	5.5		7.48	8.8	7.3	9.9	9		10.7	0
Total Soluble Solid (T.S.S.%)	17.7		15.6	14	17.7	15.5	17.4		16.1	0
Color %	95% Black		Black		yellow		85% Red		70% Red	
Sizing %										
Diameter, Cm	5.4		6.3	5.6	5.3	5.6	5		5.4	0
Circumference Cm	16.8		20	17.2	15.5	15.7	15.7		17.1	0
Avg Weight in Gram	77.4		124	70.4	64	70.7	71.4		88.3	0
Stone*	Clingstone		Clingstone		Clingstone		Clingstone		Clingstone	
Test	Good		Acceptable		V. Good		Sour		Sour	
Defects % *										
Crack	0		0	0	0	0		0	0	0
Soft	0		0	0	0	0		0	0	0
Misshape	0		0	0	0	0		0	0	0
Blemish	0		0	0	0	0		0	0	0
Damage	0		0	0	0	0		0	0	0
Sun Scald	40%		10%	5%	0	0		0	0	0
Insect Damage	Thrips 20%		20%	15%	10%	3%	Thrips 5%		0	0
Bruise	0		0	0		0		0	0	0
Gummy	0		0	0		0		0	0	0
Total Defects %	60%		30%	20%	10%	3%		5%	0%	0%

***Clingstone** refers to a drupe having a stone, which cannot easily be removed from the flesh. The flesh attached strongly to the stone and must be cut to free the stone.

Observations on plums cultivars

Black splendor plums: 30 trees of this cultivar budded on Mariana rootstock were planted in 2009. It started production in 2011; dates of blooming, fruit setting & harvesting are shown **Table 8**.

Table 8. Observations on Black Splendor cultivar in 2011 and 2012 cropping seasons.

Parameter	Date of Blooming		Date of Fruit Setting		Date of Harvesting	
	2011	2012	2011	2012	2011	2012
Self-pollination	Feb. 19	Feb. 16	20-Mar	15-Mar	12-Jun	6-Jun
Accumulated Chilling Hours	301	617	348	717	354	749

Summary of the observations on Black Splendor Plums cultivar:

Low chilling hours requirement ≤ 300 hours.

The skin color is Blue/Black with mahogany color on the shoulders.

Fruit oblate, medium size and the flesh color is beet red when it ripe **Figure 11**.

Clingstone.

Eating quality is good with a tart flavor; %TSS range 13.5-15.6.

Early maturing cultivar by the end of May, harvesting started two weeks before Sapphire, one month before Black Diamond, & 40 days before Laetitia & Larry Anne plums cultivars grown at TADCO.

Trees growth on Mariana rootstock is suitable for Super High Density planting.

Observed suckers growth of (3-10)/tree grown from Mariana rootstock.

Observed some gum exudates on the trunk.

Average productivity/tree in 2012 & 2013=20.125 kg

The comparative quality parameters for Black Splendor fruits are shown in the quality **Table 7**.



Figure 11. Black Splendor Plums Fruits

Gamonal plums

30 trees of this cultivar budded on GF - 81 rootstock were planted in 2009. We arranged three Pioneer trees in between the raw as pollinators. It started production in 2011; dates of blooming, fruit setting & harvesting are shown in **Table 9**.

Table 9. Observations on Gamonal cultivar in 2011 and 2012 cropping seasons.

Parameter	Date of Blooming		Date of Fruit Setting		Date of Harvesting	
	2011	2012	2011	2012	2011	2012
Self-pollination	Feb. 24	Feb. 25	20-Mar	15-Mar	27-Jun	23-Jun
Accumulated. Chilling Hours	305	606	741	717	354	749

Summary of the observations on this cultivar:

- i. Low chilling hours requirement.
- ii. The skin color is black to red when it ripe.
- iii. Fruit size is large and the flesh color when it ripe is yellowish green **Figure 12**.
- iv. Clingstone.
- v. Eating quality is good. TSS% reached 17.7
- vi. Harvesting started three weeks after Black Splendor & Pioneer, it was harvested on June 27 in 2012. It was similar

with the harvesting dates of Sapphire, but 28 days before Laetitia, Larry Anne & Black Diamond plums cultivars grown at TADCO.

- vii. No Suckers come from GF 8-1 rootstock.
- viii. Observed some gum exudates on the trunk.
- ix. Observed three trees are with Incompatibility between rootstock & scion.
- x. Average productivity/tree in 2012 & 2013=4.77 kg

The comparative quality parameters for Gamonal fruits are shown in the quality **Table 7**.



Figure 12. Gamonal Plums Fruits.

Pioneer plums

30 trees of this cultivar budded on GF 8-1 rootstock were planted in 2010. It started production in 2011 with little yield. Dates of blooming, fruit setting & harvesting are shown in **Table 10**.

Table 10. Observations on Pioneer cultivar in 2011 and 2012 cropping seasons.

Parameter	Date of Blooming		Date of Fruit Setting		Date of Harvesting	
	2011	2012	2011	2012	2011	2012
Self-pollination	Feb. 19	Feb. 4	26-Mar	15-Mar	15-Jun	4-Jun
Accumulated. Chilling Hours	301	583	354	717	354	749

Summary of the observations on this cultivar:

- i. Low chilling hours requirement.
- ii. The skin color is yellowish with partial red color.
- iii. Flesh color when it ripe is light yellow **Figure 13**.
- iv. Fruit size is medium to small
- v. Clingstone.
- vi. -. Eating quality is very good. TSS% range 15.2-17.7
- vii. Harvesting started early: two days after Black Splendor, it was harvested two weeks before Sapphire, 24 days before Black Diamond, 38 days before Laetitia & Larry Anne.
- viii. Observed suckers growth (2-5)/ tree comes from GF 8-1 rootstock.
- ix. Observed high gum exudates on the trunk and major branches.
- x. Average productivity/tree in 2012 & 2013=11.6 kg

The comparative quality parameters for Pioneer fruits are shown in the quality **Table 7**.



Figure 13. Pioneer Plums Fruits.

Ruby red plums

30 trees of this cultivar budded on GXN-15 rootstock were planted in 2009. It started production in 2011 with low yield, and productivity was low in 2012 due to spring frost occurred on March 19 which affected the flowers.

Summary of the observations on Ruby Red cultivar:

- i. Cross pollination with Sapphire cultivar.
- ii. Starting flowering in February 20, 2011, when the accumulation chilling Hours is equal 348.
- iii. Started fruit setting on April 4, 2011.
- iv. Medium chilling hours requirement,
- v. The fruit skin color is red, and the flesh color is yellowish when it ripe **Figure 14**.
- vi. TSS% reached 17.4
- vii. Clingstone.
- viii. Late maturity cultivar as harvesting started on July 16, 2011 which was one week before Laetitia & Larry Anne, five days after Black Diamond, and two weeks after Sapphire cultivars grown at TADCO.
- ix. No suckers came from the rootstock.
- x. Observed some gum exudates on the trunk and major branches.

The comparative quality parameters for Ruby Red fruits are shown in the quality **Table 7**.



Figure 14. Ruby Red Plums Fruits.

Alpa plums

30 trees of this cultivar budded on Mariana rootstock were planted in 2009, it started productions in 2011 with little yield, and no productivity in 2012 due to spring frost on March 16 which affected flowers.

This is some characteristics of Alpa cultivar for 2011 only:

- i. Self-pollination

- ii. Started flowering on March 10, 2011, When the accumulate chilling hours is equal 320.
- iii. Started fruit setting on April 4, 2011.
- iv. Medium chilling hours requirement,
- v. The skin color is pinkish, and the flesh color when ripe is yellowish **Figure 15**.
- vi. TSS% reached 16.1
- vii. Clingstone.
- viii. Late maturity variety as harvesting started on August 13 which is 20 days after Laetitia, 30 days after Black Diamond & Larry Anne and 45 days after Sapphire.
- ix. Observed some suckers (1-3)/tree comes from Mariana rootstock.
- x. Observed some gum exudates on the trunk.

The comparative quality parameters for Alpa fruits are shown in the quality **Table 7**.



Figure 15. Alpa Plums Fruits.

Lady red plums

30 trees of this cultivar budded on GXN-15 were planted in 2010. It started blooming on March 10, 2011 with non homogenous flowering when the accumulated chilling hours reached 320, but with failure in fruit setting

This is some characteristic of Lady Red Plum cultivar:

- i. Self pollinated
- ii. No suckers come from rootstock.
- iii. Observed some gum exudates on the trunk.
- iv. Medium to low chilling hours requirement,
- v. The skin color is red blush.
- vi. Flesh color when it ripe is yellowish. TSS% reach 15.
- vii. Stone semi-free.
- viii. Late maturity cultivar.

NECTARINE CROP

Introduction

Nectarine trees produce sweet fruits ^[13] that is not only delicious but it is a nutritious source of antioxidant, vitamins such as A and C, and they are a good source for potassium and a contributor of food energy. Nectarines can be used in the same way as peaches. Genetically, the only difference between peaches and nectarines is the lack of fuzz on the skin of nectarines. Nectarines are usually a little smaller than peaches, have more aromas, and have more red color on the skin.

Nectarines are mostly self-pollinating trees, which mean that a single nectarine tree can pollinate itself. Nectarine trees are fast growing and most will begin to produce fruit in 2 to 3 years after planting under TADCO conditions.

The leaves and buds of Nectarine trees look similar to peaches; the leaves are long, glossy, and bright green in color. The trees height reaches between 2-5 meters. The colorful spring flowers, the dangling fruits in the summer, and the red yellow foliage

in the autumn are very pleasing to the eye. There are more than 100 cultivars of nectarine, in freestone and clingstone cultivars. Nectarines do not have to be peeled because they do not have the fuzz on the skin. Leave the skin on when making pies, cobblers and fruit salads. Nectarine fruits are round with global shape or flat; they are classified according to fruit size into:

Large size fruits: ≥ 67 mm.

Medium size fruits: 56-66 mm.

Small size fruits: 55 mm or smaller.

The comparative quality parameters ^[11] of the observed Nectarines cultivars are shown in the following **Table 11**.

Table 11. Comparative quality parameters of the observed Nectarines cultivars.

Parameter	Nectarines Cultivars					
	Royal Gem		Ruby Sweet		Crimson Blaze	
	2011	2012	2011	2012	2011	2012
Harvest Qua. / Kg	78	417	8.6	192.7	0	622.7
Productivity Kg/ tree	2.6	13.9	0.3	6.6	0	21.5
Firmness (lbf)	15	10.1	17.4	10.1	0	11
Total Soluble Solid (T.S.S.%)	15.3	13.5	12.9	12	0	9
Color %	95% Red	90 Red	90% Red	90% Red	0	90% Red
Sizing %						
Diameter, Cm	5.9	6	5.6	5.97	0	5.5
Circumference Cm	18.6	18.1	19.5	18.9	0	18.2
Ave. Weight in Gram	107.7	111	118	112.9	0	91
Stone	Clingstone		Clingstone		Clingstone	
Defects %						
Crack	0	5%	0	5%	0	0
Soft	0	3%	0%	3%	0	0
Misshape	0		0%	0%	0%	0
Blemish	0		0	0	0	0
Sun Scald	0	1%	0	1%	0	2
Insect damage	20%	25%	25%	20%	0%	25
Bruise	0		0	0	0	0
Gummy	5%	10%	10	10	0	0
Total Defects %	25%	44%	35%	39%	0	27%

Royal gem nectarines

30 trees of this cultivar budded on GXN-15 rootstock were planted in 2010, it started production in 2011. Dates of blooming, fruit setting & harvesting in 2011 and 2012 cropping seasons are shown in the following **Table 12**.

Table 12. Date of blooming, fruit setting & harvesting in 2011 and 2012 cropping season.

Parameter	Date of Blooming		Date of Fruit Setting		Date of Harvesting	
	2011	2012	2011	2012	2011	2012
Self-pollination	Feb. 12	Jan. 30	15-Mar	10-Mar	27-Jun	15-Jun
Accumulated. Chilling Hours	273	554	337	717.7	354	749

Summary of the observations on Royal Gem cultivar

- i. Medium chilling hours requirement,
- ii. Fruit color is Pinkish and the flesh is yellow green when it ripe **Figure 16**.
- iii. The stone is Clingstone.
- iv. TSS% range 13.5-15.3
- v. Harvesting started late in mid of May. It is harvested one month after the harvesting date of Viowhite.
- vi. Average productivity/tree in 2012 & 2013=14.9 kg
- vii. Observed small gum exudates on the trunk.
- viii. Observed suckers growth 1-3/tree comes from GXN-15 rootstock.

ix. The quality parameters for Roval Gem fruits are shown in the quality **Table 11** of Nectarines cultivars.



Figure 16. Royal Gem Nectarines fruits.

Ruby sweet nectarines

30 trees of this cultivar budded on GXN-15 rootstock were planted in 2010. It started production in 2011. Dates of blooming, fruit setting & harvesting are shown in the following **Table 13**.

Table 13. Date of blooming, fruit setting & harvesting.

Pollination	Flowering Date		Fruit Setting		Harvesting Date	
	2011	2012	2011	2012	2011	2012
Self-pollination	Feb. 12	30-Jan	15-Mar	10-Mar	27-May	7-May
Accumulated Chilling Hours	273	554	337	717.7	354	749

Summary of the observations on Ruby Sweet cultivar

- i. Medium chilling hours requirement.
- ii. Fruit color is Pinkish, and the flesh color is yellow when it ripe **Figure 17**.
- iii. The stone is clingstone.
- iv. TSS% range 12.9-15.6
- v. Medium maturity cultivar as harvesting started by the first week of May 10 days after harvesting date of Viowhite.
- vi. Observed small gum exudates on the trunk.
- vii. Observed some suckers growth of 1-3/tree comes from GXN rootstock.
- viii. The comparative quality parameters for Ruby Sweet fruits are shown in the quality **Table 11**.



Figure 17. Ruby Sweet Nectarines Fruit.

Crimson blaze nectarines

30 trees of this cultivar budded on GXN-15 rootstock were planted in 2010. It started production in 2012. Dates of blooming, fruit setting & harvesting are shown in the following **Table 14**.

Table 14. Date of blooming, fruit setting & harvesting.

Pollination	Flowering Date		Fruit Setting		Harvesting Date	
	2011	2012	2011	2012	2011	2012
Self pollination	0	18-Feb	0	20-Mar	0	5-Jun
Accumulated	0	623	0	741	0	749
Chilling Hours						

Summary of the observations on Crimson Blaze cultivar

- i. Fruit color is Pinkish and the flesh color is yellow to orange when it ripe **Figure 18**.
- ii. TSS% range is low 8-10.
- iii. The stone is clingstone
- iv. - Late maturing cultivar, harvesting started one month after the harvesting date of Viowwhite.
- v. Observed small gum exudates on the trunk.
- vi. Observed suckers growth of 1-3/tree comes from GXN rootstock.
- vii. Productivity/tree in 2012 & 2013 is high=29.45 kg
- viii. The comparative quality parameters for Crimson Blaze fruits are shown in the quality **Table 11**.



Figure 18. Crimson Blaze Nectarines fruits.

Flat type mesembrane nectarines

30 trees of flat type Mesembrane Nectarine budded on Garnim rootstock were planted in 2009, there was little production of fruits of bad quality in 2011 as shown in **Figure 19**, and no production in 2012 due to frost on March 19, 2012.

Summary of the observations on Mesembrane Nectarine cultivar

- i. Started flowering on Feb 25, 2012 when the accumulative chilling hours reached 606 and continued until after mid of March.
- ii. There was no fruit setting in 2012 season due to frost on March 19.
- iii. Observed suckers growth of 5-10/tree coming from Garnim root stock.



Figure 19. Flat Type Fruits of Mesembrane Nectarines.

Flat type nectarines oreola

30 trees of flat type Mesembrane Nectarine budded on Garnim rootstock were planted in 2009. There was no production in 2011 and 2012.

Summary of the observations on Oreola Nectarine cultivar:

- i. Started flowering in March 5. When accumulative chilling hours reached 701 and continued until March 25, 2012.
- ii. There was no fruit setting in 2012 due to frost on March 19.
- iii. Observed suckers growth of 7-13/tree coming from Garnim rootstock.

FLAT TYPE PEACHES

Flat type peaches paraguayo delfin

30 trees of this cultivar budded on Cadaman roots tock were planted in 2009.

Summary of the observations on Paraguayo Flat Type Peaches cultivar

- i. The tree growth was moderately vigorous with semi-spreading growth habit.
- ii. It was with late blooming as it bloomed on March 18 until April 4, 2011, 2012 (**Figure 20A**) when the accumulative chilling hours reached 354, 723 in 2011 and 2012 seasons respectively with non-homogenous flowering.
- iii. No fruit setting in 2011 and with small fruits setting in 2012 an indication of long chilling hours requirement.
- iv. Observed too much suckers growth comes from Cadaman rootstock **Figure 20B**.
- v. Fruits are flat type.



Figure 20. (A) Peaches Paraguayo Delfen with late blooming on April 4, 2011, (B) Peaches Paraguayo Delfen with suckers came from the Cadaman rootstock.

APRICOT CROP

Introduction

Fruit of the tree *Prunus armeniaca*, in the rose family, cultivated generally throughout the temperate regions of the world and used fresh ^[14,15], cooked in pastries, or preserved by canning or drying. Apricot trees are large and spreading, with heart-shaped, dark green leaves. Flowers are white. The fruit is nearly smooth and generally similar to the peach in shape but with little to no hairiness when ripe. Apricots are a contributors of food energy, and a good source of vitamin A and are high in natural sugars. In addition, dried apricots are a valuable source of iron and calcium. The species is genetically diverse and can grow in a wide range of climates depending upon the cultivar.

Most commercial production in the world is limited to areas where temperatures do not fall below -10 to -22 °C for extended periods; however, certain cultivars can tolerate sever conditions. Many apricot cultivars can tolerate high summer temperatures in excess of (40 °C). Some cultivars develop an internal browning of the flesh if high temperatures persist with fruits on the trees. Apricot trees tend to bloom earlier than other stone fruit and are sensitive to frost. Frost-free areas are generally preferred.

Apricot fruits are classified according to fruit size into:

Large size fruits: ≥ 56 mm.

Medium size fruits: 45-55 mm.

Small size fruits: 44 mm or smaller

The comparative quality parameters of the observed apricots cultivars ^[12] are shown in the following **Table 15**.

Table 15. Comparative quality parameters of the observed apricots cultivars.

Parameter	Apricots Cultivars					
	Spring Blush		Big Red		Pink Cot	
	2011	2012	2011	2012	2011	2012
Harvest Quantity (Kg)	1.8	13.2	Jan-00	Aug-00	Jan-00	Jan-00
Productivity Kg/tree	0.06	0.4	0.03	7.98	0	0.1
Firmness (lbf)	7.5	4.8	8.6	3	0	3
Total Soluble Solid (T.S.S.%)	12.8	13.2	15.5	14.2	0	13
Color %	95% Pinkish	95% Pinkish	80% Red	85% Red	85%Yellowish	
Sizing %						
Diameter, Cm	3.1	3.7	3.2	4.3	0	4.9
Circumference Cm	11	11.9	12.1	13.7	0	14.4
Avg Weight in Gram	31	33.6	29	37.3	0	55.82
Stone*	Freestone		Freestone		Semi- free	
Defects % *						
Crack	0	0	0	0	0	0
Soft	0	0	0	5	0	0
Misshape	0	0	0	0	0	0
Blemish	0	0	0	0	0	0
Damage	0	0	0	0	0	0
Sun Scald	0	0	0	0	0	0
Scale Insect	0	0%	0	0%	0	20%
Bruise	0	0%	0%	0%	0	0
Gummy	0	0%	0%	0%	0%	0
Total Defects %	0%	0%	0%	5%	0	20%

***Freestone** refers to a drupe having a stone, which can be removed from the flesh with ease. The flesh is not attaching to the stone and does not need to be cut to free the stone. Freestone cultivars of fruits are preferred for uses that require careful removal of the stone, especially if removal will be done by hand.

Spring blush apricots

30 trees of this cultivar budded on Myrobalan 29C rootstock was planted in 2010; it started with little fruits production in 2011. Dates of blooming, fruit setting & harvesting are shown in the following **Table 16**.

Table 16. Date of blooming, fruit setting & harvesting.

Pollination	Flowering Date		Fruit Setting		Harvesting Date	
	2011	2012	2011	2012	2011	2012
Self-pollination	10-Mar	4-Mar	26-Mar	31-Mar	8-May	7-May
Accumulated Chilling Hours	320	692	337	749	354	749

Summary of the observations on Spring Blush apricots cultivar

- i. Medium chilling hours requirement.
- ii. The skin color is pinkish and the flesh color when ripe is yellowish **Figure 21**.
- iii. TSS% reached 12.8.
- iii. Freestone.
- iv. Harvest started by the first week of May in 2011 & 2012. It is 6 days after the harvesting date of the early apricot cultivar A-35, & two weeks before Canino and Charisma.
- v. Very low productivity, average productivity/tree in 2011 & 2012=0.23 kg, and no productivity in 2013.
- vi. Some suckers (1-3)/ tree appeared on the base of the rootstock.
- vii. No gum exudates on the trunk.
- viii. The quality parameters for Spring Blush fruits are shown in the quality **Table 12**.



Figure 21. Apricot fruits of Spring Blush cultivar.

Big red apricots

30 trees of this cultivar budded on Myrobalan 29C rootstock was planted in 2010; it started production of few fruits in 2011. Dates of blooming, fruit setting & harvesting are shown in the following **Table 17**.

Table 17. Date of blooming, fruit setting & harvesting.

Pollination	Flowering Date		Fruit Setting		Harvesting Date	
	2011	2012	2011	2012	2011	2012
Self-pollination	10-Mar	4-Mar	30-Mar	25-Mar	17-May	16-May
Accumulated. Chilling Hours	320	692	337	647	354	749

Summary of the observations on Big Red apricots cultivar

- i. Medium chilling hours requirement.
- ii. The skin color is Pinkish and the flesh color when ripe is yellowish **Figure 22**.
- iii. TSS% range 14.2–15.5
- iv. Freestone.
- v. Low productivity 2.98 kg/tree in 2012 and 5.5 kg/tree in 2013. It was harvested 9 days after Spring Blush and two weeks after the early apricot cultivar A-35, and at the same time with Canino and Charisma apricot cultivars grown at TADCO.
- vi. No suckers appeared on the rootstock.
- vii. No gum exudates appeared on the trunk.
- viii. The quality parameters for Big Red fruits are shown in the quality **Table 12**.



Figure 22. Big Red Apricots Fruits.

Pink Cot Apricots

30 trees of this cultivar budded on Myrobalan 29C rootstock was planted in 2010. It started production of few fruits in 2011. Dates of blooming, fruit setting & harvesting are shown in following **Table 18**.

Table 18. Date of blooming, fruit setting & harvesting.

Pollination	Flowering Date		Fruit Setting		Harvesting Date	
	2011	2012	2011	2012	2011	2012
Self-pollination	10-Mar	10-Mar	No Fruit Setting	31-Mar	0	19-May
Accumulated. Chilling Hours	320	715.7		749	0	749

Summary of the observations on Pink Cot apricots cultivar:

- i. Medium chilling hours requirement.
- ii. The skin color is pinkish and the flesh color when it ripe is yellowish **Figure 23**.
- iii. Freestone.
- iv. Very low productivity, average productivity/tree in 2011 & 2012=0.05 kg/tree, and no productivity in 2013.
- v. Late harvesting on May 19. It is harvested 9 days after Spring Blush and two weeks after the early apricot cultivar A-35, and at the same date of Canino and Charisma of apricot cultivars grown at TADCO. Very few fruits were harvested on May 19, 2012.
- vi. Some suckers (1-3)/ tree appeared at the rootstock.
- vii. No gum exudates on the trunk.
- viii. The quality parameters for Pink Cot fruits are shown in the quality **Table 12**.



Figure 23. Pink Cot Apricots Fruits.

COMMENTS ON BLOOMING, FRUIT SETTING & PRODUCTIVITY OF STONE FRUITS CULTIVARS IN 2012

The average dates for blooming & fruit setting of stone fruits under study was week 8 to week 13 during the period Feb 19 – March 26. Spring frost occurred on March 18 in 2010 and March 19 in 2012 caused damage to the flowers in the form of dry flowers as shown in **Figure 24** which affected fruit setting by killing the fruit embryo, and therefore affected the productivity of the damaged cultivars.

When the spring frost occurred in March 19, 2012, some of the stone fruit cultivars did not reach 100% blooming like Lady Red and Ruby Red (cross-pollinated cultivars) as they reached complete flowering on March 26 two weeks after the full bloom of the pollinators. This delay in blooming had caused a serious pollination problem to these cultivars. Some cultivars were not with homogenous flowering like Lady Red & Pioneer, and this gave them chance to escape partially the frost damage.

Invasion of flower thrips *Frankliniella occidentalis* during blooming & fruit setting affected productivity ^[16]. The insects feed and lay eggs into the buds, blossoms and small fruits in early spring leading to the formation of corky scars on the fruits surface which lowers the fruits quality. Thrips caused serious damage on the fruits of the following Plums & Nectarines cultivars, (**Figures 25 and 26**):

Plums cultivars: Black Splendor & Pioneer.

Nectarines: Mesembrane, Royal Gem, Ruby Sweet.

We observed misshape on the fruits of Royal Gem Nectarines (Twin Fruits) which apparently was due to poor pollination, and it could be caused by physical injury of frost or pests and diseases (**Figure 27**).



Figure 24. Dry Plum flowers caused by the frost in March 19, 2012.

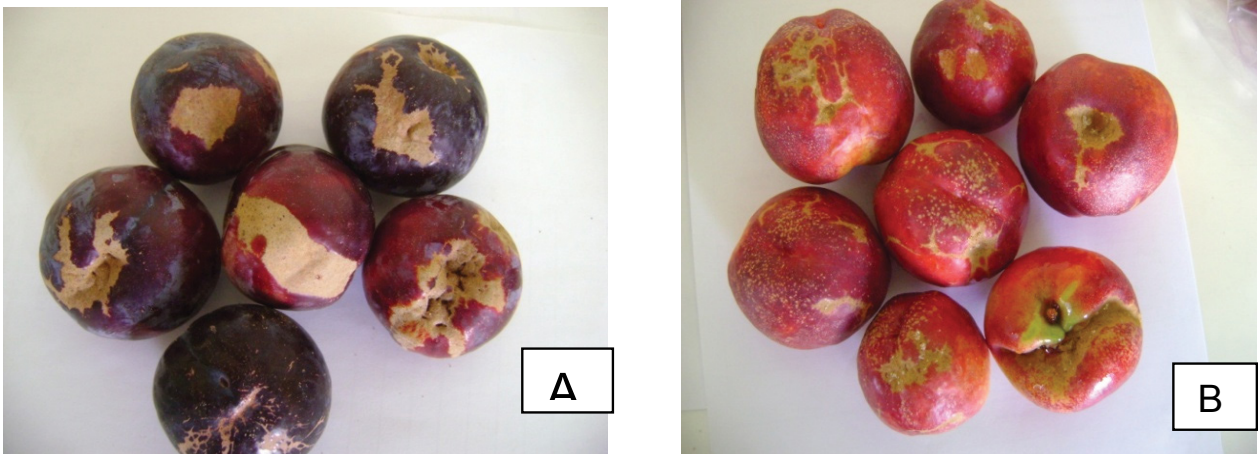


Figure 25. (A) Thrips Damage on the fruits of Black Splendor Plums and (B) on the fruits of Ruby Sweet Nectarines.



Figure 26. Dead tree of Pink Cot apricot due to Crown Gall disease.



Figure 27. Twin fruits on Royal Gem Nectarine.

OBSERVATIONS ON STONE FRUITS CULTIVARS ON APRIL 23, 2013

Summary on the various stone fruits cultivars / rootstocks combinations in relation to tree growth size, height, bearing fruits and the rootstocks suckers are shown in the following **Table 19, Figures 28 and 29:**

Table 19. Summary on the various stone fruits cultivars/root stock combinations in relation to tree growth size, height, bearing fruits and the root stock suckers.

Location	Cultivar/ Rootstock	Tree growth	Tree Height	Tree Bearing	Rootstock	Suitability for Tabuk Area
1A	Paraguayo delfin Peaches/Cadaman	Vegetative Just started,	2 - 3 meter	At the last blooming stage	Too much suckers of green color (Cadaman)	Not suitable for TADCO
2A	Oreola, Nectarines/ Garnim	Vigorous Trees	3 - 4 Meter	No fruit bearing	Too much rootstock suckers	Not suitable for TADCO
3A	Mesembrine Nectarines/ Garnim	Vigorous Trees	3 - 4 meter	Little fruit bearing	Red rootstock suckers	Not suitable for TADCO
4A	Lady Red Plum /GXN 15	Vigorous growth	4 meter	Very low	Red Rootstock. Plum green	Not suitable for TADCO
5A	Big Red Apricots / Myrobalan 29 C	Vigorous	4 meter	Almost no fruits, chilling hours problem	No Green rootstock suckers	Not suitable for TADCO,
6A	Spring Blush Apricots / Myrobalan 29 C	Vigorous	4 meter	Almost no fruits, chilling hours problem	Vigorous rootstock suckers	Not suitable for TADCO,
7A	Crimson Blaze Nectarine/ GXN 15	Vigorous Trees	4 meter	High fruit bearing	No growth	Suitable for TADCO
1B	Alpa Plums /Mariana	Vigorous	3 - 4 meter	No bearing	No rootstock growing	Not suitable for TADCO
2B	Black Splendor Plums/ Mariana	Medium Vegetative Growth Trees	2 - 3 meter	Medium to high fruit bearing, more fruits thinned.	Few Suckers, bended trees heads	High productivity, fruits little sour
3B	Pioneer Plums /GF 8-1	Vigorous growth	2 - 3 meter	Medium bearing, more fruits thinned,	Medium suckers, bended trees heads	V. Good cultivar, fruit size medium
4B	Gamonal Plums /GF 8-1	Vigorous	2 - 3 meter	Minimum to medium	Minimum suckers, Medium load	cultivar with big fruits, late harvest
5B	Pink cot Apricots / Myrobalan 29 C	Medium Vigorous	2 - 3 meter	No fruit bearing, chilling hours problem	Minimal suckers	Not suitable for TADCO,
6B	Ruby Red Plums /GXN 15	Vigorous	4 meter	Low fruit bearing	Minimal suckers (Red)	Not suitable for TADCO
7B	Royal Gem Nectarines/ GXN 15	Vigorous	4 meter	Medium fruit bearing	Minimal rootstock growth (Red)	Promising cultivar



Figure 28. Plum trees cultivars bearing fruits: (A) Black Splendor, (B) Gamonal and (C) Pioneer on May 23, 2013.

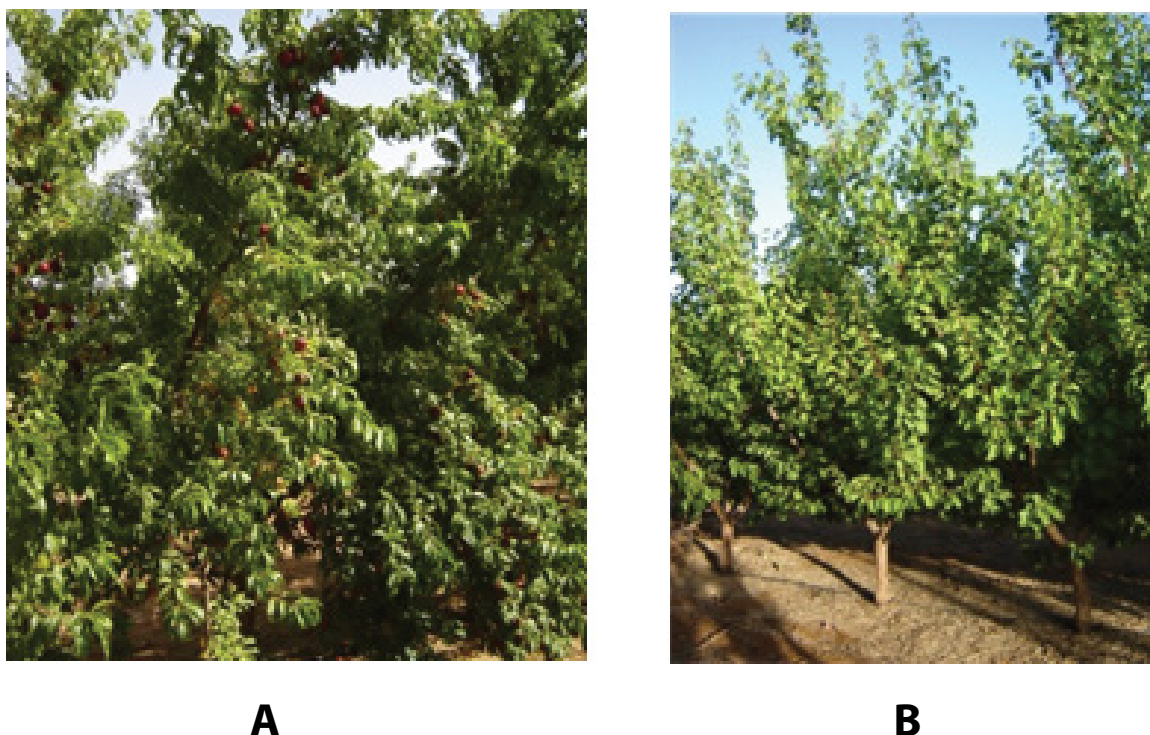


Figure 29. Nectarine Crimson Blaze (A), and Apricot Big Red (B) on May 2013.

DISCUSSION

Field observations had shown vigorous trees growth, high yield and high quality of some cultivars under the influence of the selected rootstocks, good preparation of the soil after the deep ripping and reclamation of soil by the addition of gypsum and sulfuric acid before planting. Research unit personnel observed in the 2011 season the start of production on the cultivars planted in the 2009, and in the 2012 season for the cultivars planted in 2010. The productivity of the different cultivars ranged from season to season based on: the number of chilling hours, the occurrence of frost damage in the 2012 spring season, and the nature of the cultivar if it was self-pollinated as in the peach, nectarine and some plum cultivars or they need to be pollinated, like most plum cultivars and French apricot cultivars. Presumably most of the rootstocks used with the cultivars were early to medium maturity with low to medium chilling hours requirements. The Productivity of fruit trees cultivars were affected in 2012 due to frost on March 19, but in 2013 season productivity of most TADCO stone fruit cultivars were with good fruits bearing. Most of the cultivars in the experimental area were with good load in 2012 & very good load in 2013. So, the cultivars of Plum, Nectarine, and Apricot which bear little fruits in 2012 and no fruits in 2013 were not suitable for TADCO due to the fact they need longer period of chilling hours ^[14,15] as per the results shown in **Tables 20 and 21.**

The average dates for blooming & fruit setting of stone fruits under study was week 8 to week 13 during the period Feb 19 – March 26. Spring frost occurred on March 19 in 2012; this caused damage to the flowers in the form of dry flowers and affected fruit setting by killing the fruit embryo, and therefore affecting the productivity of the damaged cultivars. When the spring frost occurred on March 19, 2012, some of the stone fruit cultivars did not reach 100% blooming like Lady Red and Ruby Red (cross-pollinated cultivars) and they reached complete flowering on March 26 two weeks after the full bloom of the pollinators. This delay in blooming had caused a serious pollination problem to these cultivars. Some cultivars were not with homogenous flowering like Lady Red & Pioneer, and this apparently allowed them to partially escape the frost damage.

Invasion of flower thrips *Frankliniella occidentalis* during blooming & fruit setting affected productivity [16]. The insects feed and lay eggs into the buds, blossoms and small fruits in early spring leading to the formation of corky scars on the fruits surface which lowers the quality of the fruits. Thrips caused serious damage on the fruits of Black Splendor & Pioneer plum cultivars and on the fruits of Mesembrane, Royal Gem, Ruby Sweet nectarine cultivars. The misshape of Royal Gem Nectarine fruits (Twin Fruits) was apparently due to poor pollination.

The results obtained shown that there were promising cultivars with good productivity and suitable for TADCO conditions, see **Table 20**:

Plum cultivar Black Splendor: Established by the US Department of Agriculture, self-pollinating and with low chilling hours requirements, early production and high productivity, with an average of 20 kg per tree. The color of the fruit is blackish blue and the color of the flesh is red similar to the color of the beet root. It is useful for fighting cancer in the human body because it contains high levels of antioxidants such as blackberry, and its taste is good with the presence of light acidity.

Plum cultivar Pioneer: South African origin, self-pollinating with low chilling hours requirements and early production, and the productivity was good with an average of 11.6 kg/tree and the taste is wonderful. The color of the fruit is yellow, with slight redness on a part of the fruit. It is the pollinator for Gamonal plum cultivar.

Nectarine Crimson Blaze is a South African cultivar, self-pollinating, low-chilling hours requirements, it is with medium maturity date by the mid of May with high productivity of 29.5 kg/tree. Its taste is acceptable, with about 9% of total soluble solids. The color of the fruit is bluish red with a slight redness on the part of the fruit.

Nectarine Royal Gem: South African origin, self-pollinating, low chilling hours requirements with medium maturity date by mid of May, had a good yield of 14.9 kg/tree good taste with about 14% total soluble solids. The color of the fruit is bluish red with a slight redness on the part of the fruit.

Table 20. Summary results for the productivity of selected stone fruits cultivars in two cropping seasons.

Plum	Season	Chilling Hours	Productivity Kg/Tree		
			Black Splendor	Pioneer	Gamonal
	2012	749	18.75	6.3	1.74
	2013	340	21.5	16.9	7.8
	Productivity Kg/Tree		20.1	11.6	4.77
Nectarine	Season	Chilling Hours	Productivity Kg/Tree		
			Crimson Blaze	Royal Gem	Ruby Sweet
	2012	749	21.5	13.9	6.6
	2013	340	37.4	15.9	6.1
	Productivity Kg/Tree		29.45	14.9	6.35
Apricot	Season	Chilling Hours	Productivity Kg/Tree		
			Spring Blush	Big Red	Pink Cot
	2012	749	0.4	7.98	0.1
	2013	340	Nil	Nil	Nil
	Productivity Kg/Tree		0.2	3.99	0.05

The apricot cultivars produced small amounts of fruits in the seasons of 2011 and 2012, and only Big Red cultivar produced 5.5 kg/tree in the 2013 season. Therefore, they were not suitable for the Tabuk region apparently due to their need for high chilling hours and need for Tom Cot pollinator. The company has successful apricot alternatives cultivars such as the early maturing cultivar A-35. For the flat type peaches and nectarine cultivars, they did not produce satisfactory yield due to high chilling hours requirements.

It had been noted that most of the selected rootstocks for the stone fruits cultivars were suitable in the calcareous alkaline salty soil except Mariana rootstock as we observed decline of the cultivars budded on this rootstock: twelve trees (40%) of Black Splendor plum cultivar were died, and five trees (16%) of Alba plum cultivar. Most of the rootstocks encouraged trees growth and did not reduce the size of the trees of the different cultivars to fit the super high density planting with the main leader system or the open center system. So, search for dwarfing rootstock [8] for super high density planting is needed. Some cultivars had shown incompatibility with the selected rootstock: Four plum trees of Gamonal cultivar shown incompatibility of the scion with the rootstock GF 8-1, and one nectarine tree of the cultivar Ruby sweet shown incompatibility with GXN 15 (Garnem) rootstock.

Some cultivars showed the incidence of Gummosis disease:

- i. Black Splendor Plum & Gamonal plum shown gum exudates at the trunk base of the tree.
- ii. High gum exudates on the trunk and major branches of Pioneer Plum.
- iii. Some gum exudates on the trunk and major branches of Ruby Red plum.

Some cultivars showed the incidence of Crown gall disease:

1. One Black Splendor Plum tree at the trunk base of the tree.
2. Two Pink Cot Apricot trees at the trunk base of each tree.

Some root stocks shown the growth of suckers at the tree base which need to be removed frequently like:

-Cadaman: +++++ -Garnim: +++++ Myrobalan 29C: +++
-GF 8-1: ++ -GXN 15: +

Some of the tested cultivars were of late maturity:

1. Ruby Red Plum as harvesting started on July 16, 2011.
2. Alpa plum as harvesting started on August 23, 2011.
3. Crimson Blaze Nectarine as harvesting started in the mid of May one month after the harvesting date of Viowhite and with low % TSS range 8 – 10.

So far, we did not observe any infestation with root knot nematodes as all the rootstocks were resistant to these nematodes. Also, we did not observe any type of yellowing or chlorosis as most of the rootstocks were tolerant to calcareous soil.

RECOMMENDATIONS

1. We recommended growing Black Splendor plum & Pioneer plum in larger areas at TADCO.
2. We recommended growing Crimson Blaze & Royal Gem nectarine in larger areas at TADCO.
3. We recommended increasing the spacing between the trees of the selected cultivars of Stone fruit cultivars to be 2.5 – 3 meters under Super High density system with the same rootstock used in the trial and search for dwarfing cultivars for 1.5 meter trees spacing.

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The authors wish to thank TADCO CEO, Eng’r Saad Al Swat, Eng’r Saeed Al Omer, and Dr Abdul Monim Ali for their continuous support during this study. We also extend our sincere thanks to Orchard 2 Supervisor and Operation personnel whom carried out the daily operations work. We extend our thanks to Mr. Hamada Tolba, Quality Control Supervisor, TADCO Laboratory staff: Mr. Conrad Angeles, Abu Kashem for the soil and tissue samples analysis, and Isaac Obra for arranging the chilling hours reports.

SUMMARY RESULTS OF THE EARLY MATURING STONE FRUITS CULTIVARS INTRODUCED TO TADCO IN 2007 & 2008

Table 21. Analysis of soil samples taken from orchard (4) on January 10, 2005.

Cultivar	Peaches (Plawhite)	Peaches (Flored)	Peaches (H. Blush)	Peaches (UF Gold)	Nectarine (Vio white)	Apricot (A-35)	Apricot (Charisma)	Apricot Super gold
Location	Orchard 2	Orchard 2	Orchard 2	Orchard 2	Orchard 2	Orchard 2	Orchard 2	Orchard 2
Planting Year	2008	2008	2007	2008	2008	2008	2007	2008
Spacing	5X3	5X3	4.5X3	5X3	5X3	5X3	5X3	5X3
Kg/Tree 2009	0.55	0.86	1.76	-	0.02	2.05	0.63	-
Kg/Tree 2010	3.7	6.6	6.6	8	1	10.25	2.4	9.85
Kg/Tree 2011	20.6	16.04	19.16	16.1	9.4	26.79	18.95	33.34
Kg/Tree 2012	19.71	14.68	18.52	9.41	9.2	31.51	29.91	29.75
Total Number of Trees	2188	2373	3727	2372	2474	2195	712	1386
No. of Dead Trees	195	49	366	57	15	9	211	161
Number of Trees left	1993	2324	2361	2315	2459	2186	501	1325
Type of Rootstock	Cadaman Early	GXN 15 Early	Nemaguard Early	GXN 15 Early	Cadaman Early	Franco Medium	Franco Medium	Franco & GXN 15
Date of Maturity in 2009	2-May	3-May	2-May	10-May	1-May	1-May	10-May	8-May
Date of Maturity in 2010	10-Apr	13-Apr	13-Apr	24-Apr	10-Apr	27-Apr	2-May	2-May

Fruit Size & Stone	Medium M. cling	Medium M. cling	Large M. cling	Large	Medium M. cling	Medium	Large	Medium M. cling
Avg Fruit Weight (Grams)	99.5	93	102	100	81.6	26.67	34.12	28
Flesh Color	White	Yellow with red spots	Yellow to Orange	Yellow	White	Orange	Light Yellow	Light Yellow
%Color	84 Red	92 Red	86 Red	92 Red	90 Red	88 Yellow	92 Yellow	92 Yellow
%T.S.S.	11.1	11.4	12.9	11.1	15.9	13.5	13.7	13.7
Taste	Good	Good	Very Good	Very Good	Very Good	Good	Good	Good
Texture	Non-melting	Non-melting	Fine	Non-melting	Melting, very fine	Non-melting	Fine	Medium
Firmness (lbf)	11.5	10.8	10.1	8.9	10.3	3.7	4.5	7.1
% Defects	5	5.6	8.1	7.6	48.3	6.4	8.2	2.5
Quantity Accepted for Sales in 2010	7479	15289	22301	18527	254	22401	1214	13062
Chilling Requirement	Low	Low	Low	Low	Low	Low	Medium	Medium

IMAGES OF THE EARLY MATURING STONE FRUIT CULTIVARS INTRODUCED TO TADCO IN 2007 AND 2008



Apricot A35, May 2009



Apricot A35 maturing on April 23, 2013



Flored Peaches May 2010



Plawhite Peaches May 2010



Honey Blush Peaches May 2010



Viowhite Nectarine May 2010



Plawhite Peaches May 2010



Honey Blush Peaches May 2010



Flored Peaches May 2010



Viowhite Nectarine May 2010

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