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AgBiz Program

Study Tour to California for Macedonian Table Grapes Exporters

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1.0 VARIETIES

The first vineyards in California were planted by Spanish monks in 1769, for production of wine for church rituals. The first table grapes vineyard was planted by William Wolfskill in 1839. In 1876, the Scottish immigrant William Thompson introduced the variety *Sultanina*, known in USA as Thomson Seedless. Today this variety occupies 90,000 ha, which makes it the most widely-planted variety of all table and wine varieties. There is no data as to the percentage used for production of raisin and fresh grapes.

Table 1. List of varieties developed in the grafting centers in California

No.	Variety	Pronunciation in MK	Viniculture center	Geneticist
1	Beauty seedless	Bjuti sidles	UC, Davis, USA	Olmo
2	Blush seedless	Bla{ sidles	UC, Davis, USA	Olmo
3	Canner	Kener	UC, Davis, USA	Olmo
4	Centennial seedless	Sentenial sidles	UC, Davis, USA	Olmo
5	Christmas rose	Krismas rouz	UC, Davis, USA	Olmo
6	Dawn seedless	Dan sidles	UC, Davis, USA	Olmo
7	Delight	Dilajt	UC, Davis, USA	Olmo
8	Early muscat	Erli muskat	UC, Davis, USA	Olmo
9	Emerald seedlees	Emerald sidles	UC, Davis, USA	Olmo
10	Gold	Gold	UC, Davis, USA	Olmo
11	July muscat	Juli muskat	UC, Davis, USA	Olmo
12	Loose Perlette	Luz Perleta	UC, Davis, USA	Olmo
13	Perlette	Perleta	UC, Davis, USA	Olmo
14	Queen	Kvin	UC, Davis, USA	Olmo
15	Red Globe	Red Gloub	UC, Davis, USA	Olmo
16	Ruby seedlees	Rubi sidles	UC, Davis, USA	Olmo
17	Scarlet	Skarlet	UC, Davis, USA	Olmo
18	Thomuscat	Tomusakt	Fresno, CA, USA	Henderson
19	Autumn king	Otm king	Fresno, CA, USA	Ramming, Tarailo
20	Autumn royal	Otm rojal	Fresno, CA, USA	Ramming, Tarailo
21	Black Emerelad	Blek emerald	Fresno, CA, USA	Ramming, Tarailo
22	Crimson seedless	Krimson sidles	Fresno, CA, USA	Ramming, Tarailo
23	Diamond muscat	Dajmond muskat	Fresno, CA, USA	Ramming, Tarailo
24	Fantasy seedlees	Fantazi sidles	Fresno, CA, USA	Ramming, Tarailo

No.	Variety	Pronunciation in MK	Viniculture center	Geneticist
25	Princess	Princes	Fresno, CA, USA	Ramming, Tarailo
26	Scarlet Royal	Skarlet rojal	Fresno, CA, USA	Ramming, Tarailo
27	Selma Pete	Selma pit	Fresno, CA, USA	Ramming, Tarailo
28	Summer Muscat	Samer muskat	Fresno, CA, USA	Ramming, Tarailo
29	Summer Royal	Samer Rojal	Fresno, CA, USA	Ramming, Tarailo
30	Sweet Scarlet	Suit skarlet	Fresno, CA, USA	Ramming, Tarailo
31	Thomcord	Tomkord	Fresno, CA, USA	Ramming, Tarailo
32	Blackrose	Blekrouz	Fresno, CA, USA	Snyder, Harmon
33	Calmeria	Kalmerija	Fresno, CA, USA	Snyder, Harmon
34	Cardinal	Kardinal	Fresno, CA, USA	Snyder, Harmon
35	Exotic	Egzotik	Fresno, CA, USA	Snyder, Harmon
36	Autumn black	Otm blek	Fresno, CA, USA	Weinberger, Harmon
37	Fiesta	Fiesta	Fresno, CA, USA	Weinberger, Harmon
38	Flame seedless	Flejm sidles	Fresno, CA, USA	Weinberger, Harmon
39	Autumn seedless	Otm sidles	Fresno, CA, USA	
40	Black Corinth	Blek korint	Delano, CA, USA	

The climate in California is favorable for production of table grapes and allows for the development of this industry. The need of the industry for new interesting table varieties is evident in the creation of research viticulture centers that developed over 50 vine varieties, spread throughout USA and the world; at the US Davis, the grape geneticist Olmo developed the attractive varieties Red Globe, Perlette, Qween, Christmas Rose, Scarlet; at the Fresno University, the geneticists Ramming and Trailo developed the varieties Autumn Royal, Crimson Seedless, Princess; the variety Sugraone was also developed in California, while in Fresno the grape geneticists Snyder and Harmon developed the variety Cardinal, which with 1300 ha is the most important table grape variety in the Republic of Macedonia. These varieties are important for the table grapes production in the USA and in other grape producing countries such as South Africa, Australia, Chile, etc. Data show that California and Italy are the most important genetic centers for developing table grape varieties in the world.

1.1 AREAS UNDER VINEYARDS IN CALIFORNIA, USA

The total area under vineyards in California ranged from 256,000 ha in 1999 to 316,000 ha in 2007. During the last 8 years, the areas under vineyards increased for 60,000 ha. 60% or 190,000 ha of these areas are wine varieties, while 40% or 124,000 are table varieties. 28.7% of the table varieties or 90,000 ha are varieties for raisin production, while 10.8% or 34,000 ha are areas under vineyards for production of table varieties for fresh consumption.

Table 2. Areas under Vineyards in California, USA

Variety	1999			2007		
	Acres	ha	%	Acres	ha	%
Raisin	210.205	85.070	33,2	224.464	90.841	28,7
Table grapes	60.243	24.380	9,5	84.702	34.279	10,8
Wine varieties	362.403	146.664	57,3	471.887	190.973	60,4
White	***144.148***	***58.337***	***39,8***	***182.486***	***73.852***	***38,7***
Red	***218.255***	***88.328***	***60,2***	***289.401***	***117.121***	***61,3***
Excluding Rootstock	632.851	256.115	100,0	781.052	316.092	100,0
Rootstock	216	87		498	202	
All Grapes	633.067	256.202		781.550	316.293	

1.2 GRAPES PRODUCTION IN CALIFORNIA

The total production of grapes in California amounts to 6.18 billion kg., of which 3.2 billion kg. are wine grapes, 2.2 billion kg. are raisin and 780 million kg. are fresh table grapes. The value of the total production amounts to 3.01 billion dollars. The value of the table raisin grapes amounts to 507 million dollars, of the fresh table grapes to 600 million dollars, and of the wine grapes to 1.8 billion dollars. The average price of the grapes is 0.511 USD/kg, or 25 MKD/kg. The price of the raisin is 0.277 USD/kg or 13.6 MKD/kg, of the fresh table grapes it is 0.82 USD/kg or 40 MKD/kg and of the wine grapes it is 0.58 USD/kg or 28 MKD/kg. The average production of wine grapes is 16.4 t/ha and of table raisin grapes 23.2 t/ha.

Table 3. Varieties of fresh table grapes in California

Variety	1999	1999	1999	2007	2007	2007
	Acres	ha	%	Acres	ha	%
Flame Seedless *	18.504	**7.489**	30,7	20.968	**8.486**	24,8
Crimson Seedless *	10.697	**4.329**	17,8	16.299	**6.596**	19,2
Red Globe *	11.309	**4.577**	18,8	12.519	**5.066**	14,8
Autumn Royal	919	**372**	1,5	4.293	**1.737**	5,1
Ruby Seedless *	3.850	**1.558**	6,4	4.097	**1.658**	4,8

Variety	1999	1999	1999	2007	2007	2007
Sugraone	2.765	**1.119**	4,6	3.880	**1.570**	4,6
Princess *	397	**161**	0,7	2.803	**1.134**	3,3
Perlette	2.348	**950**	3,9	2.469	**999**	2,9
Fantasy Seedless	638	**258**	1,1	873	**353**	1,0
Calmeria	763	**309**	1,3	791	**320**	0,9
Emperor	772	**312**	1,3	772	**312**	0,9
Summer Royal	38	**15**	0,1	753	**305**	0,9
Scarlet	66	**27**	0,1	727	**294**	0,9
Flame Tokay	449	**182**	0,7	546	**221**	0,6
Emerald Seedless *	390	**158**	0,6	540	**219**	0,6
Rouge	481	**195**	0,8	481	**195**	0,6
Christmas Rose	410	**166**	0,7	473	**191**	0,6
Jade Seedless	232	**94**	0,4	347	**140**	0,4
Sugranineteen	0	**0**	0,0	287	**116**	0,3
Beauty Seedless *	197	**80**	0,3	230	**93**	0,3
Ribier	180	**73**	0,3	227	**92**	0,3
Black Monukka	199	**81**	0,3	199	**81**	0,2
Sugrathirteen	118	**48**	0,2	192	**78**	0,2
Castlerock Red	0	**0**	0,0	182	**74**	0,2
Marroo Seedless	167	**68**	0,3	167	**68**	0,2
Early Muscat	147	**59**	0,2	147	**59**	0,2
Malaga *	132	**53**	0,2	146	**59**	0,2
Sweet Scarlet	0	**0**	0,0	146	**59**	0,2
Emperatriz	133	**54**	0,2	133	**54**	0,2
Flaming Red	131	**53**	0,2	131	**53**	0,2
Muscat Flame	91	**37**	0,2	127	**51**	0,1
Exotic	120	**49**	0,2	120	**49**	0,1
Autumn Seedless	68	**28**	0,1	107	**43**	0,1
Royal Black Seedless	0	**0**	0,0	94	**38**	0,1
Niabell	7	**3**	0,0	93	**38**	0,1
Cardinal	88	**36**	0,1	88	**36**	0,1
Kyoho	69	**28**	0,1	86	**35**	0,1
Black Emerald	53	**21**	0,1	82	**33**	0,1
Prima Black Seedless	77	**31**	0,1	77	**31**	0,1
Queen	71	**29**	0,1	77	**31**	0,1
Sugrasixteen	0	**0**	0,0	67	**27**	0,1
Italia *	60	**24**	0,1	61	**25**	0,1
Tudor	32	**13**	0,1	52	**21**	0,1
Other Table	3.075	**1.244**	5,1	7.756	**3.139**	9,2
Total Table	**60.243**	**24.380**	**100**	**84.705**	**34.280**	**100**

In the assortment of table varieties for fresh consumption three varieties occupy 58.8% of the land: Flame Seedless with 24.8% or 8.4 thousand ha, Crimson Seedless with 19.2% or 6.5 thousand ha, and Red Globe with 14.8% or 5 thousand ha.

The second group of varieties that occupies 20,7% of the total areas under table grapes includes Autumn Royal, Ruby Seedless, Sugraone, Princess and Perlette. Plantations range from 1,737 ha under Autumn Royal to 999 ha under Perlette.

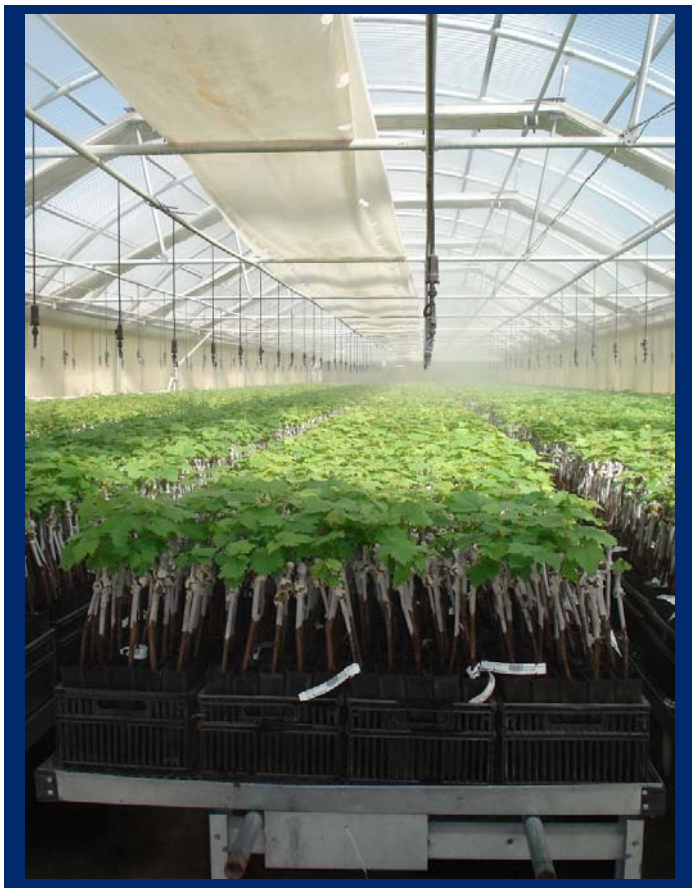
Compared to 1999, in 2007 vineyards expanded mostly for the varieties Crimson Seedless with 2000 ha, Autumn Royal with 1500 ha, Flame Seedless and Princess with 1000 ha, Sugraone with 450 ha, Summer Royal with 300 ha, Scarlet with 250 ha and Sugranineteen with 116 ha.

In Macedonia, leading varieties include Ribier, Cardinal and Italy, which are present in California with 25 ha under the variety Italia and 82 ha under the variety Ribier.

1.3 PROSPEROUS AND RECOMMENDED TABLE GRAPES VARIETIES

California experts recommended varieties that are favorable for expanding production because of their economic and technological characteristics and demand. Louis Gonzales from the grapevine nursery SunRidge and Jenifer Hashim from Davis, recommended the seedless varieties Flame Seedless, Superior, Sugraone, Thomson Seedless and Crimson Seedless, and of the seeds varieties the Red Globe as the most popular at the moment. They pointed Flame Seedless as the most resistant one. According to Lavin Corky, it is necessary to monitor closely the market demand. The assortment should include white, red and black varieties, very early to late varieties, and seedless and seed varieties. By selecting weather conditions and by application of agrotechnical and ampelotechnical measures it is possible to manage the time of ripening and the quality of the grapes. The market is unstable, picky and inconsistent, but Corky still feels that the ideal variety is Thomson Seedless, in particular grapes of this variety harvested in September. Nowadays the young population finds interesting the seedless varieties, such as Thomson Seedless, Flame Seedless and Crimson Seedless. These conclusions are evident in the current Californian varieties among which the most popular is the variety Thomson Seedless with not less than 90,000 ha, followed by Flame Seedless with 8,500 ha and Crimson Seedless with 6,500 ha, both with red skin. Red Globe, red table seed variety, is very present in the Californian varieties with 5,000 ha. It is exported in the countries of the far east, China and Malaysia.

1.4 GRAFTING CENTERS, NURSERIES, PRODUCTION OF VINE SEEDLINGS



The UC Davis organized a visit to the grafting center SunRidge in Bakersfield. It was established by Glen and Terry Stoller in 1977. Today, the grapevine nursery produces 15 million vine seedlings per year, most of which are certified cuttings produced with state-of-the-art technology. They produce wine and table varieties and rootstock. They produce a large number of the popular table varieties: Flame Seedless, Thompson Seedless, Crimson Seedless, Red Globe, Autumn King, Scarlet Royal, Ruby Seedless, etc. They recommend Harmony and Freedom as appropriate rootstock for table varieties. On such rootstock grapevines are vigorous and are therefore not recommended for rich soils where the growth is dense and the blossom is falling out. For the most intensive systems of table grapes it is necessary to investigate the most appropriate combinations of variety and rootstock depending on soil type. Based on soil testing and the experience to present, this vine nursery can recommend appropriate rootstock for the varieties grown in the Republic of Macedonia, with a warning to avoid limy soil for growing red and table varieties as on such soil for these varieties it is hard to achieve the color.

We had an opportunity to follow the entire production cycle of vine seedlings for planting in the period April to June. The process from grafting to creating a seedling takes 14 weeks and the seedling is ready for planting in the same year. The nursery also produces seedlings from green cuttings in rootstock or own root, as well as a year old grafts. The production of grafted seedlings consists of washing and disinfection of cuttings for grafting, and their eventual storage in sawdust on 2°C, for a period of 8 months until the grafting. One week prior to grafting they are heated to

26°C. They are treated with hot water in metal pools on 23°C for 5 minutes, on 50°C for 5 minutes and are kept in cold water for 15 minutes. Cuttings are then taken for bench grafting. The grafting is done with machines that cut matching slots and tabs in the root and the scions. Stratification is done in plastic boxes with capacity of app. 100 grafted cuttings, that are filled with sphagnum Peat Moss produced in Canada. Here, callusing is done at temperature of 26°C, over 21 days. Callused graft cuttings are washed and paraffined. Paraffin is heated with a melting device and then the melted paraffin is put into a thermostat where paraffin is applied. Such prepared graft cuttings are held in greenhouse in pots filled with 50% perlite and 50% Peat Moss, and added fertilizer. Polymer substance is added to the soil amendment that turns the soil amendment into a spongy mass that can easily be manipulated and does not crumble in case of crash or accidental fall. They stay in the greenhouse 5 days on 33°C. When scions shoot they are shaded, temperature is maintained to 30 to 35°C, with 85% moisture, for a period of 10 days. After this period, moisture is reduced for 5% every day. After 20 days oxygen is introduced. After 5 weeks from the beginning of the process, shoots are classified and weak shoots are held longer. The entire greenhouse process takes 7 weeks, after which they are transferred in open shaded greenhouses until sale.

Name: Sunridge Nurseries, Inc.
Address: 441 Vineland Road
City: Bakersfield
State: CA
Zip: 93307
Phone: (661) 363-8463
Fax: (661) 366-4251
Contact: Steve Maniaci
Website: http://www.sunridgenurseries.com
Email: Steve@sridge.net

2.0 CLIMATE (CHOICE OF LOCATION)

California is on the 32° N to 42° N latitude. Its upper border is on the same latitude with the Republic of Macedonia and its lower border with the latitude of Alexandria in Egypt. The climate is under strong influence of the Pacific Ocean from west and the mountain ranges on the east, isolating it. Although the mountains are with snow throughout the entire year, the weather conditions are moderate with constant temperatures. Dominant tree is the palm as it is spread all over the state of California. Due to the similarities, the climate in California is said to be Mediterranean. There are variations in the south, in Coachella, in the desert, where the rainy season lasts until April and the dry season lasts from 15 April to 15 October. The climate there is excellent for growing table grapes because of the low level of illness-related problems. In Coachella vegetation begins on 15 January, grapes are ripening at the beginning of May, in June temperature reaches 50°C, in December the grapevine is made dormant by ceasing irrigation and the chemical Dormex is applied for bud breaking. In Bakersfield, 200 km to the north, vegetation starts later in March and proceeds similarly to the Mediterranean countries in Europe. The northern regions are predisposed for growing wine grapes.

The regions are classified according to the Winkler Scale. There are 5 regions, Region I from 2500 to 3000°C, and Region V over 4000°C, as sum of active temperatures in the periods between 1 April and 31 October. The existence of these regions is an indication of the diversity of climates from north to south.
According to the soil type, research and grafting centers recommend rootstock that fit best the agrobiological characteristics of the varieties. Concurrently with the development of the new varieties, various combinations with the rootstock are explored depending on the characteristic of the varieties and the soils. California is an example of proper regionalization in viniculture, an example of successful cooperation among the research centers and the producers even before establishing the vineyards. Varieties and rootstock are determined based on the most favorable climate and pedological conditions. Table grapes are grown under ideal conditions. In USA, 98% of the areas under table grapes are in California.

3.0 AGROTECHNICAL MEASURES

In 100% of the cases, the production of table grapes in California is conducted with application of agrotechnical measures. Cultivation of the soil up to 5 times during vegetation, drop-by-drop irrigation also used for application of fertilizers, foliar fertilization for introduction of microelements and regular protection according to the program and the conditions. In Coachella nets are used to shade the bunches and reduce the temperature in the vineyard. Proper application of the agrotechnical measures is the

basis and opportunity for obtaining maximum benefit from the application of the ampelotechnical measures (management of the shoots, bunches and berries).

4.0 VINE TRAINING, SUPPORT SYSTEMS, SPACING AND AMPELOTHECHNICAL MEASURES (APPLICATION OF GREEN PRUNING AND INTERVENTIONS)

We received detailed information abut this procedure in the form of literature, practical experience and on-the-field demonstration by ***Jennifer Hashim***-Buckey, UCCE Viticulture Farm Advisor.

4.1 VINE SUPPORT SYSTEMS

As concerns this issue, the study tour was most useful. The vine support systems that are used in California to present are the single crossarm and the double crossarm trellis system, but they have proved insufficiently appropriate for dealing with bunches. These systems are substituted in California at large scale with systems that resemble or are same as the "Standard double gable/Y trellis system" which is the main system in South Africa and Australia. The Y-system is established by adding metal frames at steep angle and few rows of wire to the T-system. New vineyards are established exclusively with the Y-system. This positive experience of the Californian producers should be applied in Macedonia as well, by substituting the existing espalier in the vineyards with the Y-system.

4.2 SPACING

All varieties are planted at standards space. The distance between the rows is 3.6 m. The distance between the vines in the row is 2.1 m. There are around 1300 vines in a hectare. Such a small

number of vines reflects on the size of the stem. The stem is thick over 10 cm in diameter. The bud break is large and amounts to over 100 buds on a vine. Depending on the number of buds on the shoot i.e. the variety, the vine is cut in cordons or canes.

4.3 VINE TRAINING

The small number of vines on a unit of area allows the vine to form as a developed tree with a thick trunk and strong arms with cordons and canes. The Y-system usually forms four canes. For varieties cut in canes, each arm has two cordons and 2 canes, each cane with 10-15 buds. Larger number of buds are left with varieties where the first 6 buds along the cane are not sprouting as is the case with Sultanina, Crimson Seedless, Superior and Rally. 15 buds are cut. With the varieties Cardinal, Red Globe and Ribier about 80 buds are left on a vine, 20 buds on one arm with 6-7 cordons with 2-3 buds.

4.4 GREEN PRUNING AND INTERVENTIONS

The measures of green pruning serve to trim the shoots, the bunches and the berries. In addition to suckering and trimming of shoots, pinching and defoliation as regular measures, green interventions are taken for bunch pinching, topping and wings trimming. The number of bunches that remain on the grapevine depends on the variety, the number of vines on ha and the number of buds on a vine. The stem is girdled with a special blade, when the berries are 4-6 mm big. For seedless varieties plant hormones are used, primarily gibberellic acid, for richer bunches, for reducing blossom and for bigger berries. All green pruning measures and interventions were described in the previous report, and are explained in detail in the South African manual. The measures that concern the more significant varieties that are of particular interest to us, i.e. the varieties Cardinal and Ribier, are explained in the literature that was provide to us by UC Davis.

We can conclude that in the Republic of Macedonia green pruning and interventions are not applied and that table grapes are grown as wine grapes. Most common is the espalier with small distance between the grapevines, a large number of grapevines, low trunk, dense shoots, hidden

bunches that are difficult to trim or are not trimmed at all. Grapevines grown on trellis are rare. Gibberelic acid and etephon are not applied.

These measures are essential and required for obtaining branched and airy grape bunches with large berries. Without the application of these measures the quality standards of the European Union and of other world markets cannot be satisfied. Without application of these measures we cannot even maintain the remaining markets in Serbia and Kosovo, and that is exactly the reason why we lost the Croatian and the Bosnian markets.

5.0 HARVEST AND POST-HARVEST TECHNOLOGY FOR GRAPES

5.1 THEORETICAL BASIS

The purpose of post harvesting activities for grapes is to reduce loss of humidity i.e. weight and to prevent rot illnesses. The loss of moisture is related to the breathing and breathing is related to temperature. The intensity of breathing is proportional to the temperature. **Every time temperature is increased for 5°C, the intensity of breathing is doubled. Every measure that decreased the temperature of the grapes has a significant impact on quality.**

The manner in which harvest and packing, and pre-cooling, storage and transportation are done influences the loss of humidity. Damage to grapes begins when loss of humidity is 2-3%. The improvement of the post-harvesting activities gave excellent results in California.

Table 4. Loss of humidity in grapes on certain working positions in %

Location / Working position	Typical packing	Improved packing
Grapevine plantings	3.00	0.50
Pre-cooling	1.25	1.00
Storage	1.25	0.25
Transportation	1.50	0.60
Total	**7.00**	**2.35**

Data show that the highest losses emerge during harvest, packing and transportation of grapes. Improvement can be made in all segments if there is good organization and preparation for the operations, and if care is taken about the temperature, the speed of manipulation and the time between the harvest and the cooling that should not be longer than 2-3 hours; the loss should not be more than 2%.

5.1.1 Harvest

Before harvest the soil between the rows is made flat, the lanes are sprayed with water to protect the grapes from dust, the watering is finished and hedging of the vigorous shoots and defoliation are conducted. It is very important to maintain the lanes so that the trucks and the trailers will not bend or shake, avoid pressing of the grapes.

The harvest is done at the moment when the grape variety reaches its technological characteristics: size, color, smell, taste, sugar contents and acids. With regard to this issue, we received detailed

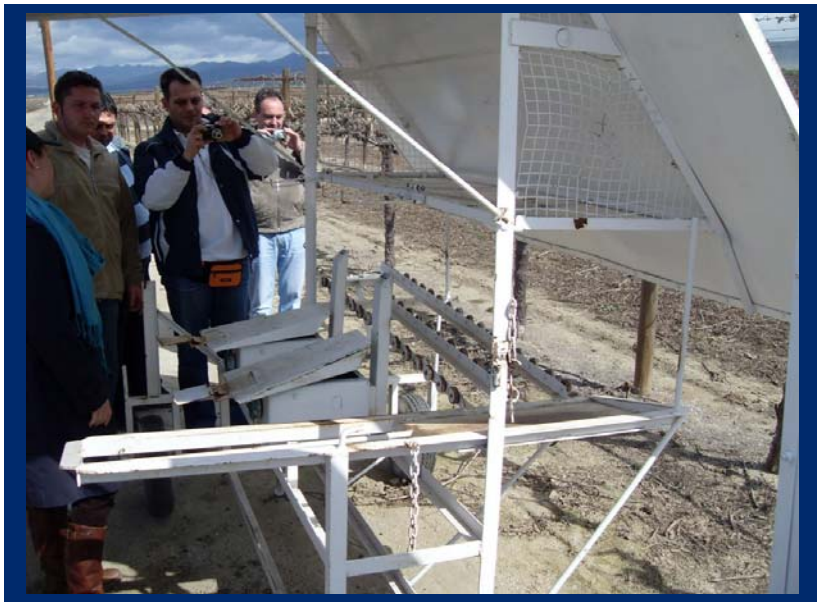
information in the form of quality standards and regulations from the Californian Association. Two lectures were held on the grapes post-harvesting technology by Jim Thomson and Adel Kedder.

According to Jim Thomson, in California grapes are harvested between 5 a.m. and 2 p.m. if the air temperature does not exceed 30°C. After 2 p.m. the temperature of the grapes reaches 43°C, even 45°C on direct sunlight. In shadow, the temperature is lower for 5°C, which indicates that grapes should be shaded when packed. Research shows that temperatures are highest between 3 and 4 p.m. It takes at least 2-3 hours from harvest to cooling, and the intention is to shorten this period and cut down on the humidity loss. Outside temperatures significantly influence the quality of the grapes, as in California grapes are most often packed in the vineyards. At temperatures higher than 37.5°C the damage to the bunch even during harvest and packing amounts to 2%. At 26.7°C even after 8 hours the loss is up to 1%.

In California, harvest is an expensive operation and it is difficult to find workers. Currently, researches are conducted to find chemicals that when applied to the bunch would corrode the peduncle of the grape bunch or the pedicel of the berries. By shaking the bunches or the berries would fall down. According to Jim this product would be interesting for the market.

Currently, the bunch is trimmed in the vineyard by removal of sick and destroyed berries and berries that are not big or ripe enough. Grapes are harvested and placed in wide plastic boxes and transported to the packing station. Packing is done in a packing trailer which is a metal construction in the form of a table on wheels. Each table has its own metal shade, moving line, storage for the packing material (boxes, various types of paper, packing) and scales.

5.1.2 Ways of packing



Grapes are packed in different types of boxes and bags. Small packages are necessary to avoid taking berries by buyers, they are easier to keep and as concerns food safety they maintain better hygiene of the bunch. Sulfur paper is used for longer storage in cold rooms, but is not used for the local market. Cardboard boxes are most often used, however they should be designed with as much wholes as possible so as to allow for flow of cold air. Wooden boxes are avoided because they absorb a large portion of the grapes moisture and develop microbes. They are used locally and are interesting because one can pile them one on the top of the other in large numbers.

5.1.3 Pre-cooling

Time necessary for the grapes to cool depends on the actual temperature of the grapes. If grapes are placed in a refrigerator without pre-cooling, they will cool down from 30°C to 15°C within 24 hours, from 15°C to 7.5°C within 24 hours and additional 24 hours are necessary for achieving 0°C. A total of three days. Research tends to shorten this period to 6 hours.

It can be achieved with Forced Air Cold Wall, a procedure described and elaborated in the South Africa Report. If grapes are packed in plastic bags, it will take 12 hours to reach 0°C. During the Forced Air Cold Wall procedure sulfur is also added and produces significant effect. During pre-cooling air humidity is not controlled as research shows that it is 85%. Even when humidity is maintained at 100% loss still emerges.

5.1.4 Fumigation

Fumigation is application of sulfur dioxide SO2 for protecting grapes from fungi, primarily botrytis. Botrytis is a fungus that causes rot in all fruits and plants. During blossom the fungus penetrates the berry. With fumigation, the sulfur contains the botrytis inside the berry and destroys all microbes on the surface of the skin and the bunch. For 100% effectiveness the dose is 100 ppm/hour or 50 ppm every two hours. By way of fumigation a dose of 700 ppm SO2 is applied, and is fully absorbed in 3 hours. SO2 is introduced, the chamber is closed and opened only after 24 hours. There should be no odor in the room nor traces of SO2. If the dose is excessive the peduncle will be damaged, turning dark and the damage will be expanding. Where a berry is injured, such damage will be evident around the injury. Where sulfur paper is used, fumigation is not applied. Research show that with proper fumigation, the grapes will absorb the sulfur dioxide in 12 hours. The maximum content of SO2 in grapes is 10 ppm. The grapes absorb this content with 12 fumigations for seedless varieties and more fumigations and larger doses for seed varieties. Temperature and sulfur dioxide are measured and controlled with special instruments.

5.1.5 Storage in refrigerator

Ideal conditions are temperature of -1°C, 95% humidity, plastic boxes and slow aeration. High humidity does not damage the bunch during fumigation even at temperature of -1°C. Damage is caused by inappropriate use of sulfur and excessive temperature variations. So as to maintain temperature precise thermostats are necessary that will not allow temperature to fall down below -2°C.

For longer storage, grapes are harvested when the dry-substance content is over 15 Brix and the sugar : acids ratio is 20:1. The more sugar content in the grapes, the more difficult it is to store. With 20% sugar content, storage amounts to 2 months.

5.1.6 Storage week points

Storage week points are the botrytis which causes darkening, and the mildew after long storage that causes white coloring from the mycelium and dry berries.

5.1.7 Other treatment

For longer storage grapes are treated with oxygen, ozone and ethylene.

5.1.7.1 *Transportation*

Transportation is efficient if the truck's chamber is pre-cooled at the same temperature as the refrigerator where grapes were stored. The best temperature is -1°C, however temperature in trucks can rarely drop below 5°C. It is good to treat it with carbon dioxide.

6.0 GRAPES MARKET

In 2004, vineyards in the world covered a total area of 7.9 million ha, of which 60% in Europe, of which 40% in Spain, France and Italy. The total production of grapes is 66 billion kg., of which 16.2 billion kg are table grapes. The total consumption of table grapes is 15.7 billion kg., mostly in China, Iran, Turkey, Egypt, USA, Italy, Korea, Germany and Morocco. The quantity of table grapes traded is in the neighborhood of 3 billion kg.

The biggest producers of table grapes are China, Turkey, Italy, Chile and USA. The second group includes South Africa, Spain, Greece, Japan and Mexico.

The biggest importers are: USA, Germany, Great Britain, Holland, Canada, France, Russia, Belgium, Mexico, Pakistan, i.e. the countries of the northern hemisphere, mostly countries that do

not have their own production of table grapes. The biggest exporters are: Chile, Italy, USA, South Africa, Mexico, Spain, Turkey and Argentina, countries that produce table grapes.

In USA, 1/3 of the table grapes or 300 million kg. are exported, in 2004 the exports amounted to $453 million. It is mostly exported to Canada 32.4%, China/Hong Kong 13%, Malaysia 12%, Mexico 9% and other countries such as Great Britain, Ireland, Taiwan, The Philippines and India. The exporting period is July through January, with pick in September and October.

The import of grapes amounts to 600 million kg. It shows a growing tendency both per year and per quantity. In average, there is a negative balance of 200 million kg. Most imports come from Chile 70% and Mexico 28%, or a total of 98% from both countries. Imports from Chile come in the period January – April, and from Mexico in the period May - June. The production of table grapes in these countries is a result of investments and transfer of technology by American companies that use the cheep labor, the excellent climate and the ripening period that provide for highest quality grapes. Proper planning of the periods for placing imported grapes on the market ensures constant supply of table grapes on the market without creating competition to the domestic producers.

7.0 LAWS, REGULATIONS, PRODUCTION STANDARDS

We were given folders with the quality standards for table grapes: United States Standards of Table Grapes (European or Vinifera Type), Effective March 29, 1999. 14 pages.

8.0 LITERATURE, BROCHURES, INTERNET RESOURCES

UC Davis provided us with the following reference materials:

Books, bulletins and papers

- Packaging California Table Grapes, University of California, Publication 1934;
- Sulphur Dioxide Fumigation of Table Grapes; Bulletin 1932;
- Vineyard Establishment, several authors;
- Varieties, several authors;
- Table grape cultural practices, several authors;

- Nutrition, several authors;
- Irrigation, several authors;

Magazines:

- Western fruit grower; www.westernfruitgrower.com
- Wines and vines; www.winesandvines.com
- American Vineyard; www.americanvineyardmagazine.com
- California Agriculture; www.CaliforniaAgriculture.ucop.edu

Catalogue

- Sunridge Nurseries, Catalog: www.suridgenurseries.com – vine nursery

9.0 CHARACTERISTICS OF A FARM FOR PRODUCTION OF THE TABLE GRAPES VARIETY RED GLOBE IN SAN JOAQUIN VALLEY

Author: Jenniefer M. Hashim and others
Sample cost to establish and produce table grapes Red Globe

The study provides calculations for growing the variety Red Globe in California, in the first two years and in full maturity. All costs are included: planting, amortization and costs for commissions, inspection and the government.

The planting distance is 3.6 m x 2.4 m, or 1,150 vines/ha. Amortization is calculated for 23 years. Harvest is done by teams of 3-4 workers, 5 boxes/h in average, 1 box contains 12 plastic bags, total of 9.52 kg in a box. Harvest is calculated to 900 boxes/acre, 2,224 boxes/ha or 21,172 kg/ha of packed grapes. Workers' daily wage is app. $11. Inspection and commission (association) costs are $0.13 per box.

Table 5. Planting costs for years I and II

Activities	$/acre	$/ha	%
Planting, supporting construction	4,978	12,304	63
Growing	1,114	2,753	14
Amortization of the equipment and the buildings	1,097	2,711	14
Other costs to the government	699	1,728	9
Total	**7,888**	**19,496**	**100**

Table 6. Growing costs in full maturity

Activities	$/acre	$/ha	$/box	%	MKD/kg
Production of grapes	1,848	4,567	2.05	23	10.8
Harvest packing	1,989	4,916	2.21	24	11.6
Material: boxes, bags ...	1,760	4,350	1.96	22	10.3
Colling, storage, sale	900	2,224	1.00	11	5.3
Association, government	408	1,008	0.45	5	2.4
Inspection, control	125	309	0.14	2	0.7
Amortization, seedling material, equipment	1,127	2,785	1.25	14	6.6
Total	**8,157**	**20,161**	**9.07**	**100**	**47.6**

The price of 1 kg of produced grapes is 10.8 MKD (23%), harvest and packing 11.6 MKD (24%), materials (boxes, bags) 10.3 MKD (22%), cooling, storage, sale 5.3 MKD (11%) and other costs 9.07 MKD (21%). Costs for 1 kg of packed grapes is 47.6 MKD, where production, harvest, packing and materials participate with 32.7 MKD (69%).

10.0 CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE ACTIVITIES

The study visit to California, USA, organized by the University of California Davis, achieved its purpose as concerns obtaining theoretical and practical knowledge of the technology of production of table grapes. The UC Davis provided us with literature that fully elaborates the technology. Californian industry is interesting for us as it has similar training systems, the packing of grapes is done on the vineyards and it uses many practical procedures. The study visit provided us with an overall impression of the problems faced and the solutions available. The study visit happened in the right time, before vegetation in Republic of Macedonia, which provides the opportunity to apply the newly acquired knowledge immediately and see the effects as early as this year.

10.1. New prosperous varieties of table grapes to be introduced in the Republic of Macedonia, with different ripening periods, color, seedless or with seeds. To examine the varieties in terms of rootstock and soil type.

10.2. Reorganization of varieties to be done according to the most favorable environmental conditions, as a significant precondition for successful and sustainable production.

10.3. Agrotechnical measures to be applied optimally and inevitably, as a precondition for achieving maximum benefit from the bunch trimming measures and for achieving optimum yield and quality of the grapes.

10.4. The existing training systems need to be changed. Californian experiences should be used, where the training systems are standard and the spacing between rows is 3.6 m, between grapevines is 2.1 m, the number of vines is around 1300/ha and there are about 80 buds in short pruning and 120-150 buds in mixed pruning. Cordons and canes are divided in four vigorously developed arms. The low number of grapevines per hectare and the number of buds per vine ensure that the vines

are established in well developed trees with trunks in diameter of over 10 cm. The number of bunches differs depending on the variety and the size of the bunch, ranges between 30 to 50 bunches per vine, but does not exceed 20-25 t/ha packed grapes.

10.5. Vine support systems are an important factor the main purpose of which is to separate the bunch from the foliage so as to achieve space for growth, better efficiency of the workers, successful protection from illness and vermin and full application of the green pruning measures and interventions. In California we had an opportunity to see successful replacement of the previously used espaliers with Y-systems, which is an option to be explored in the Republic of Macedonia as concerns use of espalier systems. Use of trellis is also recommended, but compared to the present practice, bunches should be lowered to a height of 1.40 m.

10.6. Green pruning measures and interventions are necessary to produce grapes according to the standards of the developed markets in Europe and the world. Due to lack of such measures and interventions we lost the markets in Croatia and Bosnia. Thinning and pinching of bunches, as well as of the berries, defoliation, girdling of the shoots and/or the stem and application of plant hormones are necessary measures.
10.7. Harvest, packing and storage are fully elaborated due to the literature, lectures and practical experiences acquired in California. The following activities must be undertaken: development of quality standards per variety and grapevine producing region; development of precise procedures for each company as concerns organization of operations, packing materials, training of workers, manner of implementing each procedure or process as a whole; development of procedures for controlling temperature, moisture, application of SO2; obtaining practical knowledge trough study visits to Turkey and Israel.

10.8. Organizing the producers in associations/producer organizations. Experiences in California show that associations are hard to establish but easy to dissolve. Still, today the Association of Table Grapes Producers is a powerful organization that adopts legislation, regulations, works on market approach, promotes the benefits from consumption of grapes, finances research and education centers. I propose that, as a starting activity, separate associations of grape producers and traders are established in the Republic of Macedonia to deal, in the first phase, with the technological problems i.e. to develop the procedures for production of grapes and post-harvesting technologies.

10.9. Grapes market According to Korvin Lovin, **stabile and sustainable presence on the market is achieved by production of superior quality grapes, grapes that will always have a place on the market although its price is higher than the price of the remaining grapes.** At present, the Republic of Macedonia produces grapes at the lowest price, and loses the markets of the Balkan countries to grapes of superior quality and higher price.

10.10. General conclusion. In the last 20 years table grapes in the Republic of Macedonia are being grown as wine grapes. A larger number of the vineyards have espalier support systems. In the vineyards on trellis green pruning and interventions are not applied and the bunch is not trimmed. According to Blazo Temkov, the biggest exporter of table grapes, we inherited the Croatian and the Bosnian markets from SFRY. In spite of the recognizable quality of the Macedonian table grapes, which we always stress as an advantage, the Republic of Macedonia still lost the markets in these countries to grapes produced in Italy, Spain and other Mediterranean countries. If we do not take measures for improving the grapes production technology, and if we do not produce grapes as demanded on the market, according to Mr. Temkov, the Republic of Macedonia will loose the only markets in Serbia and Kosovo very soon.