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Apple and Peach Production in Warm Climates of Northwest Mexico

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Abstract

Production of low-chill apples and peaches in the Sonora desert of northwest Mexico began 15 years ago with the introduction and testing of new cultivars. Despite unique cultural practices of foliar applications of Zn and Fe, chemical defoliation prior to dormancy, and chemical application for dormancy break plus summer temperatures of 43°C and extremely mild winters, the commercial production of apple and peach is established. The apple production is based on 'Anna' and 'Dorsett Golden' while the peach production is based on new cultivars, mainly from Florida. Markets have been based in national cities, but some export of peach has been made in the US. This area is relatively new in production of low-chill deciduous fruits, but has already established a reputation in Mexican markets for high quality summer apples and early season peaches.

Fruit production in Mexico has developed in tropical, subtropical, and temperate regions in which many native and introduced species grow and produce satisfactorily. There are more than 1 million ha of fruit trees with 78% tropical and subtropical and 22% temperate. The most important temperate fruits are grape (80,000 ha), apple (80,000 ha), peach (30,000 ha), pecan (23,000 ha), olive (10,000 ha), plum (6,000 ha) and pear (5,000 ha). An increase in production areas of these crops has been limited by late frosts, hail, and lack of chilling.

The state of Senora in northwest Mexico is traditionally known for its wheat and cotton production. Temperate fruit growing has become important because these crops require less water in that they receive trickle irrigation while agronomic crops are flood irrigated. This agricultural region is 0-400 m above sea level and its climate is hot and dry. Summer temperatures may reach 50°C. Frosts are scarce, but chilling unit accumulation ranges from 50 to 300 hrs based on bloom dates. Chill units are determined based on "key cultivars" from Florida. Total rainfall is 200 mm per year, while pan evaporation is 2500 mm. Under these conditions, only some fruit species and/or cultivars succeed.

Grape and pecan were introduced to northwest Mexico in the early 60's. Currently, 30,000 ha grape and 3,000 ha pecan are being grown. With an interest in diversifying the fruit industry, some growers began to introduce low chill cultivars of apple, peach, nectarine, plum and apricot in the early 70's. Some cultivars of apple and peach have shown suitable adaptability to this region. The low chilling peaches and apples of the Sonoran desert are now known throughout Mexico for their quality.

Cultivar selection and orchard management have been important factors in successful orcharding. Very low chilling winter seasons (less than 150 chill units) occur 1 of every 2 years which makes fruit growing difficult. Careful judgement needs to be made as to defoliation, pruning, thinning, fertilizing, and irrigation. Apple and peach, the 2 new deciduous tree crops in northwest Mexico are discussed in this report.

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Apple

The apple acreage in northwest Mexico, has increased from 100 ha in 1980 to more than 2,000 ha in 1985. Although representing 2.5% of the total area of apples in Mexico, this acreage is the earliest and prices are high.

The low chilling 'Anna' and 'Dorsett Golden' are the best adapted and earliest ripening. Cultivars 'Maayan', 'Elah', 'Michal', 'Ein-Shemer 28', 'Rahina' and 'Gala' have shown delayed, irregular and low percent bud break even after a cold winter. 'Slor' has just been introduced but looks promising.

There are some problems associated with the climatic conditions that prevail during the fall and winter period. Due to warm winter temperatures, the trees do not defoliate naturally; therefore, they are defoliated by chemicals prior to dormancy. Pruning without defoliation is difficult and non-defoliation results in a longer bloom period. It has been shown that urea (10%) or copper sulphate (10%) sprays in December induce leaf fall, although in some instances copper sulfate can cause bud or wood injury on tender tissue.

Chill unit accumulation is very low most years causing an extended bloom period of up to 45 days. Total fruit set is not affected greatly, but irregular sizes in early growth and subsequent thinning problems occur. The use of dormant oil (4%) and DNOC (0.2%) spray 4 weeks before normal bud break has shortened the bloom period to 30 days, and if the trees have been chemically defoliated an even shorter bloom period occurs. Application of urea or copper sulphate as defoliants only, without subsequent dormant oil can result in bloom 20 days earlier than non-defoliated trees.

Bloom starts in early February in both 'Anna' and 'Dorsett Golden' resulting in adequate overlap for good pollination and fruit set. 'Anna' sets 1% of its bloom when self-pollinated, increasing to 12% when crossed with 'Dorsett Golden', while the latter has a 45% set when self-pollinated. Usually 'Anna' has 5 or less seeds per fruit, while 'Dorsett Golden' has 5 or more. Fruit thinning is done by hand, although preliminary data shows that Sevin-50 at 800 ppm will induce thinning of 'Anna' but not 'Dorsett Golden'. The amount of 'Anna' fruits left vary according to tree size and fruit set. 'Dorsett Golden' requires heavier thinning, and if not done properly, alternate bearing occurs.

Fruiting of 'Anna' occurs best on short spurs, but some fruit sets on lateral buds of current wood, and on terminal buds. 'Dorsett Golden' bears fruit similarly but with less intensity on lateral buds. Both cultivars are precocious under warm conditions, producing up to 25 kg/tree in 2nd leaf trees of 'Anna' and on the 3rd leaf trees of 'Dorsett Golden'.

'Anna' fruits are elongated and few seeded with self-pollination, but will have a regular shape with several seed per fruit when cross-pollinated. Fruit size is large (150 g) if properly thinned, but fruit firmness is low, making it a soft fruit to handle. Red color is not attained adequately at maturity due to high temperatures (34°C day and 25°C night) and fruit are marketed green or slightly red striped. 'Dorsett Golden' fruits are rounded, slightly smaller and firmer than 'Anna,' and marketed when greenish yellow. Harvest of both cultivars starts in early June and extends until the end of July. These are the first fresh apples in the Mexican market and demand high prices.

The possibility of biannual production, as done in other tropical areas, has been tried without success. Trees do not differentiate flowers until autumn due to high summer temperatures.

Apple trees have been established on MM.106, MM.111, 'Hashabi' seedling, or domestic seedling rootstocks. Growth is vigorous on seedling stock reaching more than 1 meter shoot length per season (February through

October) when unproductive. Once trees starts producing, growth continues throughout the growing season with little reduction on seedling stock. Growth is reduced on dwarfing stocks, but foliage is too sparse and the exposed fruit sunburn, especially on M.26. Trees start production at 2nd leaf on both MM.106 and M.26, but production on seedling rootstocks is delayed a year. 'Anna' on MM.106 has produced 55 kg/tree on 5th leaf trees.

Pruning is done in winter after defoliating to form a central or modified central leader. Summer pruning after harvest is common to allow light penetration to older spurs and to make winter pruning less severe. Palmette systems have been used, and although tree growth is contained, fruit and wood are exposed and severely sunburn.

Even though apples have been grown only for a short time in northwest Mexico, some disease and insect problems have arisen that affect tree survival and fruit quality. Diseases that attack roots are the most important, including Texas root rot, *Phymatotrichum omnivorum*, southern blight, *Sclerotium rolfsii*, collar rots, *Phytophtora cactorum*, and *Macrophomina* sp. No leaf diseases have been reported, but *Phomopsis* canker on branches has appeared at some orchards. Insects attacking apples includes the unreported presence of ball worm, *Heliothis virescens* on small fruits; black thrips on flowers; red scale, *Anoidiella citrina*, on fruits close to harvest under slight humid conditions; and, *Erythroneura* sp. on leaves.

Soils in the area are fertile with a pH between 7.5 to 8. Micronutrient deficiencies with Fe, Zn, and Mn are a problem and foliar sprays are used frequently with NFe, NZn, and MnS04 throughout the growing season.

Research on low chilling apples cultivated in warm climates is being conducted at INIFAP (National Institute for Agricultural Research) Experiment Station in Hermosillo, Sonora. Research projects include cultivar and rootstock evaluation, water and nutrition management, pruning, planting distances, fruit set and development, overcoming tree dormancy, and insect and disease control.

Peach

The peach industry in Mexico has traditionally been an important fruit crop with about 30,000 ha and an annual yield of 210,000 tons. The main production areas have been located in central and northern Mexico, in the states of Aguascalientes, Hidalgo, and Chihuahua. The orchards are planted mostly with seedlings, "Criollos," from selected parents, but some areas have grafted cultivars, introduced from the United States, on local seedling rootstocks.

During the past 10 years, the peach industry has extended to other areas characterised by mild winters. Early attempts to grow peaches under low chilling conditions were not successful. With the introduction of low chilling cultivars, a viable industry was started in northwest Mexico. The economic basis of this industry is in supplying high quality peaches to early markets with no competition from the traditional peach production areas.

The climatic conditions of these new areas, have forced growers to adopt different management techniques according to the cultivars, supplies, and available hand labor. The common goal is to produce and market high quality fruit for national and export markets. Prices have been slightly higher in national than export markets but some exports are needed to obtain US dollars in order to buy US supplies of irrigation equipment, fertilizers, and pesticides.

The state of Sonora has 2,500 ha of low chilling peaches located mainly at the Hermosillo Coast, Carbo, and Caborca areas. About 1,000 ha are in production, with an annual crop of 4,500 to 7,000 tons. Although 60% of the

total area is planted with 'Desertgold', the interest is now focused on other cultivars that have lower chilling, larger size, greater firmness, and more attractive fruit. 'Desertgold' is not being planted any more. 'Flordaprince' and 'Flordagold' are the main cultivars being planted and should be the leading cultivars within 5 years due to their high fruit qualities and their dates of maturity, ripening the first week of April and the end of April, respectively. Other cultivars and selections from the University of Florida show potential for the area (Table 1). The combination of fruit quality and harvest date is stimulating interest for national and export markets.

The cultivars now under production, have shown some problems associated with mild winters. The trees do not defoliate naturally due to the warm temperatures prevailing during the fall, making pruning or dormant sprays difficult. Treatments with Zinc Sulphate (4%) induce leaf fall.

Late and uneven flowering and foliation resulting from insufficient chilling unit accumulation is a major problem with some cultivars (150-200 chill units). Data obtained from the research station at Hermosillo, has shown that sprays of dormant oil (2.5%) and DNOC (0.12%) 4 weeks before time of normal bud break, induces an early and regular bloom and foliation with accompanying fruit set. Some preliminary results have shown the efficiency of Cyanamide (2%) to induce early bloom.

Fruit thinning is by hand, since no other method is available. Growers tend to over thin to obtain large fruit and get higher market prices. However, less response to thinning has been observed on 'Desertgold'.

The rootstock used is mainly 'Nemaguard'. Growth is vigorous with 0.6-1.0 m shoot length per year. The irrigation and fertilization practices are regulated to reduce growth. The strong reduction of irrigation after harvest, to reduce vegetative growth, is associated with a high rate of twin fruits the following season, especially on 'Flordagold'.

Soils in the area are fertile with a 7.5 to 8 pH. Micronutrient deficiencies of Fe and Zn are a problem, which are controlled by foliar sprays of NFe and NZn throughout the season.

Table 1. Characteristics of peach varieties cultivated in Sonora at the Hermosillo coast and Carbo.

Cultivar	Est. chill units	Fruit develop. period (days)	Size (g)	Color: Skin (% red over ground color)	Flesh[v]	Shape[w]	Texture[x]	Time of[y] harvest (days)	Markets[z]
Fla. 9-1	150	63	80	30 red over yellow	Y	E	MF	-7	L
Fla. 8-1	250	63	85	30 red over bright yellow	Y	R	F	-4	N,E
Flordaprince	150	82	90	70 red over yellow	Y	RT	F	0	E
Fla. 81-1	200	66	110	20 red over yellow	Y	R	F	3	N,E
Maravilha	200	73	95	80 red over cream white	W	R	F	7	N,L
Desertgold	350	76	95	40 red over yellow	Y	RT	MF	12	N,L
Desertred	150	88	120	90 red over yellow	Y	RT	F	12	N,L
Flordagem	250	84	90	30 red over bright yellow	Y	R	F	12	N,L
Flordagold	300	88	100	20 red over bright yellow	Y	R	VF	16	N
Rayon	200	95	120	30 red over greenish yellow	Y	R	MF	21	N
Hermosillo	250	101	125	80 red over yellow	Y	R	F	28	N

[v]Y = yellow, W = white
[w]E = elongated, R = round, RT = round tip
[x]F = firm, MF = medium firm, VF = very firm
[y]Days before and after Flordaprince
[z]L = local, N = national, E = export

Pruning is mostly done in winter to eliminate unproductive wood and enhance the renewal of productive twigs. In summer, all the water sprouts are eliminated to prevent strong cuts in winter. Heading back to force the basal foliation of the twigs is necessary.

Some diseases and pest problems are affecting peach production. Texas root rot *(Phymatotrichum omnivorum)* and Coryneum blight *(Coryneum beyerinckii)* are the most important. Black thrips and aphids are present mainly early in the season. The Sonora peach production area has been free of fruit flies, and a special effort is being made to keep this pest to the south in order to protect the export fruit markets.

Research on low chilling peaches at the Campo Agricola Experimental de la Costa de Hermosillo is focusing on cultivar testing, cultural practices such as pruning, irrigating, nutrition, and rootstock improvement. Recently a breeding program for nectarines has been initiated to combine low chilling with resistance to fruit russeting.

Book Review

Otdalennaya Gibridizaciya Kostochkovyh Plodovyh Rastenij (Interspecific Hybridization of Stone Fruits), 1985, by Gennadij V. Eremin, published by Agropomizdat, Moscow, U.S.S.R.

G. Eremin is acknowledged to be one of the foremost authorities on stone fruit hybridization of the Soviet Union. Written in the Russian language, this 280-page text plus 24-page photographs is an up-to-date book, particularly concerned with the investigations in the U.S.S.R. As a result of his long association as the Director of the Krymsk Breeding Station (Krasnodar district) of the All-Union Institute of Plant Industry, perhaps the largest collection of stone fruit hybrids in the world is gathered and created.

The issue is treated in a current context that will capture the interest of the western researchers. There is however a long tradition of most of the Soviet investigators to classify the wide genus Prunus into many separate genus—plum, peach, apricot, cherry, Padus cherry, and almond. Some other genus are discussed by the author as well: Microcerasus Webb emend Spach (including Prunus tomentosa, P. pumila, P. Besseyi), Louiseana Carr. (incl. P. triloba), and Padellus Vass. (P. mahaleb).

The following subject matter in the above topic is divided into nine chapters: 1) Systematic and genesis of the species of Prunoideae Focke; 2) Germplasm resources for breeding objectives; 3) Genetic incompatibility in remote hybridization and ways used to overcome it; 4) Producing of new forms; 5) Spontaneous remote hybridizing; 6) Remote hybridization and originating of species; 7) Allopolyploidy and originating of species; 8) Remote hybridization for breeding purposes in plum species, apricot, peach, almond, cherry, and rootstocks or stone fruit trees; 9) Decorative hybrids for green areas.

The present book should be of great interest and a cherished addition to the literature in interspecific hybridization of stone fruit.

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