FIG CULTIVAR DEVELOPMENT AND EVALUATION

J. F. Doyle and L. Ferguson
Department of Pomology
University of California
One Shields Avenue
Davis CA 95616
USA

K. Herman
The Specialty Crop Company
17053 Road 26 Suite D
Madera CA 93637
USA

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Abstract

The principal objective of this project is the development of a high quality, large size, light colored dried fig, as similar as possible to the Calimyrna fig variety. In contrast to the Calimyrna, this new fig would not need to be caprified (pollinated) and would have a small closed ostiole (eye), restricting insect access to the interior of the fig fruit.

Hybridizations directed at the project goals began in 1991 and continued in 1992. By the end of 1993, about 2400 hybrid fig seedlings had been planted in seedling rows at the UC Kearney Agricultural Center (KAC), Parlier, California, USA. From 1994 through 1996, 45 seedlings were initially selected as having some promise of development into the desired type of cultivar. From 1997 through 2000, evaluation of the 45 selections has continued, primarily from fruit produced in the original seedling block. In addition to the oldest seedling block, additional plantings of the advanced selections have been made in a consolidated selection block at KAC and in three grower test plots in Madera County, CA.

The primary characteristics under evaluation are fruit size, skin color, skin quality, ostiole size, fruit flesh quality and density, fungal decay potential and tree productivity. During the 2000 season, fruit was observed at KAC and in grower trials. Although production was light to very light in some of the grower locations, the 45 selections were reduced to 12 primary candidates by the end of the year 2000, using the seven criterion listed above.

Evaluation of fungal decay potential was carried out during 1999 and 2000. A field test planting of a row of 50 trees of the most advanced fig selection 6-38W was established in spring of 1999. Although too young yet to produce much fruit, the growth and production characteristics of this selection will be observed over the next several years. An additional test planting of three advanced fig selections will be established in grower trials in spring of 2001.

1. Introduction

Bearing orchards of all fig cultivars growing in California as of July 31, 2000 are estimated at 14,726 acres. Non-bearing fig trees are estimated at 576 acres, for a total statewide estimate of 15,302 acres. The Calimyrna fig cultivar makes up about 43 percent

of the total, estimated at 6,083 acres bearing and an additional 425 acres non-bearing. Prices received by producers for dried merchantable Calimyrna figs have always been high, reflecting the desirability of this cultivar for use in packaged figs. Unfortunately, average per acre production for Calimyrna is relatively low. Statistics for the 1999 crop year show 3,654 tons of Calimyrnas (merchantable and substandard) produced on 6,083 acres statewide, for an average of 0.60 tons or 1200 pounds per acre. Newer orchards have a somewhat higher production potential, due primarily to higher tree densities.

Incidence of fruit loss or quality deterioration due to endosepsis, smut and other internal diseases is especially high in the Calimyrna cultivar. The process of caprification of this Smyrna (non-persistent) type fig allows the pollinating wasp to vector various fungal and bacterial organisms into the fruit. The large open ostiole of the Calimyrna also allows other insects to enter the fruit, causing further potential for disease contamination. The development of a persistent (common) type fig similar to Calimyrna, but not needing caprification to set a crop and having a small tight eye, would greatly decrease the amount of fruit loss due to spoilage. This type of fig would enhance the possibility of substantially increasing net return per acre to the grower.

The primary objective of this project is the development of a high quality, large size, light colored "Calimyrna type" fig that would not need caprification (pollination) and would have a small closed ostiole (eye) restricting insect access.

2. Materials and methods

The University of California has maintained a fig cultivar improvement program since 1922. The "Conadria" and "DiRedo" cultivars were released to the industry from this program in the mid 1950s and the "Tena" cultivar was selected and released in the mid 1970s. The key to the development of hybrid fig seedlings that are persistent or of the "common" type came in 1942 when Dr. Ira Condit discovered a unique type of caprifig growing at Cordelia, California. This caprifig, thought to be a European cultivar named "Croisic," was parthenocarpic, edible and could pass on the persistent characteristic to a portion of a seedling population developed from it. In time, through the efforts of Dr. William Storey, the Cordelia caprifig was improved through hybridization. By the late 1970s, three superior persistent caprifigs had been identified for use as pollen parents, each bearing heavy loads of fruit with green skin, white meat and amber pulp. One of the caprifigs contained genes of the Calimyrna cultivar. By the late 1980s, with additional hybridization, four new persistent caprifigs had been identified by James Doyle, each containing a varying percentage of the Calimyrna genome.

The current University of California fig cultivar development program is located at the University of California Kearney Agricultural Center (KAC), Parlier, California. The breeding strategy used to achieve the goal of this program is based on the use of the various most recently developed persistent caprifigs, each containing some percentage of Calimyrna genome. The caprifigs are used in a recurrent backcross system, using the Calimyrna fig as the recurring female parent. These backcrosses produce seedling populations with each generation of seedlings possessing an increasing percentage of the Calimyrna genome. Once fruiting of the new seedlings begins, caprifigs and nonpersistent figs are identified and discarded. The persistent type figs are retained and evaluated, using

the criterion of fruit size, quality and tight eye. Seedling figs not meeting the criterion are discarded. Initial evaluation is accomplished in the seedling blocks. Once superior selections are identified, they are re-propagated and placed first in the KAC selection block and then eventually in commercial fig plantings so that comparisons can be made between the new selections and established cultivars. By use of the recurrent backcross method and careful selection, most of the desirable characteristics of Calimyrna could presumably be restored in a common (persistent) type fig.

3. Results and discussion

Controlled cross-pollinations directed at the development of hybrid fig seedlings were initiated in June of 1991 in several Fresno County, California, commercial fig orchards. Pollen was introduced into several different female parent figs with primary emphasis on use of the Calimyrna cultivar. Table 1 displays numbers of seedlings grown in 1992 from the 1991 hybridizations. The female and pollen parents used in each cross are listed, as well as the percentage of Calimyrna genome in each of the persistent caprifig pollen parents.

Table 1. 1992 Fig Seedling Populations

Female Parent	Pollen Parent	% Calimyrna	#Seedlings
Calimyrna	D3-11	50	890
Calimyrna (#C)	D3-11	50	63
Calimyrna	D3-9	25	76
Calimyrna	D13-39	38	124
Stanford Calimyrna	D3-11	50	273

The seedlings listed in Table 1 were field planted in 1992 at the Kearney Agricultural Center. The permanent seedling rows were 12 feet apart and the seedlings were spaced 2½ feet down each row. A low volume (fanjet) irrigation system was installed in 1992 to provide for controlled irrigation of the high-density seedling block. All seedlings were suckered and staked in a vertical position during their developmental stage in order to promote as rapid and as directed growth as possible. This technique has been utilized to shorten, in as much as possible, the unproductive juvenile growth stage of hybrid seedlings.

Additional hybrid fig crosses were made during 1992, partially emphasizing Tena as the female parent and the persistent caprifig D3-11 (with 50% Calimyrna genome) as the pollen parent. This cross was specifically directed at the incorporation of the tight eye characteristic found in the Tena cultivar into a seedling population also partly derived from Calimyrna. Additional seed from the 1991 crosses of Calimyrna by the D3-11, D13-39 and D13-54 caprifigs was planted in 1993 to increase the numbers of seedlings in each of these families and to obtain the fullest expression of the range of traits contained in the various caprifigs. Table 2 lists the parentage and number of fig seedlings planted in seedling rows at Kearney in 1993.

Table 2. 1993 Fig Seedling Population

Female Parent	Pollen Parent	%Calimyrna	#Seedlings
Tena	D3-11	50	353
Calimyrna (F)	D3-11	50	196
Calimyrna (B)	D3-11	50	196
Calimyrna (CL)	D3-11	50	17
Calimyrna	D13-39	38	58
Calimyrna	D13-54	38	98

2.1. Seedling Evaluation

Production of fruit on the seedling populations planted at Kearney in 1992 and 1993 began with the first small amount of cropping in 1994. By 1998, all of the hybrid seedlings had produced enough fruit to complete the initial selection process within the seedling blocks. Seventeen fig selections were identified in 1994 and 19 fig selections were identified in 1995. The last 9 selections were made in 1998. The 1994 selections were grafted into a grower orchard in spring of 1995. Trees made from cuttings of the initial 17 selections were grown in a nursery at Kearney during 1995. Finished trees were established in two grower sites, as well as in a selection block at Kearney in spring of 1996. Cuttings of the nineteen 1995 selections were nursery planted at KAC in the spring of 1996 and were subsequently established as trees in two grower plots and in the KAC fig selection block in spring of 1997. Most of the 9 most recent 1998 selections were rooted as cuttings and were planted in the KAC selection block in 2000. Additional trees of these last selections will be grafted on existing five-year old trees in the KAC selection block in spring of 2001.

Seven primary characteristics are being used to evaluate fruit produced in the KAC seedling blocks as well as in the grower test plots. These include fruit size, dried skin color, dried skin quality, ostiole size, dried fruit flesh quality and density, fungal decay potential and tree productivity. From 1997 through the 1999 growing season, all 45 selections were observed in the KAC seedling block. Insect pressure and fruit contamination is very high in the Kearney blocks, limiting the level of fruit flesh quality and density evaluation that can be carried on at that location. The other six selection criterion can and have been used at Kearney to identify the superior selections. Evaluations made during the 1998, 1999 and 2000 seasons have now reduced the original 45 selections down to 12 primary candidates for further evaluation.

Evaluation of fruit produced at grower test locations continued in 2000 but was rather preliminary and limited by the light amount of fruit present. Fruit evaluation will continue in 2001 with emphasis on the increasing numbers of fruit samples produced in grower test plots. These evaluations will involve the two plantings in Madera County as well as the seedling and selection block at Kearney. Fruit size, dried skin color and quality, ostiole size, dried fruit density and quality and tree productivity will again be the primary characteristics under evaluation. Data from fruit samples at Kearney have indicated some correlation between small ostiole size and lowered incidences of internal decay and infestation. All of the most advanced 12 selections now appear to have a smaller ostiole opening than Calimyrna. During 1999 and 2000, evaluation of the

potential for fungal decay was accomplished by T. Michailides and M. Doster (Department of Plant Pathology, UC Davis). This evaluation will continue in the original seedling blocks during 2001.

A single test planting of 50 trees of the advanced fig selection *6-38W* was established in a grower test location in 1999. From observations made at Kearney, this selection appears so far to be among the best of the final 12 selections. Data from grower test plantings has been inconclusive due to the young age of the trees. The *6-38W* is a cross of Calimyrna with the persistent caprifig D13-39. It is a large size, high quality fig with good color and a relatively tight eye. The tree is large, vigorous and highly productive. The original seedling tree has produced as much as 60 pounds of dried fruit per year at Kearney.