THE ART AND SCIENCE OF ROSE BREEDING
Agenda

- Introductions
- Six-Step Rose Breeding Overview
- The Perfect Example
- Tom’s Favorites
- The Not-So-Perfect Example
- Keith’s Favorites
- Biotechnology & the Blue Rose
- The Future of Rose Breeding
Introducing: The Godfathers of Rose Breeding

Tom Carruth and Keith Zary
Six-Step Rose Breeding Overview

- Step 1: Set breeding objectives
- Step 2: Parental selection
- Step 3: Hybridizing process (April-June, December)
- Step 4: Progeny selection (4-6 years)
- Step 5: Global trialing (2 years)
- Step 6: Build-up and commercial introduction
Step 1: Set Breeding Objectives

Shared Breeding Objectives

- Disease resistance
- Overall garden performance
- Attractive growth habit
- New colors
- New fragrances

Tom gives special focus to garden beauty, attractive aging color, and rapid repeat-blooming climbers.

Keith concentrates heavily on own-root vigor, powerful fragrances, and strong hybrid teas with high-centered bloom form.

Tom’s ‘Fourth of July’

Keith’s ‘Diana, Princess of Wales’
Step 2: Parental Selection

Weeks/J&P Breeding Programs
- Each program has about 2-300 parents
- About half are proprietary
- Both programs located in So Cal
- Important to select parents that will help reach breeding objectives

Tom’s Top Parents
- Voodoo
- City of San Francisco
- Baby Love
- Santa Claus
- Unnamed yellow R. soulieana derivative from Herb Swim’s work

Keith’s Top Parents
- Beloved
- Gemini
- Snowcone
- Unnamed red arching SH seedling from Footloose
- Unnamed fragrant yellow orange blend floribunda seedling from Mirabella

‘Baby Love’

‘Beloved’
Step 3: Hybridizing Process

- Conduct pollinations (April to June)
- Harvest and clean seed (August to September)
- Stratify seed (70 to 90 days at 2°C)
- Plant seed (December)
Step 4: Progeny Selection

- First year selection in seedling greenhouse
- All subsequent selections conducted in Wasco fields
- Trialed for at least 6 years
- Selection criteria
  - Disease resistance
  - Vigor and plant habit
  - Beauty of flower
  - Floriferousness
  - Fragrance
  - Cold hardiness
All-America Rose Selections (AARS)

- Established in 1938 in response to Plant Patent Act
- 20-25 test gardens across the country
- Rigorous two-year, unbiased trial
- AARS winners considered the best roses in the country

Step 5: International Trialing

Hot Cocoa
2003 AARS winner

Gemini
2000 AARS winner
Step 5: International Trialing

- Switzerland
- Japan
- New Zealand
- Australia
- Chile
- Italy
- Germany
- Spain
- Holland
- England
- United States
- France

Weeks J&P
The Perfect Example

**Breeding Objectives**
- Vigorous climber
- Fast repeat bloom
- Novel colorations
- Disease resistance
- Large sprays of flowers
- Nationwide performance

**Parental Selection**
- Roller Coaster
- Altissimo

**Progeny Selection**
- Fourth of July
  - 1999 AARS winner

Altissimo
Tom’s Favorite Rose Creations

- Fourth of July
- Ebb Tide
- Home Run
- Julia Child
- Moonstone
The Not-So-Perfect Example

Breeding Objectives
Soft pink hybrid tea
Color blend
Powerful fragrance
Super clean foliage
Own-root vigor
High-centered blooms

Parental Selection
Fragrant Lace
Pope John Paul II
Keith’s Favorite Rose Creations

- Gemini
- Snowcone
- Tahitian Sunset
- Beloved
- Tuscan Sun
The Mysterious Blue Rose
Biosynthetic Pathway of Pigments

Flavonoid 3’-hydroxylase

Pelargonidin

cyanidin

Pelargonidin

delphinidin blue pigment

Flavonoid 3’, 5’-hydroxylase

The pathway of roses
Roses are Red, Violets are Blue

Lavande

Madam Violet

AOZORA (Blue sky)

Seiryu (Blue Dragon)
Generation of Blue Roses

Obtaining a F3’5’H gene from blue flowers

Induction of callus from leaves

Transformed cell

Introduction of a F3’5’H gene and selection

Flowering

Cultivation in glasshouse

Regeneration
Pigment Analysis vs. Mauve Roses

- **Our blue rose**
- **Lavande**
- **A Mauve rose**
- **Madam Violet**
- **Blue Moon**
- **Seiryu**

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(mg/g petal)
In the End, Roses ARE Blue!

(Well, sort of...)
TO INFINITY AND BEYOND!

The Future of Rose Breeding
Compact Plant with Big Blooms
New Colors
Really Big Tree Roses
Shade-Loving Roses
Drought Tolerant Roses
Water-Loving Roses
Really Cold Hardy Roses!
New Fragrances
Rainbow Roses?
ANY QUESTIONS?