# *The California Rice Varieties*

***From the Rice Experiment Station***

***UC Rice Production Workshop 2015***

**Kent McKenzie**

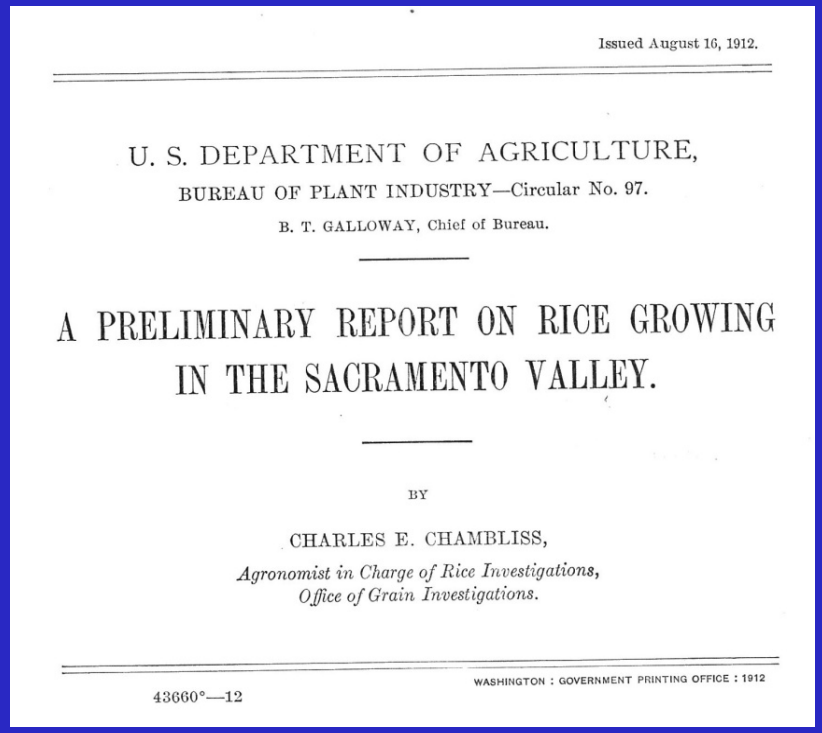
# Rice Experiment Station 1912-2015

*"Whereas an agreement has been reached between the said Sacramento Valley Grain Association and the Bureau of Plant Industry of the United States Government, whereby the said Bureau will undertake to establish and conduct a Cereal Field Station upon the lands hereinafter described, for the purpose of conducting experiments for the improvement of cereals as to yield, quality, disease resistance, etc. and to determine the best methods of cereal production in California."*
*Deed of Trust, June 19, 1912*

**RES varieties are grown on > 90% of California rice acreage**

**The RES Rice Breeding Program has released 47 new cultivars including 10 different market types since 1969.**

**Commercial rice production was launched in 1908 with the maturing of a successful rice crop on 16 ha near Biggs, California. The experiment was by W.W. Mackie, USDA's Bureau of Soils Survey, and led to the assignment of C.E. Chambliss from the Bureau of Plant Industry to take charge of rice investigations for California.**



Issued August 16, 1912.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF PLANT INDUSTRY—Circular No. 97.

B. T. GALLOWAY, Chief of Bureau.

A PRELIMINARY REPORT ON RICE GROWING IN THE SACRAMENTO VALLEY.

BY

CHARLES E. CHAMBLISS,

*Agronomist in Charge of Rice Investigations, Office of Grain Investigations.*

43660°—12

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1912

**Kyushu rice from 1908**

# Founding Varieties
# ‘Colusa’ & ‘Caloro’

Short grain selections from temperate japonica plant introductions from China and Japan constituted essentially all California's rice production until the 1950’s

# CALROSE

## Founding California Medium Grain

- California's first medium grain variety developed by pedigree breeding (Caloro/ Calady//Caloro) and released in 1948.
- By 1975 it was grown on 70% of California's rice acreage.
- Calrose was successful because of its adaptation, yield, grain quality, California's climate, and marketing.
- Today Calrose is a market trade name for California medium grain rice.
- The improved California medium and short grain varieties grown today are the direct descendants of Calrose.

# Major US Market Classes

- **Distinct shape associated with cooking and processing characteristics**
  - Medium and short grains
  - Long grains
- **Physicochemical tests are used as general type indicators**
  - Amylose content
  - Gelatinization temperature, Viscosity profile (RVA)
- **Physicochemical tests are not known or clearly defined for many categories**
  - Calrose
  - Short Grains
  - Premium quality (medium and short grain)
  - Special purpose (waxy, low amylose, and aromatics)

# Major US Market Grain Classes

| | | | |
|---|---|---|---|
| L/W ratio | < 2 | 2 - 3 | > 3 |
| Amylose % | 16 | 17 | 22 |
| Alkali value | 6 | 7 | 4 |
| Setback | 20 | - 40 | 40 |
| Texture | Moist | Moist | Dry |

# Variety Naming System

Grain Type → M
Maturity → 1
Release number → 05

# M-105

**M-105 is a medium grain with very early maturity. It is the fifth release.**

**S=short grain**
**L= long grain**

**Calhikari=premium short**
**A=aromatic**

**Calmochi=waxy(sweet)**
**Calmati=basmati**

# Variety Protection
## Intellectual Property

- RES rice varieties are protected under the U.S. Plant Variety Protection Act (PVP), Title V of the National Seed Act since 1988.
- Export of seed of protected rice varieties is prohibited.
- Seed of protected varieties may be sold only as a class of certified seed produced in California.
- RES rice varieties are protected by US Utility Patents since 2000.
- Use of these patented varieties for research or breeding purposes requires a Material Transfer Agreement (MTA) from CCRRF.
- CCRRF has not charged any royalties or fees for any of the rice varieties that we have in production.

## RES Varieties in Commercial Production

- Medium grain
  - California — Calrose (M-104 to M-209)
  - Premium — M-401, M-402
- Short grain
  - California — S-102
  - Premium — Calhikari-201, Calhikari-202, Koshihikari (Japanese)
- Long grain
  - Traditional US — L-206
- Special Purpose
  - Waxy, Mochi, or Sweet — Calmochi-101, Calmochi-203
  - Aromatic (Long grain) — A-202
  - Basmati — Calmati-202
  - Low Amylose — Calamylow-201

## 2012 Very Early Advanced Variety Tests (4 location average)
## UC Cooperative Extension- Hill et al.

| Entry | Grain Type | Grain Yield kg/ha | Harv. H20 (%) | Seedling Vigor (1-5) | Days to 50% Heading | Lodging (1-99) | Height (cm) |
|---|---|---|---|---|---|---|---|
| 09Y2141 | SWX | 11220 | 20.9 | 4.9 | 90 | 35 | 97 |
| M206 | M | 10820 | 20.6 | 5.0 | 92 | 20 | 94 |
| 09Y2036 | S | 10760 | 19.1 | 4.9 | 89 | 60 | 97 |
| 10Y3286 | M | 10750 | 19.0 | 4.9 | 88 | 2 | 91 |
| 11Y1005 | L | 10620 | 18.0 | 4.8 | 93 | 2 | 94 |
| 08Y3310 | M | 10520 | 20.8 | 5.0 | 94 | 1 | 89 |
| M104 | M | 10450 | 19.6 | 5.0 | 86 | 10 | 91 |
| 08Y2049 | SSR | 10350 | 19.5 | 4.1 | 89 | 10 | 86 |
| 06Y575 | L | 10320 | 19.0 | 4.0 | 99 | 10 | 97 |
| CH202 | SWX | 10160 | 17.9 | 4.9 | 89 | 60 | 86 |
| L206 | L | 10140 | 16.8 | 4.6 | 92 | 1 | 81 |
| 08Y3269 | M | 10140 | 21.7 | 4.9 | 96 | 25 | 94 |
| M202 | M | 9880 | 21.4 | 5.0 | 95 | 20 | 97 |
| CH201 | SPQ | 9770 | 17.6 | 5.0 | 94 | 50 | 89 |
| S102 | S | 9640 | 15.6 | 5.0 | 84 | 30 | 91 |
| M205 | M | 9250 | 22.8 | 5.0 | 99 | 25 | 89 |
| CM101 | SPQ | 8770 | 16.5 | 5.0 | 85 | 35 | 91 |
| MEAN | | 10200 | 19.2 | 4.8 | 91 | 23 | 91 |
| CV | | 4.7 | 5.5 | 2.5 | 1.2 | 66.4 | 4 |
| LSD (.05) | | 340 | 0.7 | 0.1 | 0.1 | NA | 2.5 |

S = short; M = medium; L = long; PQ = premium quality; WX = waxy; SR = Stem Rot Resistant.

Subjective rating of 1-5 where 1 = poor and 5 = excellent seedling emergence.

Subjective rating of 1-99 where 1 = none and 99 = completely lodged.

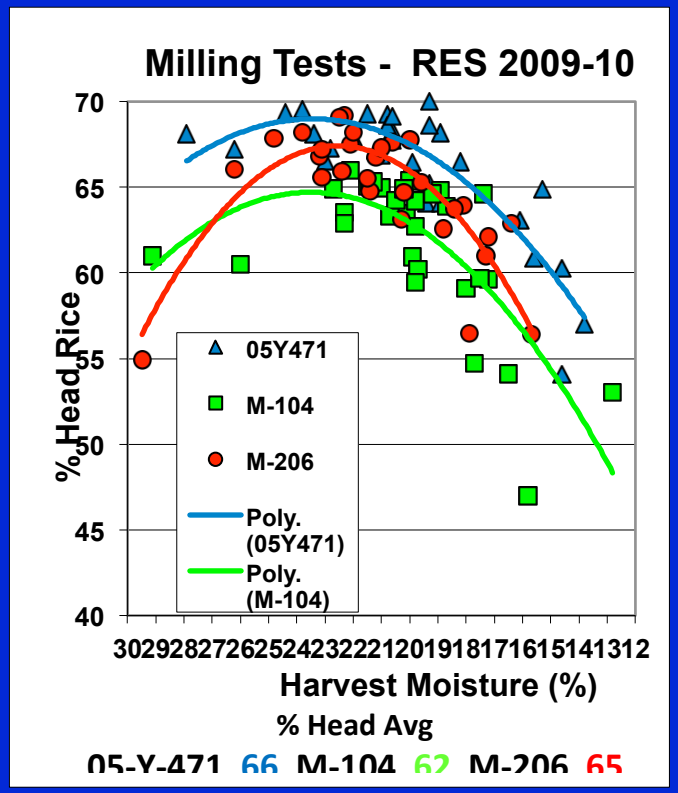
http://ucanr.edu/sites/RiceTestSite/Reports-Publications/Agronomy_Papers/

# CALROSE SERIES

| Variety (year) | Strengths | Weaknesses | Comment |
|---|---|---|---|
| M-104 2000 | Earliest maturing<br>Very blanking resistant | Milling yield can be lower<br>More susceptible to blast | Cold areas<br>Late planting |
| M-105 2011 | Early Maturing<br>Excellent milling yields | Not as early as M-104 or as blanking resistant | M-206/M-104 alternative |
| M-202 1985 | Old broadly adapted | Lodging<br>Head rice yield stability | Seed production ending |
| M-205 2000 | Yield  Lodging resistance<br>Good milling | Susceptible to blanking/blast<br>Later maturing | Very popular in warmer areas |
| M-206 2003 | Good yield potential<br>Excellent milling yields | Lodging | Most widely planted |
| M-208 2006 | Resistant to Blast Race | Slightly lower yield potential | Blast prone areas |
| M-209 2015 | Highest yield potential<br>Larger kernel | Milling yield not as high?<br>Commercial experience? | 2015 seed release |
| | | | |

# Staying Focused on Breeding Objectives

## High Stable Milling Yield




**M-105**
**Very Early Maturing**
**Calrose Medium Grain**

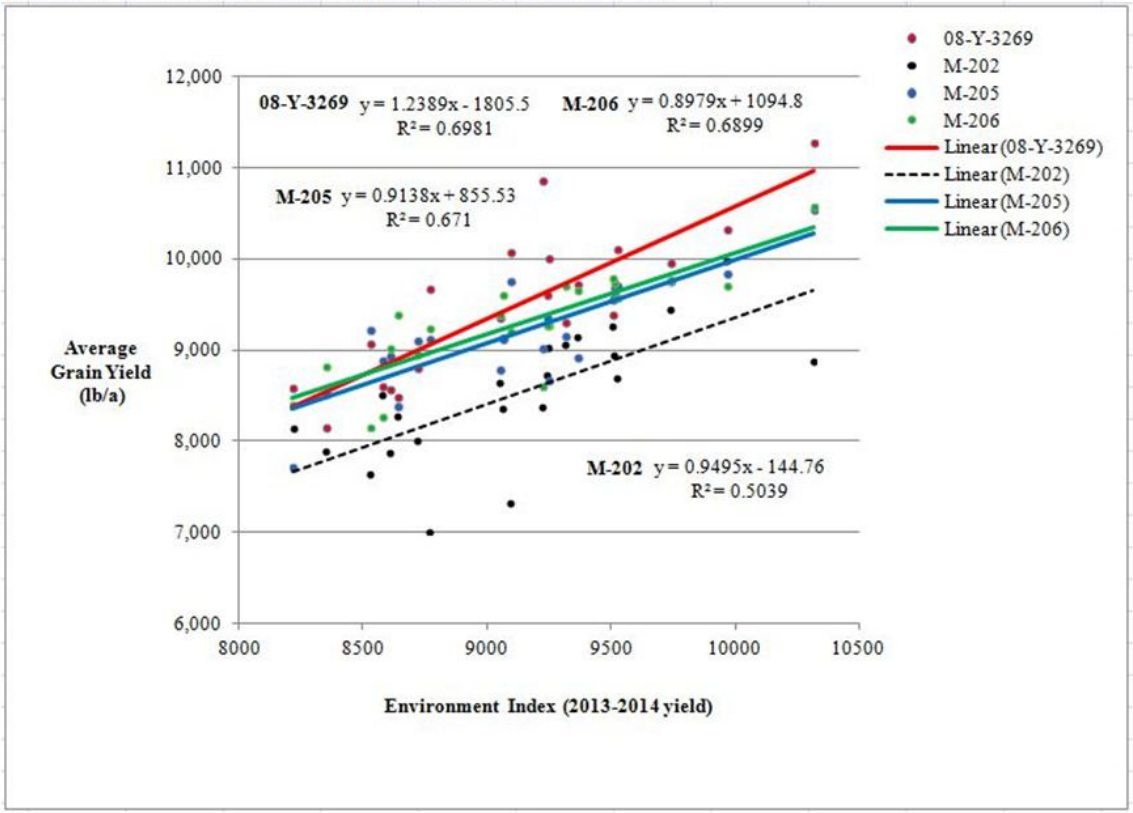
# Statewide Data Summary- M-209, 2010-14.

| Item | Entry | Seedling Vigor | Days to Heading | Plant Height | % Lodging |
|---|---|---|---|---|---|
| Very Early SW, 2010-14 | M-202 | 5.0 | 89 | 102 | 29 |
| | M-205 | 4.9 | 93 | 98 | 6 |
| | M-206 | 4.9 | 85 | 102 | 28 |
| | **08Y3269** | 4.9 | 91 | 100 | 7 |
| Early SW, 2012-14 | M-202 | 5.0 | 94 | 96 | 15 |
| | M-205 | 5.0 | 97 | 92 | 17 |
| | M-206 | 5.0 | 88 | 96 | 21 |
| | **08Y3269** | 4.9 | 95 | 95 | 15 |
| Intermediate-Late SW, 2013-14 | M-202 | 5.0 | 89 | 104 | 25 |
| | M-205 | 4.8 | 92 | 100 | 17 |
| | M-206 | 4.9 | 83 | 100 | 32 |
| | **08Y3269** | 4.9 | 90 | 103 | 17 |
| | | | | | |
| **Overall Means** | **M-202** | **5.0** | **91** | **101** | **24** |
| | **M-205** | **4.9** | **94** | **96** | **11** |
| | **M-206** | **4.9** | **86** | **100** | **26** |
| | **08Y3269** | **4.9** | **92** | **99** | **11** |

# Comparative Yield of 08Y3269 in SW Test

| Year | Location | Average Grain Yield | % Grain Yield Advantage Over | | |
|---|---|---|---|---|---|
| | | | M-202 | M-205 | M-206 |
| 2010-14 | Biggs | 10,080 | 15 | 0 | 4 |
| | Butte | 9,330 | 13 | 5 | 4 |
| | Colusa | 10,140 | 9 | 5 | 3 |
| | Yuba | 9,600 | 5 | 2 | -1 |
| **Early SW Average** | | **9,790** | **10.6%** | **3.1%** | **2.7%** |
| 2012-14 | Biggs | 10,430 | 23 | 8 | 12 |
| | Sutter | 9,830 | 4 | 8 | 2 |
| | Yolo | 9,960 | 8 | 4 | 1 |
| | San Joaquin | 8,280 | 2 | 23 | -7 |
| **Very early SW Average** | | **9,620** | **9.4%** | **10.5%** | **2.1%** |
| 2013-14 | Biggs | 10,690 | 22 | 5 | 6 |
| | West Sutter | 9,080 | 7 | 5 | 0 |
| | Glenn | 8,550 | 2 | -1 | -3 |
| **Int-Late SW Average** | | **9,440** | **10.2%** | **3.2%** | **1.2%** |
| **Grand Average** | | **9,680** | **10%** | **6%** | **2%** |

Trend analysis of combined 2013-2014 SW average grain yield of 08-Y-3269, M-202, M-205, and M-206 plotted against grain yield environment index. Data for plotting were taken from Supplemental Tables 1-11.



# M-209

## Experimental 08Y3269
## (Foundation seed released 2015)

**Dr. V. C. Andaya**
**Director of Plant Breeding**

- Overall Statewide yield advantage of 10%, 6%, and 2% over M-202, M-205, and M-206,respectively
- Adapted in areas where M-205 or M-202 are grown
- Days to heading is in between M-202 and M-205
- Slightly bigger (longer) kernels compared to M-205 or M-206
- Less lodging than M-206, no major blast resistance genes
- Milling yields slightly lower
- Yields may be low in San Joaquin but has better performance than M-205 in cool areas

08Y3269 was tested in UCCE Statewide yield tests for 5 years, and one year strip trial, and at RES

# Premium Quality Medium Grain
# (premium paid over Calrose)

| Variety (year) | Strengths | Weaknesses | Comment |
|---|---|---|---|
| M-401<br>1981 | Quality standard<br>Large kernel | Late Maturing, blanking<br>Lodging, low milling, chalk | Warm areas |
| M-402<br>1999 | Earlier Maturing<br>Better milling yields | Smaller kernel<br><M-401 cooking quality | Limited use |
| | | | |

# Premium Quality Medium and Short Grains

M-401 M-402 Kokuhorose

**Micro-cooking tests**

- ✓Cook slightly sticky, glossy
- ✓Taste smooth, tender, slightly sweet
- ✓Subtle aroma
- ✓Soft after cooling
- ✓Protein < 6.0%

# SHORT GRAINS

| Variety (year) | Strengths | Weaknesses | Comment |
|---|---|---|---|
| S-102 2000 | Earliest maturing Yield, large kernel | Milling yield can be lower Rough hull | Std. short grain |
| Calhikari-201 1999 | Seed vigor, premium quality | not blanking resistant, blast susceptible | 1st CA premium short grain |
| Calhikari-202 2012 | Higher yield, better cooking than 201 | Lodging, not blanking resistant | Improved CA premium short grain |
| Koshihikari 1953 | Premium quality std. Good milling | Extreme lodging, later maturing, and low yields | Japanese introduction |
| Calmochi-101 1985 | Very blanking tolerant, very early | Rough hull, lower yields | CA mochi (sweet or glutinous) rice |
| Calmochi-203 2015 | Smooth hull Very high yields | Long grain filling period, experience, market acceptance ? | New release |
| | | | |

# Calmochi-203

## Experimental 09Y2141

## (Foundation seed released 2015)

•09Y2141 is a stable high yielding, semi-dwarf, early-maturing, smooth, waxy short grain.
•Significantly higher grain yield than CM-101 in all 38 Statewide Test environments from 2010 to 2014
(27% yield advantage 9650 lb/acre vs. 7590 lb/acre for CM-101)
•Similar to CM-101 in seedling vigor, taller by about 5 cm, it required one more day to reach heading and 11 more days to reach maturity (20% MC), and it lodged slightly more.
•Higher head rice percentages, larger grain size dimensions, and lower viscosity than CM-101.
•Blanking, based on the San Joaquin Tests, was about 3% higher in 09Y2141 than in CM-101.
•Comments from external evaluators in 2013 and 2014 ranged from 09Y2141 being softer than CM-101, to it being acceptable and a potential replacement to the current variety.
•Specialty type should be grown with marketer contract.

**Dr. S.O. Samonte Short Grain Project Leader**

# LONG GRAINS

| Variety (year) | Strengths | Weaknesses | Comment |
|---|---|---|---|
| L-206 2000 | High yield, lodging resistant, large kernel | Slightly less vigor and lower milling than medium grains | Market and miller |
| Calmati-202 1996 | Basmati cooking and aroma | Low yield potential, rough hull, low milling yield, blanking | Warm areas Market and miller |
| A-202 2014 | Higher yield and seedling vigor | Commercial experience limited, not blanking resistant | Warm areas Market and miller |
| | | | |

# A-202

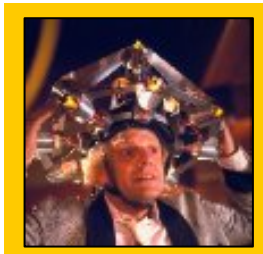
## Released to California Seed Growers 2014

Dr. Farman Jodari
Project Leader

Early maturing aromatic long grain

(Replacement for A-301)

- Improved Seedling Vigor 3.5 vs. 4.9
- Earlier Maturity head 9 days earlier
- Yield Advantage 18%
- Head Rice Yield 60 vs. 53



# Its Quiz Time!
# (almost done!)

## M-206 is . . .

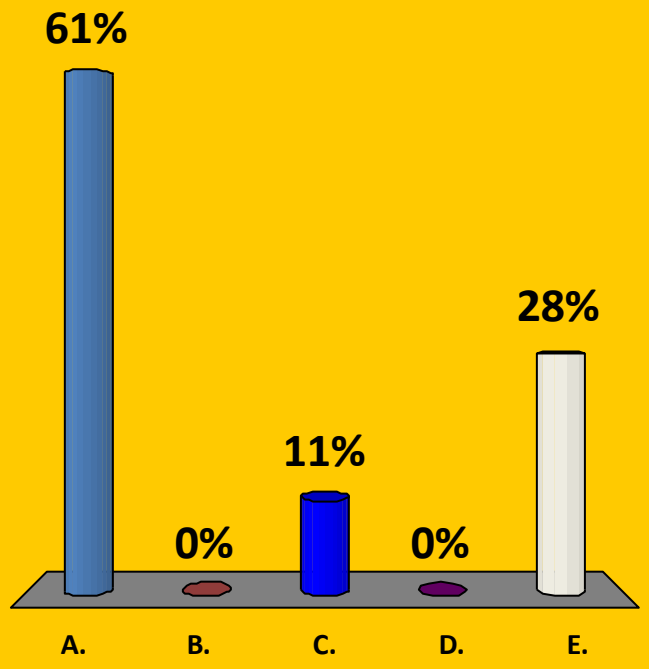
✓ A. An early maturing Calrose legacy medium grain rice and is the 6th release.

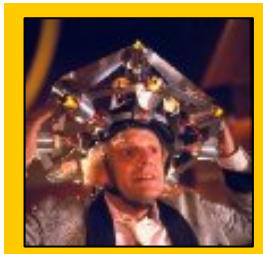
B. Name of the form you fill out at the FSA Office.

C. An very early maturing Calrose legacy medium grain rice and is the 6th release.

D. Name of the droid in the new STAR WARS movie.

E. A late maturing premium quality medium grain rice and is the 6th release.





# Its Quiz Time!
# (getting closer!)

**The Statewide Yield Tests are:**

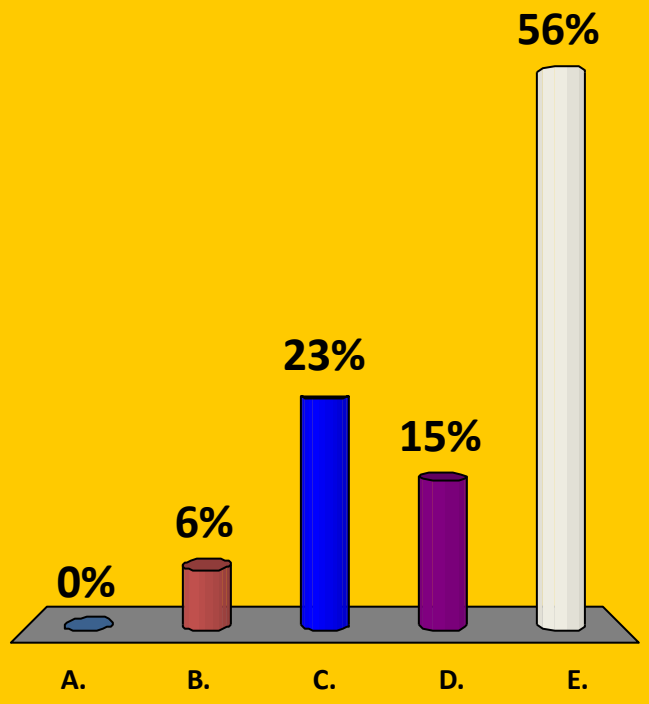
A. Department of Education tests for elementary school children.

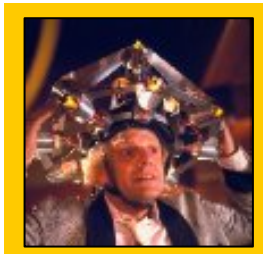
B. Are tests of experimental lines and rice varieties conducted at the Rice Experiment Station.

C. Are tests of experimental lines and rice varieties conducted at the Rice Experiment Station and in growers fields.

D. Are tests of experimental lines and rice varieties conducted at the Rice Experiment Station and in growers fields by the UCCE.

✓ E. Are tests of experimental lines and rice varieties conducted at the Rice Experiment Station and in growers fields by the UCCE funded by the California Rice Research Board.





# Its Quiz Time!
# (Last one)

## The RES rice varieties discussed today are:

A. Public varieties and have no restriction on their use, export, or sale.

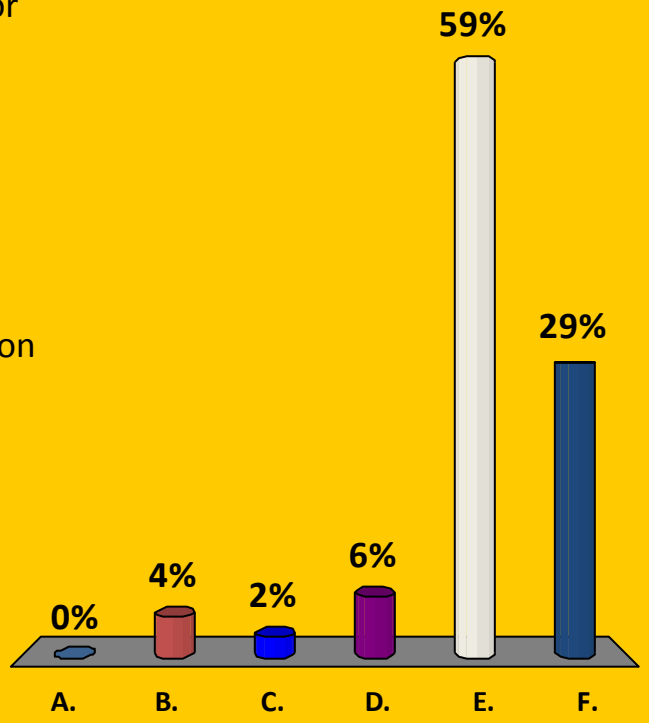
B. The property of the California Cooperative Rice Research Foundation and have no restriction on their use, export, or sale.

C. The property of the University of California and have no restriction on their use, export, or sale.

D. The property of the University of California and have restriction on their use, export, or sale and require “royalty payments”.

E. The property of the California Cooperative Rice Research Foundation and have restriction on their use, export, or sale and require no “royalty payments”.

F. The property of the California Cooperative Rice Research Foundation and have restriction on their use, export, or sale and require “royalty payments”.



# The Rice Experiment Station Staff

*(It's where the varieties come from)*