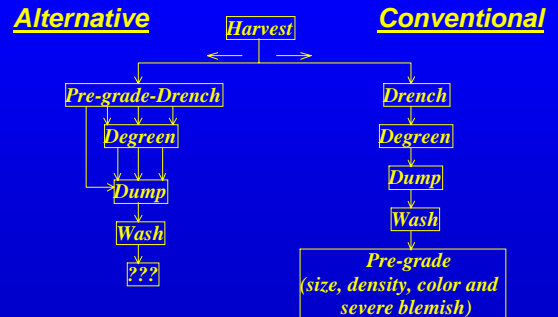


## Color Separation of Florida Citrus Prior to De-greening

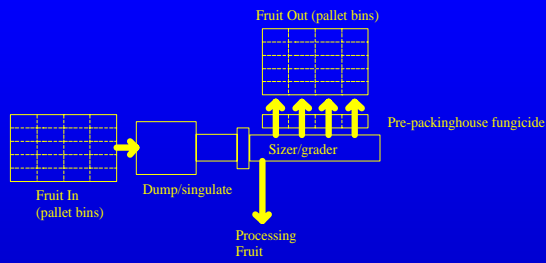
William M. Miller  
Citrus Research & Education Center  
Presentation for 44th Not Quite Annual Citrus  
Packinghouse Day



## Fruit Process Operations



## Grading facility



## Automatic Grading Parameters

Parameter	Technology Status	Constraints	Field Run (unwashed)
Color	Proven	Standards [function of market], camera view [CV]	?
Blemish	Proven	Standards [f[market, blemish], CV]	Doubtful
Density	Proven	Volume calculation, edge detection (ED), CV, accurate mass	Probable
SSC (Brix level)	Proven-NIR	Cost, temp. correction, peel compensation, speed	Probable
Size	Proven	Axis consideration (AC), ED	Probable (Under/Over)
Shape		CV, ED, AC	?

General disclaimer: Higher accuracy and throughput desirable for all of the above

## Initial study with the objectives :

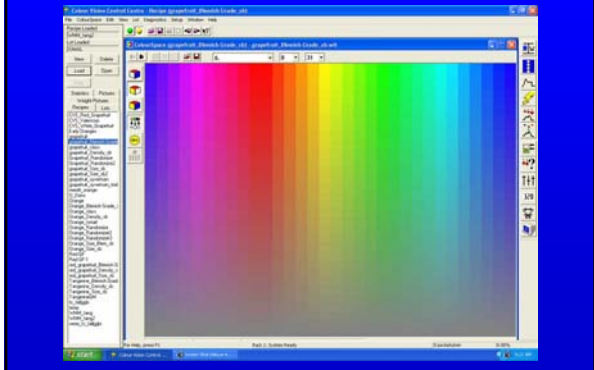
- Determine the feasibility of citrus fruit color separation before de-greening
- Determine the percent of fruit that may bypass de-greening or be de-greened for shorter periods

[Note: initial tests with Fallglo tangerines in Fall 2003]

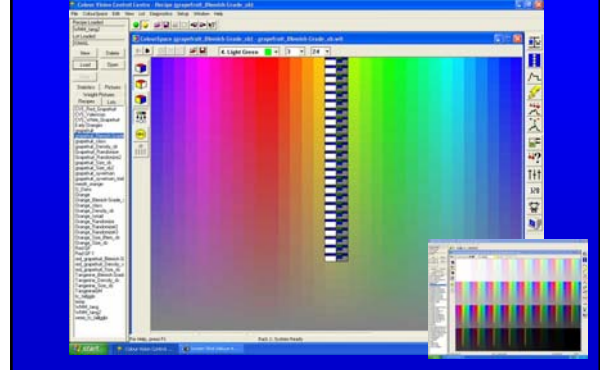
## CVS Grading Unit



## Color Space (hue, saturation, intensity)



## Color Space Definition



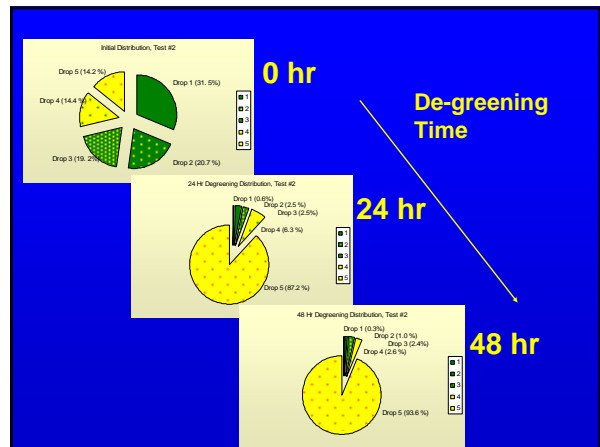
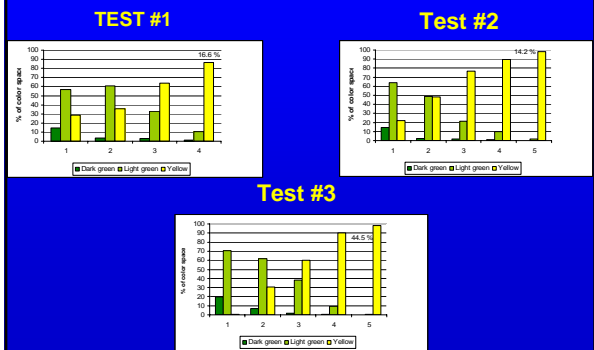
## Color Drop Assignments

Drop Assignment	Dark Green	Light Green	Yellow
#1 Dark Green	> 10 %	> 40 %	-----
#2 Light Green 1	5 - 10 %	30 - 40 %	-----
#3 Light Green 2	-----	15 - 30 %	-----
#4 Light Green 3	-----	5 - 15 %	> 25 %
#5 Yellow	Default (< 5 %)	Default (< 5 %)	Default (0-100 %)

## Fallglo tangerines 3 tests- Fall 2003

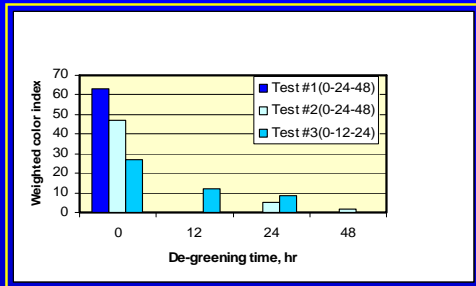


## Initial Color Distributions



### Color change- Fallglo (fall2003)

-based on weighted color index  
(100- all fruit dark green, 0- all fruit yellow/orange)



### General Conclusions

-Preliminary

- Field-run fruit can be separated readily, based on color, with current optical grading equipment.
- Initial tests with Fallglo tangerines indicated that 14 to 44 % of fruit had adequate color for immediate packing.
- Extending the de-greening time from 24 to 48 hr (test #2), 12 to 24 hr (test #3) provided only a slight improvement in color grade improvement. Percent of Fallglo fruit categorized as dark or light green dropped from 3.1 to 1.3 % (test #2) with an additional 24 hr de-greening.
- Late season harvested fruit had a significantly higher percent of fruit with acceptable color, yet the dark green fruit was more difficult to de-green.

### Advantages/Disadvantages field-run fruit grading

#### Advantages

- Enhance fruit quality as de-greening time is eliminated or minimized
- Facilitate better use of de-greening room space (e.g all fruit with 24 hr requirement in one area)
- Efficient use of packingline and de-greening rooms- a higher percent of the fruit handled would be packable grade(s)

#### Disadvantages

- Additional handling step in/out of pallet bins
- Available fruit to pack may be limited at some times, a priori de-greening time may be difficult to estimate
- May not totally replace current pre-grade operation

### Acknowledgements

- Sherrie Buchanon, Sr. Engineering Technician and Guillermo Moreda, Ph.D. student, Univ. of Madrid
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Thank you for your attention

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