INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES
UNIVERSITY OF FLORIDA

FLORIDA COOPERATIVE EXTENSION SERVICE

PACKINGHOUSE NEWSLETTER

W. Wardowski, Editor
CREC
700 Experiment Station Road
Lake Alfred, Florida 33850
Phone (813) 956-1151

Packinghouse Newsletter No. 166
February 28, 1992

Key Index Words: Citrus Packinghouse Day, Grading, Lighting, Machinery, Safety

LIGHTING FOR GRADING

Bill Miller
Citrus Research and Education Center, Lake Alfred

Lighting is very important in manual grading and inspection tasks in many industries. Grading of Florida citrus is no exception. Ergonomic design of a grading station would include:

1. Conveyor considerations (capacity, length, width, speed, roller rotation),
2. Graders' placement and positioning,
3. Location of fruit discharge chutes and reject conveyors,
4. Graders' work schedule and equipment (e.g., gloves),
5. Work environment (noise level, air-conditioned area),
6. Lighting.

Fluorescent lighting is normally used as opposed to incandescent bulbs. However, the fluorescent bulb selection should be taken into consideration. Fluorescent lights have a wide range of phosphor colors (Table 1). "Warm" lamps generally enhance reds and oranges, dulls blues and imparts a yellowish tint to whites and greens. "Cool" lamps enhance blues, dull reds and imparts a bluish tint to whites and greens.

Table 1. Light Characteristics

Description	Lamp color	Lumens per watt	CRI
HPS lamps	warm	N/A	20
Warm white	warm	80	52
Designer 3000	warm	82	69
Metal halide	mid-range	N/A	65-70
Designer 4100	cool	82	69
Cool white	cool	79	62
Design 50*	cool	55	90
Mercury lamps	cool	N/A	22
Daylight	cool	67	76

*Above table consolidated from W. W. Grainger, Inc.

The color rendering index (CRI) measures the amount of color distortion. A CRI of 100 would indicate no color shift or distortion. A recent assessment in Washington state apple packing (Kuperfman, 1991) indicated no significant difference between bulbs with CRI ratings from 40 to 80. However, Maunder (1991) reported that higher CRI ratings were advantageous in detecting bruising and green areas for potato. Affeldt, et al (1991) recently reported a mix of bulb types, fixture orientation and light intensities (54-2152 lux) for California and Arizona citrus packinghouses. At present, we have no data for Florida citrus but a survey of Florida industry practices is underway.

Intensity of lighting is normally reported in lumens. Measurements can be made with hand-held light meters typically used for photography and costing $50 to $200. When divided by the coverage area,the term lux (lumens/square meter) is employed. Many light meters measure in units of foot-candles (1 foot-candle = 10.76 lux). Illumination requirements vary significantly dependent upon the task. Some examples from Diffrient et al. (1981) follow in Table 2.

Table 2. Examples of Illumination Requirements

Situation	Foot-candle units	Lux
Movie theater	0.1	1
Indoor parking	5	54
High school football	2	215
Mail sorting, difficult inspection	100	1080
High difficult inspection, detailed drafting	200	2150
Most difficult inspection, fine machine work	1000	10800

To relate these levels to the power of the sun, a bright, sunny midday output is 80,000 lux. For fruit and vegetable grading, a range from 1,000 to 2,000 lux brackets most recommendations. Lighting too intense can result in glaring and a diminished grader performance.

Two factors should be noted here. First, the luminous flux is reduced by the square of the distance. Secondly, a lamp's output will degrade with time and is further reduced via dirt/dust on bulbs or reflectors or both. Dependent upon bulb type, a flourescent lamp will generate approximately 75 to 80% of its initial output after 5000 hours of service. Ambient temperature will also alter the lamp's illumination output.

A reflector arrangement with an adjustable chain support is recommended. The grading table illumination will be increased and the shading effects minimized. A vertical chain adjustment can be used to eliminate direct light shining into an operator's eyes. Illumination is an important design area that can improve grader performance and thereby product quality. Initial design and proper maintenance are both essential.

References

Affeldt, H. A. and P. W. Winner. 1991. Lighting practice and principles for manual citrus inspection. ASAE Paper No. 91-3549. St. Joseph, MI.

Diffrient, N., Tilley, A. R. and D. Harmon. 1981. Humanscale 9-light and color. MIT Press.

Kupferman, E. 1991. Cherry quality - a 1991 postharvest update. Tree Fruit Postharvest Journal 2(1):5-8. Washington State University.

Maunder, B. 1991. Shedding light on packinghouse. Grower 115(24):27-28.

MACHINERY SAFETY

Bill Miller
Citrus Research and Education Center, Lake Alfred

To identify accidents by machinery type, an OSHA report (Best's Safety Directory 1989) classified all machinery into six groups: 1) conveyors, 2) saws and cutters, 3) presses, 4) rolls and lathes, 5) mixers and drilling rigs and 6) pumps. Of these six, conveyors proved to be the most hazardous machine category.

The main cause for all accidents was problems with operating procedures. Other accident factors cited include: illiteracy/language difficulties, poor housekeeping, loose clothing/long hair, multiple trades working together, machines in a testing stage, workers alone and alcoholism. Preventive measures to remediate the above include: 1) establish and enforce safety procedures, 2) supervision, 3) training programs, 4) lockout and tagging procedures, 5) machinery guarding, 6) machinery maintenance and 7) personal protective equipment. These preventive measures are the responsibility of management in concert with the employees.

One area that could be improved in almost any citrus operation is proper machine guarding. Gears, chains and sprockets must be guarded by one of the following: 1) complete enclosure, 2) standard guard at least 7 feet high, 3) band guard covering the gear face, with flanges extending inward past the root of the teeth on any exposed sides. If any part of the gear train is within 6 feet of the floor, install a disk guard or complete enclosure 6 feet high. All sprocket wheels and chains (except manual type) which are not 7 feet above the ground must be enclosed. If a drive extends over other machines or work areas, provide protection against falling.

The above discussion includes excerpts from the OSHA Safety Guidelines. It is certainly to everyone's benefit to become familiar with these guidelines and to implement and encourage safety programs through proper equipment installation, machinery maintenance and worker safety training.

References

Best's Safety Directory 1989. Chpt. 8. Machine guards, process guidelines tool handling.

U.S. Dept. of Labor, OSHA Administration. 1976. Machine Guarding. OSHA 2247.

FLORIDA CITRUS QUALITY TESTS

Will Wardowski
Citrus Research and Education Center, Lake Alfred

This 20 page special publication is available from the University of Florida (see Available Publications) as a "for sale" publication. It explains the maturity test methods and uses for Florida citrus. It is an extensive revision of an earlier bulletin by the same title. Topics include the basics of maturity standards, certification, evaluation of maturity, facilities and equipment and methods of calculating the crop value based on pounds-solids. This information will be of interest to growers, packers, processors, fruit inspectors and marketers.

THIRTY-FIRST ANNUAL CITRUS PACKINGHOUSE DAY

THURSDAY, SEPTEMBER 10, 1992
CITRUS RESEARCH AND EDUCATION CENTER
700 EXPERIMENT STATION ROAD
LAKE ALFRED, FL 33850

Citrus Packinghouse Day is scheduled Thursday, September 10, 1992 with registration beginning at 8:30 AM and the program beginning at 9:30 AM. Tickets for lunch may be purchased at registration. There is no meeting registration fee and reservations are not required.

Equipment displays will be in the afternoon. Exhibitors are encouraged to register soon. Phone (813) 956-1151 for W. Miller or W. Wardowski to obtain an exhibitor registration form.

AVAILABLE PUBLICATIONS

Available from Dr. W. Wardowski, CREC, 700 Experiment Station Road, Lake Alfred, Florida 33850

Florida Citrus Packing Line Studies with an Instrumented Sphere, by W. M. Miller and C. Wagner. 1991. Applied Engineering in Agriculture. 7(5):577-581.

Mechanical Harvesting: Rising Phoenix or Long Dead Zombie?, by Bill Grierson. 1991. Citrus Industry. 72(2):74-76.

Sucrose Phosphate is not Transported in Vacuoles or Tonoplast Vesicles from Red Beet (Beta vulgaris) Hypocotyl, by Ed Echeverria and Michael E. Salvucci. 1991. Plant Physiol. 96:1014-1017.

Available from Mr. Yu Zhang-long, Guangzhou International Conference Centre for Science and Technology of China, International Citrus Symposium, Xiao Bei, Xia Tang, Xi Sheng St. Huan Shi Middle Rd., 510050 Guangzhou, China

Proceedings of the International Citrus Symposium, by Huang Bang-yan and Yang Qian. November 5-8, 1990. 2 volumes, 168 papers. U. S. $120.00.

Available from IFAS Publications, Bldg. 664, P. O. Box 110011, University of Florida, Gainesville, FL 32611-0011

Florida Citrus Quality Tests, by W. Wardowski, J. Soule, J. Whigham and W. Grierson. 1991. IFAS, Univ. of Fla., Fla. Coop. Exten. Serv. SP-99. 20 pages. $3.00 in U.S.(Florida residents add 6%); $5.00, outside U.S., shipped airmail.