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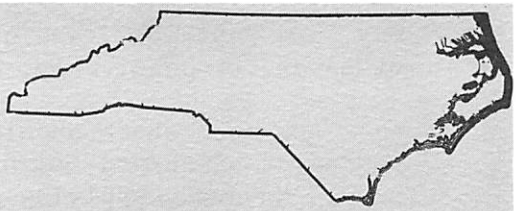

Greenhouse Shadings - A Little Goes A Long Way

by Bill Fonteno

As Spring finally arrives, many growers begin to think about shading their greenhouses. Here in North Carolina, summer shading is necessary to keep day temperatures down, but sometimes we tend to over do it. With the noteable exception of tropical foliage plants, most of our floricultural crops can use full sunlight (10,000 foot candles) during their vegetative growth stage. (Some light reduction is beneficial during the latter part of the flowering stages for some crops, like chrysanthemum, to prevent flower burn.) Therefore, too much shading can reduce the quality of our product and/or increase cropping time.

Here in North Carolina, we enjoy relatively high light all year long. Acroos the state, we receive the maximum amount of total radiation per day (intensity x hours of sunlight) in June and the least amount of radiation in December. The northern coastal region (around Cape Hatteras) receives more sunlight in June than any other area in North Carolina. Using this value as 100%, Table One shows the relative amounts of sunlight received per day for six locations across North Carolina throughout the year. For any given month, there is little difference in the relative amounts of sunlight for different locations. However, some interesting differences do exist. For example, Raleigh (82%) receives 6% less sunlight in April than either Wilmington or Cape Hatteras (88%). In fact, the Piedmont area (around Raleigh) generally receives the least amount of sunlight all year. However, all North Carolina radiation values are much higher compared with northern locations like Buffalo, New York where they would have half the amount of sunlight we do in December and January.

In comparison, Albequerque, New Mexico generally receives more sunlight all year than any place in North Carolina, even though it is approximately the same latitude as Charlotte. Why? The explanation can be found in Table Two. This table shows the number of hours of daily sunshine (not obstructed by clouds) for these same locations throughout the year. Note that Charlotte has approximately 10.5 hours of sunshine per day in June, whereas Albequerque receives 12.2

Cloud cover is important because the shading level for your greenhouse is based on the maximum sunlight exposure. If your greenhouse will only be exposed to this maximum level for a relatively short period, it may be

beneficial to put on a very light shade which would be adequate for April, May, and September, and use alternative shading systems such as cheese cloth or saran for June, July, and August.

How much shade should you apply? The generally accepted light intensity needed at bench/bed height in the greenhouse is approximately 5,000 fc (½ full sun). However, applying 50% shade to your house will give you much less light than 5,000 fc.

Light is partially screened out due to the covering on the house. Glass will allow about 90% of the light through to the crop; one layer of polyethylene will let in about 88%, two layers lets in about 80%; whereas new fiberglass will transmit 90-95%. Another reason for light reductions is the structured supports for the house itself. In a glass house, the frame and sash bars can block out as much as 15% of the light (the amount blocked out by a poly-house frame would be less). Therefore, on a bright summer day, light intensity at bench height could be as little as 7,000 to 8,000 fc.

Obviously, light intensities are too important to be left to chance. Therefore, the only way to be sure of your light intensity is to measure it. All greenhouse operators should have a light meter. There are many light meters that can do the job. The best light meter I've found is made by General Electric, model 214. I like this one because it measures directly in foot candles, can be used both in the greenhouse and indoors, needs no batteries, is extremely portable, and is inexpensive (approximately $40.00). By measuring the light levels, you can design your shading system to provide the best combination of light and temperature control.

When to apply? Looking at Table 1 we see a big jump in total daily radiation between March and April and a substantial decrease between August and September. Growers should begin to monitor light intensity in April, the exact date of application will vary with location and work schedules. Most houses should be shaded by May 1. Don't be afraid to leave shade off if your greenhouse temperatures can be maintained without it until then.

Many growers let the shade simply wear-off in the fall. A residue of shade may still remain through the winter. These deposits, along with accumulated dust, can create a 20% light reduction during the winter. Therefore, coverings should be cleaned and shading removed when it is no longer

Table 1. Percentage of maximum daily total solar radiation.*

Month	Asheville	Charlotte	Greensboro	Raleigh	Wilmington	Cape Hatteras	Buffalo, New York	Albequerque, New Mexico
JAN	36	35	35	34	37	34	18	47
FEB	48	48	48	47	50	47	30	59
MAR	65	65	65	64	68	66	42	78
APR	82	84	84	82	88	88	51	95
MAY	90	92	93	90	95	96	67	105
JUN	93	95	96	93	98	100	77	111
JLY	88	90	92	89	90	94	79	105
AUG	80	84	84	80	81	84	69	96
SEP	68	70	70	68	71	72	53	84
OCT	57	58	56	53	58	56	35	67
NOV	42	42	42	41	44	43	18	51
DEC	33	34	33	32	35	33	15	42

*All values are percentages of maximum value compared with Cape Hatteras in June.
Data derived from U.S. Weather Service figures.

needed. Generally September/October is when this is done. Many times our brightest weather occurs in early September, so cautious measurement is needed before shading is removed.

Keeping a close watch on light levels in your greenhouse will allow you to modify these general recommendations to best fit your own operation.

Table 2. Hours of daily sunshine.*

Month	Asheville	Charlotte	Greensboro	Raleigh	Wilmington	Cape Hatteras	Buffalo, New York	Albequerque, New Mexico
JAN	4.7	5.3	5.1	5.0	5.8	4.9	3.5	7.1
FEB	5.7	6.3	6.1	6.0	6.4	6.0	4.5	7.8
MAR	6.8	7.4	7.0	7.1	7.6	6.6	5.8	8.8
APR	8.2	8.9	7.7	8.5	9.3	8.6	7.1	10.0
MAY	9.3	10.1	9.6	9.4	10.1	9.5	8.8	11.1
JUN	9.7	10.5	10.1	9.5	10.4	10.0	10.6	12.2
JLY	8.6	9.4	9.3	8.9	9.2	9.2	10.9	11.0
AUG	8.1	8.9	8.8	8.2	8.8	8.5	9.6	10.2
SEP	7.8	8.2	8.1	7.5	7.9	7.1	8.0	10.0
OCT	7.2	7.8	7.6	6.9	7.7	6.5	5.9	9.0
NOV	6.0	6.6	6.3	6.1	6.9	5.6	3.2	8.2
DEC	4.7	5.4	5.3	5.0	5.7	4.9	2.7	7.1

*Numbers of hours of sunshine/day (unobstructed by clouds).
Data derived from U.S Weather Service figures.