Cans of honey in wash boiler. Note honey gates for filling jars.

has an answer to that. The old-fashioned copper wash boiler makes a perfect heating tank. It holds two 60-pound cans nicely. All that is needed is a wooden rack in the bottom to allow the hot water to circulate underneath the bottoms of the cans.

For awhile wash boilers were a drug on the market. The housewife had become emancipated by the washing machine and the Irish piano and the copper wash boiler had been relegated to the shed. That's how I got mine, all for free. But then something happened. Someone discovered that old copper wash boilers made lovely planters when polished up. And the rage was on. Just try to find a copper wash boiler. They used to be a regular catalog item in mail order house catalogs, then they stopped advertising them too. Now they are back again. But don't ask me why, the price has shot up to $19.99. That's a lot more than Grandma paid for hers. So go snooping around, you may be able to find one yet and get it for very little, or nothing, like I did. The lady who gave me mine kind of hated hers, thinking back on those days years ago when she had to bend her back over that scrub board inside her wash boiler. She was glad to see it go.

If you have a floor furnace in your house, and your wife will let you get away with it, having that wash boiler on top of the grill will warm your house and your honey, all at the same time. And that saves money too. So now you have a good argument, if you need one.

Solar Radiation and Honey Production

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AMONG OTHER factors affecting nectar secretion Shuel[1/] found that solar radiation is important. His experiments showed that the amount of solar radiation received by the plant the day before and two days before nectar collection from the blossoms was significantly correlated with the volume of nectar collected. Sunlight provides the energy by means of which green plants manufacture food. Beekeepers are mainly interested in the production of nectar, which, among other substances, contains glucose, fructose and sucrose. Because the amount of solar radiation received by the earth's surface is not generally known by beekeepers, I thought that readers of Gleanings in Bee Culture might be interested in the data presented below. It is my impression that Dr. Shuel's findings have not received the attention that they merit. For example, we tend to think that temperature during the honey flow is all-important.

The amounts of solar and sky radiation for different locations, as given in this paper, were taken from a bulletin by Crabb.[2/] He compared the annual pattern of solar radiation for 36 stations in the United States. Besides the six stations represented in Figs. 1 and 2, data from additional stations are given in Table 1. In some cases the length of record is for a few years only. In such a case the record may not represent the station. Eppley pyrheliometers were used to measure the radiation received. Gram-calorie was the unit of measure. Crabb defined a gram-calorie as "the quantity of heat necessary to change the temperature of one gram of water from 3.5°C. to 4.5°C."

The sky and solar radiation for six widely separated stations is given in Figs. 1 and 2. Figure 1 demonstrates that solar radiation increased from east to west, from Massachusetts to Idaho. Figure 2 shows that solar radiation increased from south to north, from New Orleans to Madison. If all factors affecting nectar secretion — soils, precipitation, temperature, humidity, for example—were equal we would expect to have the greatest amount of nectar secretion for a particular plant species in the North and West.

A long discussion of the amount of solar radiation received at different locations is not needed here. The Figs. (1 and 2) and Table 1, included, give the reader an idea of how much the amount of solar radiation increases and then decreases during the main part of the growing season. I want to remind the reader that the main honey

Table 1 — Time and Amount of Solar and Sky Radiation
(in gram-calories per square centimeters)[3/]

Location	Years	Approx. period & amount of greatest radiation	
		Time of Year	Amount
Miami, Florida	11	April to mid-August	475 - 525
Gainesville, Fla.	3	May	600
Blue Hill, Mass.	15	June and July	500 - 525
Washington, D. C.	33	June and July	500 - 525
State College, Pa.	7	Mid-June to mid-July	525
Put-in-Bay, Ohio	6	Mid-June to mid-July	550 - 600
East Lansing, Mich.	5	June to mid-July	500 - 530
Columbia, Mo.	4	July	600
Boulder, Col.	4	June to mid-July	525 - 575
Riverside, Cal.	15	Mid-June to mid-July	600
Fresno, Cal.	19	June and July	over 675/4
Friday Harbor, Wash.	3	June and July	575 - 600

flow in the southern states is much earlier than in the Middle West. For example, the main flow in the Baton Rouge area is in April and May while in the Madison, Wisconsin area the flow begins late in June and may extend into August. Note that the solar radiation in New Orleans (see Fig. 2) is much lower in April and May than at Madison in June and July.

Clouds reduce the amount of solar radiation received by the earth. One reason for the relatively low rate of radiation received at New Orleans (Fig. 2) is the frequency of clouds and daytime precipitation. The high rate of radiation at Lincoln (Fig. 1) is associated with clear skies and infrequent daytime precipitation. Kincer (1916) lists the percentage of total seasonal rainfall (April to September inclusive) of stations east of the Rocky Mountains. Table 2 gives a portion of the stations. Note that at Tampa and New Orleans only about 25% of the seasonal rainfall is at night (75% in the daytime). In Denver, Des Moines, and Lincoln from 50 to 66% of the seasonal rainfall is at night (50 to 34% in daytime). Honeybee activity is more likely to be reduced by daytime showers in the Southern States than in the Middle West or the Plain States. Butler and Finney/5 reported that their data show an association between variations in radiation of clear light and honeybee activity.

Table 2 — Average seasonal precipitation (April 1 to September inclusive) for a 20-year interval, 1895-1914./6

Location	Average nighttime fall in % of total seasonal
Tampa, Florida	24
New Orleans, Louisiana	25
Vicksburg, Mississippi	41
Montgomery, Alabama	32
Atlanta, Georgia	35
Nashville, Tenn.	45
Springfield, Illinois	53
Madison, Wisconsin	55
Grand Rapids, Michigan	59
Boston, Massachusetts	48
Albany, New York	46
Columbus, Ohio	42
Des Moines, Iowa	60
Rapid City, South Dakota	54
Lincoln, Nebraska	66
Denver, Colorado	50
Havre, Montana	53

The estimated average honey yield per colony (see Table 3) bears out roughly what I have been saying about solar radiation. Average honey yields tend to increase from south to north and from east to west. Admittedly other factors affect nectar secretion and colony yields, but we should remember that long, clear days favor increasing nectar secretion and honeybee activity./7

Table 3 — Estimated average honey yield per colony, 1962-66, in pounds./8

State	Yield
Louisiana	33
Mississippi	29
Alabama	25
Georgia	35
S. Carolina	19
Tennessee	18
Arkansas	26
Florida/9	66
Vermont	45
New Hampshire	35
Massachusetts	21
New York	56
Pennsylvania	36
Michigan	77
Wisconsin	99
Minnesota	90
North Dakota	105
South Dakota	101
Nebraska	88
Iowa	85

1/ Shuel, R. W. Some factors affecting nectar secretion in red clover. Plant Physiology, 27 (1), p. 95 - 110, 1952.

2/ Crabb, G. A. Jr. Solar radiation investigations in Michigan. Michigan State College Tech. Bull. 222, 153 p. 1950.

3/ From Crabb, 1950.

4/ Above top value of Crabb's chart.

5/ Butler, C. G. and D. J. Finney. The influence of various physical and biological factors of the environment on honeybee activity. Jour. Exnerimental Biology, 18, (3), p. 206 - 212, 1942.

6/ Kincer, J. B. Daytime and Nighttime Precipitation and their economic significance. Monthly Weather Review, 44, Nov. 1916. U. S. Dept. of Agriculture, Washington, D. C.

7/ The author is indebted to Dr. Norbert M. Kauffeld, Bee Breeding Investigations for the use of library facilities.

8/ Anderson, E. D. An Appraisal of the Beekeeping Industry. A.R.S. 42-105 38 p. July 1969. Agric. Res. Service, U.S.D.A.

9/ Florida is an exception, possibly because of citrus and other plant species peculiar to the state.

Honest About It

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THE GOLDENROD is yellow, and my mind turns back to some years ago when a man came to the house and wanted to hire a few colonies of bees for pollination. This is the story he told me. He had spent the most of his life farming, down east. The highway department had taken the best of his farm and industry wanted the rest, so two years before he had retired. For his retirement he purchased eight acres in the frost-bitten hills of McHean County. On this farm there was a nice house, a small barn and about 50 fruit trees. When he moved he had brought with him his household goods, three head of beef cattle and two colonies of bees.

The first summer his bees had done fair and made enough honey for his own use, but that fall they contacted foulbrood. He killed the bees; burned and buried the frames and honey; scraped out and scorched the hive bodies and supers. The next spring he installed two new packages of bees. They developed very slowly, and they also developed foulbrood by that September so he burned the whole outfit. Now he needed bees to pollinate his orchard.

Who wants to put bees where for two consecutive years bees have had to be killed because of foulbrood? I had a yard located on a farm that had been sold and the purchaser's wife absolutely refused to move in until those cursed bees were out. I had doubled up in my other yards but there were still two colonies to move.

This man lived just off the road between home and my favorite trout stream, too far to go to tend bees, but not too far to go fishing. I told him I would be over the next evening. The next evening when I drove into his farm I checked where he had had his bees, and I could see why his packages had not developed. He had kept his bees down in a gully, protected from wind on three sides and when there was fog it did not lift until noon. After looking the place over real good I made a proposition which I knew he would not accept. I would furnish the bees and needed equipment and he would take care of them. The bees would be permanent, not just for pollination, and they were to be placed on the back of the place at the highest elevation he had, and he was to build and maintain a windbreak. In return he would get the pollination he needed and what honey he wanted for his own use, and

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