State of Iowa

1929

REPORT OF THE

STATE APIARIST

FOR

The Year Ending December 31, 1929

Also Report of the Convention of the Iowa Beekeepers' Association at Ames, January 30-31, 1930

F. B. PADDOCK, STATE APIARIST

Ames, Iowa

Published by
THE STATE OF IOWA
Des Moines

LETTER OF TRANSMITTAL

HON. JOHN HAMMILL, *Governor*—

SIR: As required by law, I herewith transmit to you my eleventh annual report as State Apiarist for the year ending December 31, 1929.

F. B. PADDOCK, *State Apiarist.*

Ames, Iowa, February 28, 1930.

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REPORT OF THE STATE APIARIST

REVIEW OF THE YEAR

The beekeeping industry of Iowa began the season of 1929 with a winter loss of from 30 to 35 per cent, which is far in excess of the average 12 per cent loss that the industry sustains. The reason for this excessive loss was undoubtedly the long confinement of the bees for the weather was so consistently cold that it was not possible for the bees to fly during the entire winter. Furthermore,

The colonies in this apiary do not suffer from snow and cold

this long period of low temperature caused a heavy consumption of stores and the result was the death of an unusual number of colonies.

The producers, however, realized the situation and began plans early for the replacement of lost colonies. In a large measure this replacement was done by the purchase of package bees from southern beekeepers who make it a business to produce bees instead of honey. Literally carloads of packages were shipped into this state last spring. Following this was a program of conservation in which most of the beekeepers were very careful in their management so as to retain the swarms which might issue naturally and many other producers made artificial increase wherever possible. The climatic conditions were especially favorable for this replacement program. The spring was rather late and slow, but the colonies built up in good shape, therefore, the beekeeper was able to take every advantage of natural conditions. The bees on the whole, were in very good condition by the time the honey flow started, which was somewhat later than normal.

The flow for the season of 1929 was unusually good, being very strong throughout an unusually long period. Wherever colonies were of any considerable strength the return or yield per colony

There is a heavy loss of colonies where they are not protected during the winter.

was very good. The 1929 crop of honey for the state of Iowa was listed as an average crop or rated at 100 per cent. In some localities the crop was exceptionally good while in one restricted area along the Missouri river the honey crop was exceedingly low. This area takes in a large proportion of the commercial production in the state.

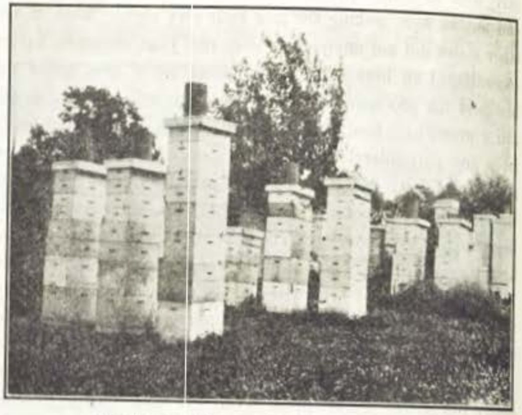
The increase in the crop condition in general was due in a large part to the increased acreage of the white biennial sweet clover. This is being planted quite extensively in the crop rotation scheme and soil improvement program of general agriculture. The sweet clover area is extending eastward over the state very rapidly even to the old white clover area which has been almost non-productive of late. During the season of 1929 the white Dutch clover yielded honey quite abundantly over a large portion of the state and especially in the old area where it was formerly the prime honey producing plant. This plant is becoming less dependable each year as a producer of nectar for some unknown reason, therefore,

the attitude of the beekeeper has changed from one of assurance for white clover to the attitude of "Do not expect a crop of white clover, but be prepared if it should come."

The good crop of Iowa honey this year was of superior quality, and it moved to market more rapidly than in former years. The carry-over of honey throughout the United States was very low, and buyers were seeking the new crop very early. Some of the other states did not enjoy a big crop this year, therefore, buyers concentrated on Iowa. The large lots of honey were out of the hands of the producer very early this year, and even late in the fall it would have been difficult to have shipped a carload of honey from any particular locality in the state. The lots of available honey were down to 6,000 and 8,000 pounds or even less. There is a growing tendency on the part of the producer to ship out of the area wherever possible. The next step which is contemplated by the small producers is to pool their crop so as to ship in carlots. The effort to market honey locally has not met with the big response which was expected and producers in general are coming to realize that marketing is a business by itself and so they are not willing to undertake a sales program. There is yet too much honey put on the market in an indifferent manner by the smaller producers and this is restricting the consumption of honey very materially. Every effort is being made by educational agencies to get the small producers to do more with their honey locally and to put the product up in better condition so it will encourage consumption. On the other hand every reasonable effort is made to get the small lots of honey into the hands of the large buyers who are in a position to take care of the marketing problems.

For the year of 1929 Iowa ranked at the top of the list for the value of inter-state shipments of honey; in fact, it was almost 20 per cent over the next state. This is interesting and is accounted for in part by a change in the marketing of honey which leads most of the Pacific coast product into foreign trade, mostly to the European countries, and such honey does not enter into domestic inter-state shipments.

The honey products of the United States this year shows a very large increase and is placed ahead of the production of soybeans and sweet clover seed. It is listed as one-tenth of 1 per cent of the national agricultural income. There are big possibilities for the increase in the production of honey in the state of Iowa. It has been estimated by Dr. Pammel, who has made a very thorough study of the honey plants of Iowa, that the total possibilities for the honey crop of Iowa would be about \$30,000,000 to \$35,000,000, based on the possible acreage of clovers alone. This does not take into account the value that might be obtained from fruit blooms and other plants. This is not a matter of making more producers



A good crop of honey produced by a "side liner."

but rather of bringing about greater returns for those who are already in production.

There is a close relationship between the honey producing industry and that of agriculture in general. Throughout the state of Iowa during the past year there have been numerous examples of low production of clover seed both in the medium red and sweet varieties. These areas coincide with the areas of poor honey production, especially in the sweet clover belt adjacent to the Missouri river which has been mentioned previously. Here field after field was cut for seed and threshing tests were made, but found to be so unprofitable that the crop was left on the ground in windrows just as it has been harvested.

There is an increased interrelation of honey production and fruit growing. The most notable example is the work which has been done in Michigan where Special Bulletin No. 188 has been issued by the Experiment Station giving the results of their pollination studies. This institution has issued a bulletin on the Renting of Bees for Orchards which appeared as Extension Bulletin No. 56. Booklets have been prepared by the educational department of one

of the leading supply firms showing the advantage of proper pollination of fruits by bees. One of the leading journals, the American Bee Journal, in its November issue featured pollination of fruits by bees. The probable reason why this matter is not so keenly felt in Iowa as in other states is due to the fact that the planting of fruits is more general in smaller areas and more vari-

Honey house recently constructed by N. Williamson, Bronson, Iowa.

eties and also that the distribution of bees is more general than most any other state in the Union. However, as plantings increase in this state on a commercial basis, the problem is sure to be felt.

The industry of Iowa honey production is not without its problems. The first is one of increasing the consumption for honey. It is true that in this state there is an unusual advantage in that approximately 80 per cent of the honey produced is consumed by the people of the state, which is estimated at 5 pounds per capita. However, the consumption of honey throughout the United States is only 2 pounds per capita, and it is necessary to increase this consumption in order to profitably increase the production. The American Honey Institute is doing a fine piece of work along this line and their efforts will be noticed in many other industries. Just at present a close contact has been made with the baking industry of the country to encourage the use of more honey in baking. Wherever honey recipes are used extensively they are also correlated with the use of fruits which shows further the inter-relation of the two industries.

Cooperative marketing is a problem which is confronting the industry at the present time. There is now in operation in Iowa one very successful cooperative marketing agency, the Sioux Honey Company at Sioux City, Iowa. This organization has developed a large trade for honey and is now consuming considerable amounts of Iowa honey to supply their plant in order that their trade in other states may be served. An inter-state organization known as the Mountain States Honey Producers' Association is incorporating so as to include beekeepers' organizations in other states, and it is likely that the beekeepers of Iowa will consider this marketing organization in the near future. Cooperative marketing has shown its advantages and as soon as the majority of beekeepers appreciate these advantages and are willing to take advantage of them, cooperative marketing will be much more common than it is today.

Office of the Cooperative, The Sioux Honey Company at Sioux City, Iowa.

Another problem confronting the beekeeping industry today is the proposed legislation by congress relative to corn sugar. It is proposed that corn sugar may be used in any material without indicating its presence on the label. This is in contrast to the standards of the pure food law which has been so successfully operated for the last quarter of a century in this country. This legislation has been condemned by the United States Department of Agriculture and by such food authorities as Dr. Harvey W. Wiley. It cannot be argued as a farm relief measure for the corn sugar people need a very high grade of corn, higher than the average corn of Iowa or adjacent states will grade. Furthermore the corn sugar interests are shipping in millions of bushels of corn from Argentine which they are able to get at a price much lower than they need to pay for domestic corn. It is to be hoped that allied interests will assist in preventing undesirable legislation in regard to this product.

PRODUCTION

The honey producer is dependent on climate to as great an extent as any one engaged in any phase of agriculture. To that extent certain important factors of production are beyond his control and he is at the mercy of the elements. This is the very reason why every possible attention should be given to the factors of efficient production which are under control. It has been said that honey production should be made up of 90 per cent brains and 10 per cent capital. Whether this proportion is correctly stated or not the two items should be made to yield bigger returns at this time of great need for increased efficiency of production.

The producer has two items of capital investment, equipment and stock with which to use the brains in management or manipulation. Equipment is of prime importance as to kind or character and amount. The kind of equipment necessarily means the best afforded by modern manufacture and not make-shift boxes or barrels. The details of equipment are largely determined by the type of honey produced, section, cut comb or extracted. Beyond that

New equipment costs money but if taken care of will give returns.

there is no size or shape of hive or accessory equipment which will reduce the proportion of brains that it is necessary to apply to production. One producer will make a success with one size of hive and a neighbor may do equally well with another size. The two have applied the fundamentals of bee behavior to their type of equipment to secure maximum returns. Because any piece of equipment has been a success in the hands of one producer does not insure its success when operated by any other producer. Get good equipment, frames, foundation, extractors and then *use* it properly but do not *misuse* it.

The amount of equipment is much more important than the type. It is safe to say that more honey is lost in Iowa through failure of the producer to provide ample storage space than is harvested at the present time. Everyone has marveled at the production records of Dr. C. C. Miller, who said, "I always count on six supers of comb honey from each hive but I always prepare seven supers." The lament which is so commonly heard each year when production stories are being told, "I could have had another fifty pounds but my supers were all full." It's a queer situation when the producer admits his inability to give the bees an opportunity to harvest the crop of nectar which nature has so generously

Equipment left to the elements soon loses its value.

provided. A big reason why there is always a shortage of equipment is because it is not properly taken care of from one season to the next. Here is where the bee moths take their toll from the producer.

Improved stock is just as necessary in modern honey production as it is in any other endeavor of production. No end of effort has been expended during the past eleven years in Iowa to get producers to realize the importance of this matter. It is true that any honey bee will gather honey but it is also true that the best crops are obtained from the best stock. The demand of the country for over half a century has been to get Italian queens at the

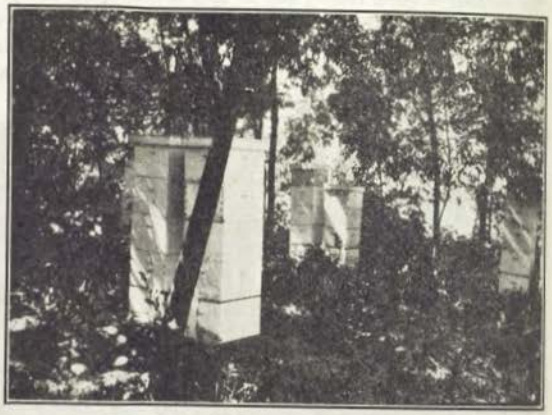
head of every colony. The wild bee could not withstand the hazards of modern production as well as Italians. Great improvement has been made in production through the use of Italians. There is still a great demand for the better use of better stock. There is no method available now for checking upon the performance of stock, as indicated by queens. The queen breeders deserve great credit for having brought about as much improvement as they have and probably they are doing all they can but more needs to be done. The problem of controlled mating has been the first impediment to progress. A queen may show a high production record and is used as a mother but will her daughters exhibit this character? The records have not been kept to indicate this point. The methods of queen rearing may be open to criticism, the producers of other countries will not consider using a queen reared by our methods. The breeders of this country are accused of using quantity methods rather than quality methods. It is true that

Spring requeening is a regular practice in commercial yards.

methods employed in other countries would not begin to meet the situation of this country. Some modification of the methods now in use must be brought about to secure queens of better inheritance and better constitution.

It has been shown that too much replacement of queens is necessary in the apiaries to insure better production. There are undoubtedly several factors contributing to this situation. Besides the inheritance of performance there is vitality as may be influenced by methods of rearing.

The other factors may include methods of preparation for shipment, process of transportation and methods of introduction by the producer. The queen breeder uses the best performing queen as a mother and the drones or male side are only indicated by good color. It may be that larva-reared queens are inferior to egg-reared queens and it may be that too large operations are programmed by the queen rearer. The methods of preparation for shipment employed by many breeders are open to question and perhaps the type of cage employed for shipment could be improved for it was invented 50 years ago. Methods of introduction by the

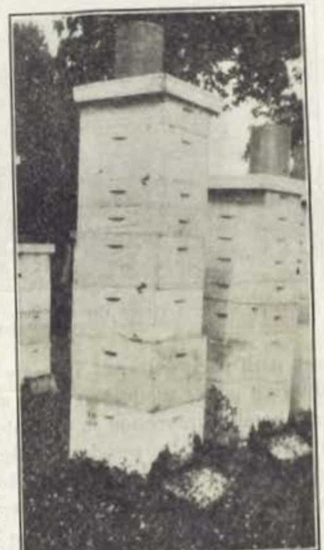


The colonies of Caucausians do bring in the honey.

producers need careful study to determine possible improvements. Replacement of queens represents a real problem to the producer and is one of the real factors of increased yields.

The problem of stock improvement has revolved around the use of the Italian race of bees. It is hard to explain why all effort has been givėn to this one race of bees and expect them to perform equally well under all of our varying conditions. Producers of honey in other countries have not followed such a program, producers of other agricultural products in this country have not followed such a program. There is developing in Iowa a desire to find out if another race of bees would do better under existing conditions than Italians. Several large producers are making trials

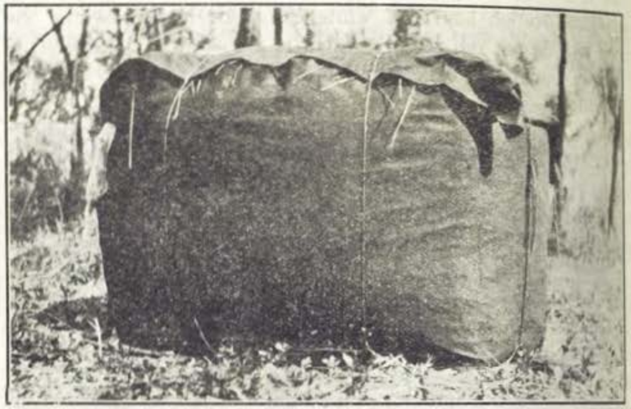
with Caucasians, a race originating in the southern mountains of Russia. The known qualities of this race which may prove of value to Iowa producers are: provision the brood nest well for winter, survive low temperatures well, brood up rapidly in the spring, fly at low temperatures for supplies, which enable them to gather nectar on cold spring days, have greater tongue length which may be a factor in red clover pollination and will result in greater yields of nectar. They are of very gentle disposition and produce exceptional section honey of white cappings, restrict winter entrance and do not rob readily which is a factor in the spread of American foulbrood. The rapid building up in the spring must be handled accordingly by the producer or excessive swarming will be detrimental. Entrances must be reduced early in the fall to discourage propalizing.



Production of a Caucasian colony.

The Carniolan race originates in the northern Alps mountains and in general has the traits of the Caucasians, the ability to withstand adverse condition. It must be admitted that climatic conditions of Iowa are much more severe than the home of the Italian race of bees. A more effective race of bees for production in Iowa is necessary as a means of increased efficiency of production. The fact that there are more satisfied users of Caucasians and Carniolan bees each year would seem to be an indication of their possible value for use in this state.

The winter loss constitutes one of the major problems confronting the producer of this state. The recognized fundamentals of wintering are: large proportion of young bees, ample stores of good quality and sufficient protection. The loss increases as any one of these factors may be neglected. The proportion of producers who give careful attention to colony population is exceedingly small. More people are inclined to have some interest in the stores of a colony but very few seem to exercise any concern about colony protection. The losses of last winter, of at least 35 per cent average for the state, should create some interest in this problem. There are two possible methods of working for better results; more careful attention to wintering colonies or kill the colonies and re-



A colony of bees comes thru the winter in excellent condition when it is properly prepared.

stock with package bees. There are plenty of successful producers following either method so it is a matter of choice for those who are becoming interested in the matter. It is certain that it would be more efficient to purchase package bees than to suffer such extreme loss as is now common. The purchase of package bees is no longer the risk that it was a few years ago. The preparation and transportation of package bees has progressed far more than has the knowledge of proper installation by the average producer. The experience in the first case is concentrated among a few who are specialists and depend on their success to maintain a living. A large proportion of those who are receiving packages have had little or no experience.

EDUCATIONAL WORK

Demonstration apiaries established in widely scattered areas over the state yielded 158 pounds per colony, check colonies 98 pounds while average state yield for 1929 was 80 pounds per colony.

There were 150 demonstration colonies and 300 check colonies in the work conducted in the several counties throughout the state. The increase over state yield of demonstration colonies was 11,700 pounds and of check colonies over average state yield 5,400 pounds, making an increase of 17,100 pounds in apiaries where specialist

The outdoor packing serves as spring protection for the brood rearing period.

gave Apiary Management lectures and conducted result demon-
strations. This honey was practically 50 per cent comb honey and
50 per cent extracted honey. Valued at 15 cents per pound this
would mean a direct increase return of $2,565 to cooperator bee-
keepers. A total of 4,000 beekeepers were given personal assist-
ance or advice in their apiary management problems which could
be valued at $5.00 per person making an increase of $20,000. This
work in most cases was help in controlling disease and actual
assistance in methods and procedure used. Fifteen hundred col-
onies were found diseased and treatment was urged and put into
effect by the specialist. Without considering the benefit derived
from treating these colonies, but the value received from preven-
tion of spread can be valued at $15,000.00. This is based on the
fact that if these colonies were not treated and disease controlled
on a cooperative and area basis at least 100 per cent more disease
would appear the following season. Therefore, valuing the col-
onies at $10.00 it would mean a net saving of $1,500.00. The
information and special work given to beekeepers on control, treat-
ment and symptoms of disease, and the literature and help given

on management of bees, preparing honey for market and assistance given in exhibiting honey at county fairs and state fair, and the actual treatment given the 1,500 diseased colonies of bees located in Iowa will far out value the $37,565.00 specified above. It can

A colony properly prepared and wintered contains seven frames filled with brood. Compare with next picture.

be conservatively stated that an increase saving in value for bees and honey in Iowa annually is $75,120.00 responsible to the Extension Service.

EDUCATION AND DISEASE ERADICATION

Disease eradication in conjunction with Demonstration Apiary work was conducted in Dallas, Fayette and Chickasaw counties, with very interesting results. An area in Dallas county of approximately a township was inspected in 1927 and 26 apiaries were found to be contaminated with American foulbrood. With the assistance and perfect cooperation of the beekeepers in the area the disease was treated or destroyed by the specialist. Six capable beekeepers assisted the inspector in treating the diseased colonies disinfecting all used equipment and disposing of all honey from these apiaries. The results after three years of checking shows these 26 apiaries were free of disease. The work took approximately 10 days' time of the specialist. In this area 137 colonies were found diseased which could be conservatively estimated at a loss of $1,370.00 to beekeepers. If this disease was allowed to stay for a year without treating the damage would have easily

doubled or very likely trebled. It would have been impossible to treat these colonies with success unless cooperation of the bee-keepers had been made possible prior to the clean-up. The value of the "clean-up" of disease went well into the thousands of dollars to the owners of bees as well as to the neighboring bee-keepers. The demonstration apiaries conducted continually for four years prior to the disease clean-up, made the above work

Colonies which had no winter protection had two frames of brood at the same time as the seven shown in the preceding picture.

possible with 100 per cent success and also was a factor in the low cost of conducting the disease eradication campaign in Dallas county.

In Chickasaw county in 1926 in connection with demonstration apiary project, apiary inspection was conducted in New Hampton and vicinity and 52 per cent disease was found. After a thorough clean-up the following year only one apiary of five colonies of disease reappeared the second year and one colony appeared the third year. The community was one where bees had been kept for many years and disease had been present for from 7 to 10 years. The apiaries were poorly kept and many deserted, but the interest revived with the beekeepers attending the demonstrations and demanded a clean-up. The results show conclusively what can be done when the beekeepers cooperate and are anxious to clean up. Cooperation, ability to follow instructions and belief in the idea that a clean-up of disease could be made, solved the problem of

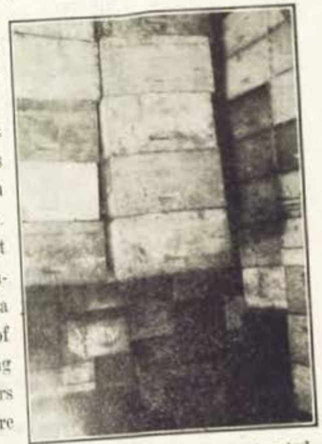
New Hampton beekeepers. Demonstrations and educational work paved the way for this clean-up.

In Fayette county a condition similar to Chickasaw county prevailed in the territory east of Fayette. The beekeepers were discouraged; they were certain after several attempts to clean their apiary and meeting with failure, beekeeping could not be made profitable. Meetings and demonstrations with a few personal visits revived the interest and in 1929 on finding more than 200 diseased colonies the beekeepers made no resistance and often requested the inspector to burn. The 200 colonies were killed and all diseased comb and inside fixtures of diseased colonies were burned. If no educational work had been done prior to this clean-up, severe trouble would have been encountered by the inspector. Without cooperation from beekeepers a clean-up of disease is impractical, if not impossible. The beekeeper had attended meetings and demonstrations where disease treatment, control and eradication had been discussed and demonstrated. When the inspector gave his opinion of the cheapest and most thorough method of handling the diseased colonies the beekeepers gave 100 per cent cooperation in following these instructions.

INSPECTION

Splendid cooperation has been given by producers in all counties where work was done during the present season. There has been no difficulty in getting diseased colonies destroyed in counties where the area clean-up work has been conducted. Producers in such territory have become familiar with the place of eradication and feel that such methods are best. There is still a small amount of disease present in some of the larger commercial apiaries, probably due to infection in the extracting equipment or combs. Disease was found to be very general in one of the new territories where inspection was conducted. One of the largest producers of the state found his apiaries so badly diseased that four hundred colonies were killed. This program includes the rendering of thirty-six thousand brood combs and the disinfection of forty thousand super combs, in addition to the treatment of hive bodies and supers. Another producer in this area burned one hundred colonies of bees and most of the equipment. This is an example of what disease is costing producers of Iowa, more in the case of a single individual than the amount of the entire state appropriation for inspection work.

The effect of clean-up work on the development of honey production in an area is interesting. Little honey was produced in Ida county four years ago. Large numbers of box hives were used and equipment generally was poor with mostly black bees. The equipment is almost replaced now, quantities of package bees and Italian queens have been shipped in. Such development is the result of the educational part of inspection service so now Ida county is fast becoming one of the large honey producing areas, in fact carlot producers can be found next year if there is a favorable season.



A corner of the 4,000 supers treated for disease.

TABLE 1—SUMMARY OF 1929 INSPECTION

Counties	Colonies	Diseased	Treated	Destroyed	Reinspected	Incomplete %
Black Hawk	555	226	47	206	555	--------
Boone	159	2	--------	2	159	--------
Bremer	116	11	10	1	90	--------
Buchanan	159	--------	--------	--------	159	--------
Cherokee	97	5	--------	2	--------	--------
Chickasaw	450	137	29	119	164	--------
Crawford	190	16	--------	16	70	--------
Dallas	1,041	129	29	123	823	--------
Decatur	373	113	62	54	368	--------
Delaware	60	--------	--------	--------	--------	--------
Dubuque	210	2	--------	2	--------	--------
Fayette	1,180	360	91	306	1,180	--------
Hardin	20	1	--------	1	--------	--------
Ida	1,281	15	--------	9	--------	--------
Johnson	70	9	--------	--------	--------	--------
Monona	1,281	327	2	152	--------	--------
Page	380	25	1	24	25	--------
Polk	50	36	22	34	50	--------
Pottawattamie	1,234	85	--------	63	--------	--------
Sac	80	--------	--------	--------	80	--------
Shelby	169	15	4	10	169	--------
Story	200	51	--------	51	124	--------
Washington	64	26	--------	--------	--------	--------
Webster	250	12	--------	12	250	--------
Woodbury	3,988	148	14	35	1	--------
Worth	56	10	--------	2	28	--------
Totals	13,712	1,762	311	1,224	4,315	9.2

TABLE 2—SUMMARY OF IOWA INSPECTIONS

	Apiaries	Colonies	Diseased	Reinspected	Per Cent
1919	66	......	32	......	......
1920	118 (94)	......	......	......	......
1921	155 (81)	......	......	......	......
1922	238	4,086	920	......	22.5
1923	198	4,152	567	......	13.6
1924	629	11,631	1,512	......	13.0
1925	829	11,429	1,702	......	14.9
1926	794	11,071	1,779	......	16.1
1927	964	13,934	1,893	2,803	13.5
1928	816	16,844	1,368	4,367	8.1
1929	...	13,712	1,762	4,315	9.2

TABLE 3—SUMMARY LOCALITY INSPECTION

REGULATORY

	Apiaries	Colonies	Diseased	Per Cent	Reinspected	Treated	Destroyed
Black Hawk County							
1926	25	162	53	32.1	...	...	...
1927	30	190	38	20.0	80	...	...
1928	21	224	58	25.2	107	5	53
1929	..	555	226	....	555	47	206
Bremer County							
1927	42	169	46	27.2	18	...	...
1928	33	134	25	19.4	91	9	16
1929	..	116	11	....	90	10	1
Cherokee County							
1926	15	140	9	6.4	...	...	...
1927	17	195	28	14.3	...	...	...
1928	11	127	4	3.1	127	4	...
1929	..	97	5	....	...	...	2
Decatur County							
1928	12	485	68	14.3	422	...	27
1929	..	373	113	....	368	62	54
Dubuque County							
1928	1	270	...	....	...	...	...
1929	..	210	2	....	...	...	2

EDUCATIONAL

	Apiaries	Colonies	Diseased	Per Cent	Reinspected	Treated	Destroyed
Boone County							
1928	3	74	4	5.4	70	...	4
1929	..	159	2	....	159	...	2
Buchanan County							
1928	4	130	...	....	130	...	...
1929	..	159	...	....	159	...	...
Chickasaw County							
1926	12	104	91	87.5	...	...	...
1927	33	415	219	52.7	354	...	...
1928	8	223	12	5.3	118	...	2
1929	..	450	137	....	164	29	119
Dallas County							
1926	24	261	24	9.2	...	...	...
1927	17	267	137	51.2	148	...	...
1928	24	542	...	....	162	...	...
1929	..	1,041	129	....	823	29	123
Fayette County							
1927	26	743	190	25.5	646	...	...
1928	21	861	214	24.7	861	9	177
1929	..	1,180	360	....	1,180	91	306
Shelby County							
1928	12	116	11	9.4	...	...	...
1929	..	169	15	....	169	4	10

AREA CLEAN-UP

	Apiaries	Colonies	Diseased	Per Cent	Reinspected	Treated	Destroyed
Ida County							
1926	94	749	80	10.8	...	...	...
1927	152	861	90	10.4	73	...	...
1928	120	1,313	46	3.5	...	...	34
1929	..	1,281	15	....	...	...	9
Monona County							
1928	1	174	11	6.3	...	...	...
1929	..	1,281	327	....	...	2	152
Page County							
1928	75	577	117	20.2	135	43	76
1929	..	380	25	....	25	1	24
West Pottawattamie County							
1926	116	1,017	476	46.8	...	...	...
1927	219	2,043	308	15.0	997	...	...
1928	174	1,515	221	14.5	841	180	17
1929	..	1,234	85	....	...	...	63
Woodbury County							
1924	120	5,236	314	6.0	...	...	...
1925	166	2,838	482	16.9	...	...	...
1926	322	5,719	526	9.2	...	...	...
1927	214	6,339	223	3.5	43	...	...
1928	92	6,442	119	1.8	87	66	55
1929	..	3,988	149	....	1	14	35

IN MEMORIAM

JOHN F. REINEKE

John F. Reineke, of Holstein, Iowa, farmer and beekeeper, passed away in the Holstein hospital January 10, following an operation.

Mr. Reineke and his sons owned and operated one of the largest and best equipped apiaries in the state. He was the originator of the Reineke straw hive. Born in Germany in 1873, he came to this country when but 16 years of age, engaging in farming and beekeeping near Holstein. In 1900 he was married to Miss Nellie Marquardt, and to this union five children were born.

I recall with pleasure the many visits I have had at the Reineke home during apiary inspection. An effort was made to call on him as early in the season as possible so as to avoid handling the tons of honey which were on the hives soon after the honey flow started. Mr. Reineke never had much disease among his bees. He always said the time to take care of disease was the evening following the day on which it was found.

The apiary is left in charge of his two sons, Lester and Henry.

HOWARD SHIPTON.

MYRON GOODRICH BEALS

Mr. Myron Goodrich Beals was born December 10, 1859, near East Hardwick, Vermont, and died at his home near Oto, Iowa, February 23, 1929, aged 69 years, 2 months and 13 days.

Mr. Beals came to Woodbury county, Iowa, in 1881, locating at Smithland, Iowa, working in the employ of A. A. Christie, who was the largest honey producer in the state. After working for Mr. Christie for a few years, he moved to Oto, Iowa, engaging in the business with his brother, Mr. F. A. Beals. He was one of the oldest beekeepers in the state, having spent over fifty years in the business in both Vermont and Iowa.

Surviving him are his wife, two sons, Arthur Beals, at home, and J. D. Beals, Dwight, North Dakota; Seba Franzen, Smithland, Iowa; Ethel Beals, Oto, Iowa; Hazel Beals, Rapid City, South Dakota, and Jane Robson, Sioux City, Iowa.

The two sons have followed in the footsteps of their father and are engaged extensively in the production of honey.

BEEKEEPERS' CONVENTION

The eighteenth annual convention of the Iowa Beekeepers' Association was held at Ames, Iowa, January 30-31, 1930.

Officers of the Current Season

President—N. Williamson	Bronson
Vice President—J. G. Jessup	Council Bluffs
Secretary-Treasurer—F. B. Paddock	Ames
Director—E. G. Brown	Sioux City
Director—A. F. Karsten	Alta Vista
Director—Harry A. Pease	Shenandoah
Director—N. I. Lyle	Sheldon

PAPERS READ BEFORE THE CONVENTION

THE FRUIT GROWER'S BEES

Frank C. Pellett, Hamilton, Illinois

Early in the month of April when the fruit trees were in bloom, I stood on a hill in the Stark Orchards at Louisiana, Missouri, and looked down the long rows which were so full of promise for the coming crop. In conversation with the manager, D. E. Lewis, we tried to form some idea of the number of blossoms just then opening. It seemed impossible to form any reasonably accurate estimate of the number on a single tree to say nothing of the thousands of trees composing the more than 300 acres in the Stark Orchards.

With hundreds of blossoms on a single branch and many thousands on a single tree, the number soon reaches into figures beyond the ability of the mind to grasp readily. The present day tendency toward specialized production in every line develops difficult problems unknown to our forefathers. Since we have come to understand the part which insects play in distributing the pollen from flower to flower and from tree to tree, we are not surprised that many of the first large orchards which were planted in solid blocks of one variety, were unfruitful. Later plantings are correcting this mistake by interplanting of suitable varieties, but the problem of securing a sufficient number of pollinating insects still remains.

A single apple tree or even a small orchard will attract the insects of the neghborhood, and these are usually sufficient to serve small groups of trees. When thousands of trees are blooming together, the natural supply of insects is hopelessly inadequate for the purpose to be served. The fruit grower must supply the deficiency, and honeybees are the only insects which he can secure in sufficient numbers and whose movements he can control. Living in large colonies in hives as they do, the owner can move them wherever he will with the assurance that the bees will recognize the hive as home and continue to forage over the surrounding territory.

It thus is quite possible to supply plenty of pollen carriers for an orchard of any size. The one factor beyond the grower's control is the weather. Unless the temperature is mild and the air favorable for flying, the blooming period may pass with the bees confined to their hives. It is in the time of unfavorable conditions when but a few hours of flying weather prevails, that the service of the bees is most apparent. At such times it often happens that there will be a crop of apples on one side of the tree and few, if any, on the other, because the bees sought the sheltered side when visiting the flowers. At such times trees near the hives may set fruit freely while those at a distance are barren.

I need not dwell at length on the proof of the services of the bees, since that is already very well known by those who have followed the trend of recent experiments. A year previous to my visit to the orchard under discussion, I visited another and much larger one where large blocks were planted to a single variety. The bringing of bees into that orchard had secured striking results and convinced the manager beyond doubt of their value. Walking down the long rows of trees in one of the largest and finest apple orchards in America, I was impressed with the cost of the experiment which had been necessary to demonstrate the service which the honeybee performs in apple pollination. The understanding of the inter-fertility of varieties and the necessity of cross pollination is a development of recent years. Enormous expenditures were made in planting large orchards in solid blocks of single varieties, which proved unprofitable, before this relationship was understood.

The Stark orchard is planted on the tri-angle system with the trees fifteen feet apart. When the filler varieties are removed the permanent trees will stand at a distance of about thirty-three feet each way. Only four rows of permanent trees of one variety are set together. These are alternated with a similar number of rows of another variety. It is thus only necessary for the bees to fly over two rows of trees from either side without visiting the pollinating variety next to it. There is a total of thirteen of the leading commercial varieties in the orchards, although the greater part of the acreage is devoted to the Golden Delicious and Starking, two of the most popular market apples at the present time. Between each two rows of permanent trees is a row of an early bearing variety planted as a filler. A splendid opportunity of comparing results in cross pollination is thus provided.

The hives are placed in groups of five, a quarter of a mile apart. This is in contrast with the method of the fruit men who place a hive under every fourth tree in every fourth row, to insure even distribution throughout the orchard. Mr. Lewis is of the opinion that the bees work equally well over an area of a quarter of a mile; and the care of the bees is somewhat simplified by having the hives in small groups farther apart.

This year's crop certainly appeared to justify the methods followed in the Stark orchards. A second visit in September when the crop was being gathered was fully as interesting as the one when the trees were in bloom. About 18,000 bushels of Golden Delicious were harvested, with a smaller crop of the other varieties. Many orchards in the region reported a short crop and some had few apples to sell. Of course the varieties which happened to bloom when weather conditions were favorable would have a better set of fruit than those which bloomed when the weather was bad, but it is significant that where the interplanting of suitable varieties is the rule, with bees in the orchards, crops are much better.

It was surprising to see what a light showing one hundred hives of bees made in that big orchard. Among the millions of blossoms then open, the bees seemed few and scattered. With three of us counting the bees, still it was impossible to determine accurately the number present in one tree, but as nearly as we could determine there was an average of about a dozen bees to the tree. One bee which Mr. Lewis followed for a period of twenty minutes visited 75 flowers of two different varieties in that time.

If each bee would visit 200 flowers each hour, those visited by the working population of a hive during an entire day would be many. The number needed will thus be seen to vary greatly according to the weather. Where one hive might do very well for ten acres in fair weather, ten times as many might be insufficient if only a few hours of sunshine occurred during the blooming period. Lewis had about one hive for each three acres of orchard, but talked of increasing the number in the future as insurance against bad weather.

Much attention has recently been given to the use of bees in fruit pollination in Michigan orchards. The work has largely been under the direction of H. D. Hootman, Secretary of the Michigan Horticultural Society. Some of the results were published in a bulletin by Mr. Hootman

and G. H. Cale, issued by the American Bee Journal. Another bulletin was issued by the Michigan Agricultural Experiment Station. Some of the results mentioned are very interesting and indicate that large dividends have been paid to the fruit growers from their investment in bees. Hootman, in the American Bee Journal, reports one case where 600 bushels of Hubbardston apples were secured with bees in an orchard, which without them had never yielded more than 100 bushels. The station bulletin mentions the case of a sixteen-year-old pear orchard that had never produced more than 18 bushels in one year, which produced 1,000 bushels in 1926 when an apiary was established there.

In the Bee Journal bulletin mention is made of the Roach orchard at Hart, Michigan, where a twenty-acre block of McIntosh apples had never yielded more than 1,600 bushels. When bees were brought to the orchard the resulting crop was 4,000 bushels. It was estimated by the Company that the gains from the use of bees in their cherry orchards at the same time was $250 per acre. Their total increase in all fruit crops as a result of the work of the bees in pollination was estimated at something like $10,000—certainly a good investment for one season. Numerous other cases are mentioned where similar results were obtained. In connection with several of these trials, single trees were caged to prevent the bees from reaching the flowers. In every case the yield of fruit on the caged trees was very low.

Since beekeeping is a specialized business, it is important that the care of the bees be left in the hands of someone who fully understands their needs. Where bees can be rented for pollination purposes, it will usually be the most satisfactory plan for the fruit grower. In many cases it will only be necessary to furnish an apiary site and very small additional payment for bees to be left there permanently. Where the beekeeper must move the bees into the orchard and out again at the close of fruit bloom, he can hardly afford to do so for less than three to five dollars per hive. If bees are left in the orchard permanently, it will be necessary to use care in spraying to make sure that the poison is applied at a time when the bees will not be killed as well as the pests.

BEES FOR THE ORCHARD

Dr. E. F. Phillips, Ithaca, New York

The demand for honeybees for use in bringing about cross pollination of fruits is increasing and will still further increase. Clean cultivation, intense regional specialization and other less tangible causes are reducing the number per acre of fruit of individuals of wild species capable of serving the orchardist, and this reduction in some places has reached a point where the natural supply of pollinating agents in an average year is inadequate to set a profitable fruit crop. It is not proposed to discuss problems arising from the need of pollinating varieties and other horticultural problems or the factors reducing wild species but rather to mention some problems connected with beekeeping and entomology which arise from the need of pollinating agents. Some of the beekeeping advice that has been given regarding this problem seems seriously erroneous, and it is hoped to correct this in part.

The greatest menace to the use of honeybees in orchards in many fruit areas is the prevalence of dusting with poisonous materials. Spraying with whatever material used is rarely seriously damaging to bees unless applied right at the time of blossoming, which is rarely advised or practiced, except where cover crops are in bloom. Dusting with poisonous materials, whenever practiced, is usually or often exceedingly damaging to bees and to other insects capable of pollinating fruit blossoms. Unless dusts are applied when the wind is not blowing, a cloud may drift for considerable distances from the point of application often falling on flowers of different species then in bloom, from which the bees gather it. In certain apple regions of New York where dusting is prevalent, honeybees have been reduced so greatly that short crops have become common. It will of course be evident that poisoning from dusting not only kills bees but that it causes the more extensive beekeepers to remove their apiaries to safer locations, which is a more immediate result of dusting even than the death of colonies. Small holders soon lose their bees and discontinue beekeeping.

The need for more pollinating insects brings to the front certain beekeeping problems, and while it is the task of those interested in the development of beekeeping to find a proper solution for these problems, at the same time it is well for entomologists to know what these problems are so that they may better appreciate their seriousness and so that they may be aware of the influences which their recommendations may have on the problem.

If a fruit grower decides to bring to his orchard honeybees for pollination purposes, it is to his advantage to bring in colonies which will work effectually. It must for the present be assumed that in the majority of cases the orchardist is not a beekeeper and that he cannot accurately evaluate the colonies which he may rent or buy. A strong colony will rush into the orchard at least four times as many bees as one of half strength, and the increase in the number of flying bees is not in proportion to the actual number of bees in the hive. A colony of bees having at the time of apple blossoming six frames of brood is perhaps above an average colony under fair management for this time of year in those regions where the beekeeper is aiming to have his colonies ready for clover when it comes into bloom in June. On the other hand by proper wintering and spring care, it is often possible to have twice that much brood at the time that apple comes into bloom. This means that a different, better and more difficult management is required when the chief aim is to obtain pollinating agents. Methods for getting stronger colonies are well enough known. The average orchardist who is not a skilled beekeeper will not once in a thousand times get colonies of proper strength, and unless he takes up beekeeping as a serious part of his study and work, he cannot expect to get the results from bees under his own management which he should get. This means that it is rarely profitable for the orchardist merely to buy some colonies and to place them somewhere within summer flight distance of his trees.

It is also evident that the average beekeeper cannot furnish colonies of the best strength for the work desired, and that only the beekeeper who makes preparation for fruit pollination a definite part of his management can furnish colonies of useful strength. There are probably not enough such beekeepers at present in or near any of the eastern fruit areas. This makes it desirable that steps be taken to see to it that the fruit grower gets a square deal when he rents colonies, otherwise the results obtained will not be satisfactory and the necessity of bees in the orchard will not be convincingly shown. It is difficult to arrange that the fruit grower get the best colonies because he cannot himself evaluate them but must depend on a skilled beekeeper to determine colony strength.

In Massachusetts Mr. C. L. Farrar has attempted this by suggesting prices for rental based on the number of frames covered with bees when the outer temperature is 60 to 65° F. at the time of delivery at the orchard, an observation which can be made by one who is not a beekeeper. He suggests a $5.00 rental as a basis for computation, with a reduction of $1.25 for each frame covered less than five and an addition of $1.00 for each frame covered over six. The number of colonies needed may be increased or decreased accordingly. This proposal is a step in the right direction, but the basis for computation is questionable, for no colony covering less than six frames is worth carrying to the orchard, unless perchance the air temperature exceeds 70° for some time during fruit bloom. A better basis would be to demand that no colony covering less than six frames be used and to base the computations on a cluster spread of ten frames.

It should be evident to any person informed about bees that a colony in a single hive body of standard size is a poor agency for the fruit grower

to bring to his aid. Better beekeeping methods demand that colonies wintered outdoors be kept in two full depth hive bodies throughout the winter, and the average beekeeper who does not follow this practice cannot once in a score of seasons furnish colonies worth much to the orchardist. By the time that the bees are to go to the orchard, they will under proper care have filled both hive bodies to a considerable extent, although there will still be corners not filled at lower temperatures. With exceedingly strong colonies there will be a possibility, amounting almost to probability, that the bees will swarm during fruit bloom unless steps are taken to prevent this misfortune to the beekeeper. Since it is usually not practicable to manipulate bees while in the orchards, this means that colonies of the proper strength should not go to the orchard even in two hive bodies but that a third, empty hive body should be given them as a preventive of swarming and to prevent undue crowding in the event of a good nectar secretion from the fruit blossoms. To carry colonies to the orchard in three hive bodies is a trying task. This means that the beekeeper must demand higher rentals for such colonies, but as Farrar has pointed out for weaker colonies, the number of colonies needed in any orchard may be proportionately reduced, so that exceedingly strong colonies should be much cheaper per acre for the orchardist. One excellent colony will easily cover four acres in any weather when the bees can fly, whereas basing recommendations on weak colonies, one colony to the acre is usually recommended. The demand that all colonies be strong will actually work to the advantage of the beekeeper by leading him into better methods of management.

Cluster spread, while easily observed by one not familiar with bees, is not the safest possible guide, since excitement of some sort may cause the bees to spread beyond their usual cluster space. The temperature within the hive governs this rather than the outer temperature. A safer criterion would be the frames containing brood. Ten frames of standard size containing brood, not counting combs containing eggs only, is a fair basis of computation, for it is quite within the range of beekeepng possibilities for a skilled beekeeper to have such strength in average colones at the time of fruit bloom. If the rental is computed on the basis of $10.00 for such colonies and if it is planned to place one such colony on each four acres, this will lead to better beekeeping and to far better service to the orchardist. The count of brood frames will of course include some frames in the central part of the cluster which are well filled and others at the edges which are only slightly filled, but if combs containing eggs only are eliminated, this gives a fair and measureable criterion. Naturally only the beekeeper owning the bees or some other beekeeper can make this determination, but unless the beekeeper is honest enough to report a true count, he is not a proper person with whom the orchardist can deal.

Trials of the use of package bees shipped into northern orchards just before fruit bloom have been made, and some of these tests have been unsatisfactory, since some fruit growers have simply left these packages, containing originally in some cases a frame or two of comb foundation, in the orchards. They almost at once become equivalent to box hives which are a menace. It is nevertheless possible to use such packages to great advantage, and in some fruit areas it will be wholly impossible to get enough colonies of bees for proper pollination by rental of full colonies. Two plans are proposed for this purpose, the temporary one being much preferable.

Package bees for temporary use should be ordered to arrive about one week before the earliest opening of the fruit blossoms. Arrangements should be made with some experienced beekeeper to furnish a bottom board, double cover, two hive bodies, five drawn combs and a feeder of at least 5 pounds capacity for each package ordered. If possible the beekeeper should make the installations and should feed the bees daily until they surely have enough stores to last through the blossoming period. One package of three pounds should be supplied for each acre of fruit. Such packages have the advantage that the bees have at first no brood for which to care and they are young vigorous bees. Just as soon as the petals have dropped, the beekeeper should be asked to remove the bees from the orchard, and he should be given the bees as his compensation for the use of the equipment and for his labor in their care and transportation. By doubling them up, the beekeeper can make a smaller number of colonies for clover gathering, or he can use them to advantage in strengthening his colonies or in other ways. He will get only about a fair compensation for his work if he gets the bees without charge.

Another way to use package bees from the South is to get them earlier, help them to build up for three to four weeks before the blossoming period and then to keep them permanently in or near the orchard. This makes it necessary that the orchardist become a real beekeeper if he is to get later service from the purchased bees, and since he probably will not become a skilled beekeeper in the majority of cases, this plan is rarely to be recommended.

American foulbrood is prevalent in many fruit areas or adjacent to them. If diseased bees are moved about, this vastly increases the danger of spreading infection, and moving should not be permitted without inspection of the colonies at some time which will insure their freedom from this disease. If many bees are moved, it will be impossible to have the colonies all inspected before they should be moved to orchards, because of the short time available and chiefly because of the uncertainty of the weather at that season. This means that those beekeepers who plan to engage in rental of bees should have their apiaries inspected the fall before and they must be given a permit to move based on the fall inspection. This is moderately but not entirely safe. The inspector who grants such a permit should aim so far as possible to inspect the bees while in the orchards, and in granting the permit he should stipulate that if any colonies are found infected on orchard inspection, they will be burned on the spot and the beekeeper will then receive no rental. This will increase the care of the beekeepers in their own inspections before moving.

It has been suggested that when colonies are inspected in the orchards, the inspectors mark on the outside of each colony the number of frames containing brood, thus assisting the orchardist to make his own computations of the rental due the beekeeper. This would have some disadvantages to the apiary inspectors, but is not without merit.

Under present dusting practices in many fruit areas, beekeeping within the fruit areas is too uncertain to be recommended. This means that at present the fruit grower who plans to own his own bees or the beekeeper who plans to rent bees for orchard use should plan to keep them outside the fruit areas except during the short period when they are needed for pollination. This often means a moving of twenty to fifty miles or more if a suitable permanent site is found. This in turn means that if the fruit grower undertakes to be a beekeeper, he at once embarks on outapiary management, which is the most difficult phase of beekeeping. Under such conditions it would be the height of folly to recommend to a fruit grower that he produce comb honey.

The difficulties of getting colonies ready for pollination work have been intentionally emphasized to prevent entomologists from giving their fruit growing constituents bad advice about engaging in beekeeping. In a few instances such advice has been given by horticulturists, entomologists and county agents, leading the fruit grower to believe that he has taken the necessary steps as to honeybees, whereas as a matter of fact he is in extremely poor condition. These warnings are based on some experience recently in attacking this problem and from reading of the advice already given from other workers, some of which seems to be thoroughly unsound. It is hoped that these remarks may help to adjust this question to the advantage of all concerned.

THE FACTORS GOVERNING THE USE OF BEES IN ORCHARDS*

Ray Hutson, Assistant Entomologist,
New Jersey Agricultural Experiment Station

The value of bees in orchards as pollen carrying agents is widely recognized. However, few orchardists and too few beekeepers look squarely at the problem notwithstanding the fact that there are certain rather definite factors involved. The best understood ones are: the size, shape and location of the orchard, the varieties concerned, and the weather. These factors are somewhat interdependent but are separated in this paper to give a proper treatment to each factor.

The size, shape and location of an orchard in regard to the use of bees for pollination is extremely important. A young or small orchard located near an area of woodland or uncultivated ground is less likely to need bees moved into it for pollination. At Glassboro, New Jersey, an orchard of about thirty acres, in such an area, has consistently borne fruit with no honey bees near. Collections made during blooming time have yielded 15-20 bumblebees per hour of collecting during three years in addition to Halictus and other pollen carrying bees. In the larger orchards in the same area surrounded by cultivated land bumblebees and other flower visiting insects were seldom seen although the same collecting technique was employed. The few bumblebees taken in these latter orchards were invariably on the outer edges of the block. Conditions in northern New Jersey orchards are markedly different. In that locality orchards are scattered more than in South Jersey, and sod orchards are common. These conditions make for an abundance of overwintered insects at blooming time. Collections in these orchards at blooming time resulted in the capture of hundreds of Halictus bees in an hour's collecting.

The difference in numbers of insects brought out by these collections is the result of the conditions. Most orchards in southern New Jersey are in the midst of cultivated areas and clean culture is practiced. In northern New Jersey orchards are surrounded by areas of pasture or woodland and many are sod orchards. There is a greater tendency toward large orchards in southern New Jersey than in northern New Jersey.

A few years ago, due to the popularity of certain varieties, and economies in spraying, picking, etc., large plantings of single varieties were made. This was in ignorance of the sterility relationships of fruits. We know today that certain fruits are self-fertile, i. e. set fruit, conditions favoring, if pollen from an anther of the same variety reaches the stigma of the flower. Experimental work supports the contention that more and better fruit is obtained from self-fertile fruits when insects are present to effect cross-pollination. However, by far the greater number of fruits are self-sterile, i. e. set fruit, in profitable amounts only if pollen from another of a different variety reaches the stigma of the flower. This explanation should indicate that some varieties of a given fruit need pollenizers more than other varieties of the same species. It should also be apparent that bees or other pollenizers will do no good if working only on a self sterile flower in a large block. With self sterile trees pollen from some other variety must be furnished by topworking, interplanting, or the use of "bouquets" of flowers placed in water about the orchard. The sterility relationships of fruits vary and should be determined for each region. This has been accomplished in most states by the Experiment Station.

Experience over a period of years in New Jersey demonstrates the utter dependence of pollination upon weather conditions. Unfavorable weather will cut down the set of fruit when all other conditions are at their optimum. Everyone recognizes that a downpour of rain will prevent insect visitation to flowers. This has been proved experimentally as long ago as 1890[1]. The 1924 blooming season in New Jersey was very rainy[2]. Little fruit set in orchards abundantly supplied with bees. High winds serve to keep insects away from flowers. Records kept since 1923 indicate that when winds get above 25 miles per hour among the trees insects do little work. Humidity short of rainfall exerts a retarding effect also but cannot be observed directly hence its effect is not accurately known. That temperatures influence all life processes is widely known. However, in pollination, the strength of colony, amount of honey present, the proportion of fielder bees, young bees, and brood, all have the tendency to destroy the absolute relation of temperature. As a result of these conditions the temperatures at which bees work in orchards vary somewhat. Bees are of course most active at the higher temperatures prevailing during the blooming period. The lower limit is harder to fix. New Jersey records indicate activity at temperatures as low as 53° F. in some years.

The amount of sunshine during the blooming period influences the activity of the bees also but like humidity is hard to separate from the other causative factors.

These factors govern to a large extent the intelligent use of normal colonies of bees in orchards. It should be patent that the weak colony is of no use for pollination. Consideration by the orchardist and by the beekeeper of these factors and observation should determine the need for the additional pollination furnished by honey bees in any given orchard. Such observation may entail the keeping of weather records, collection of insects, and possibly in extreme cases the trial of varieties as pollen parents.

*Paper of the Journal Series, New Jersey Agricultural Experiment Station, Department of Entomology.

[1]Halstead, B. D. 1890, Influence of Rainfall at Blooming Time on Subsequent Fruitfulness, N. J. Agr. Expt. Sta. Animal Repor: 1890:320-332.

[2]Hutson, Ray, N. J. Agr. Expt. Sta. Bulletin 434.

THE PSYCHOLOGY OF AMERICAN FOULBROOD ERADICATION

Chas. A. Reese, State Apiarist, Columbus, Ohio

Certain groups of American beekeepers are some of the most ingenious people in the world when it comes to deceiving themselves regarding the importance of American foulbrood. They have continued in this state of mind for so many years, that the time is rapidly approaching when it will be necessary for them to change their attitude or continue to accept their losses. It will soon be too late to do otherwise but make a clean sweep of all bees within certain areas if losses through American foulbrood are to be erased from the ledger. Peculiar as it may appear as a group, they are extraordinarily reluctant to face the music, that is, to openly admit present condition of affairs within their community are their own fault. A heavily infected apiary is universally attributed to negligence on the part of neighbors rather than the result of thoughtlessness on their part, such as shifting brood, interchanging supers or similar practices to equalize strength, practices positively dangerous in the presence of American foulbrood. Such absurd and ridiculous arguments are presented to state apiarists many times during a season. It appears many would rather be ridiculous than admit the situation is of their own action, or to do anything to correct it. When the situation becomes desperate and they can no longer deceive themselves and are forced to do something for self preservation, they are likely to resort to all manner of half-hearted methods of control, but then not until they have exhausted all alibis. More often any gestures toward alleviating the situation are conversational rather than to accept or promptly put into action a progressive program of eradication. Conservation has been another factor responsible for so many failures in making attempts toward a "clean-up."

Too often when the salvage of equipment, honey and bees is attempted infection usually is not only retained but spread all over the landscape. It seems peculiar that so many beekeepers continue to maintain this attitude toward American foulbrood in spite of the great volume of discussion on the subject in current publications, farm press, Federal and State bulletins, together with personal visits by extension specialists and inspectors. If all the various methods of control and treatment advocated for the past half century had been successful to any degree. American foulbrood would be past history rather than the greatest issue at present in American beekeeping. Of all the many procedures advocated by their respective proponents so far, there is one and only one absolutely positive foolproof method to eradicate American foulbrood, and that is the present policy of destroying by fire all infected materials by a thoroughly trained inspector. Experience has clearly demonstrated it is absolute folly to permit individuals to continue to treat infected colonies, if eradication is the desired goal. Peculiar as it may appear, interest and enthusiasm displayed soon vanishes when individuals proceed with the actual labor necessary to do a thoroughly efficient clean-up of the situation. The average beekeeper has no conception of the cause of American foulbrood nor the many means of transmission, hence the folly to delegate the most important part of the program to the individual.

At the beginning of the "area clean-up" policy in Ohio many individuals were permitted, by request, to shake their diseased colonies and treat infected equipment with many patented disinfectants or modifications of the same. The percentage of those who were successful in their efforts has been so small that further expenditure for materials cannot be justified. Peculiar as it may appear, in many instances the original out-lay of cash for materials has been in excess of the cost of new equipment to replace infected materials even if they had been completely destroyed by fire. However, the writer does not infer the failures were in any respect attributed directly to the various disinfectant solutions, but entirely to the discrepancies on the part of the operator. In American foulbrood eradication there are no royal roads or short cuts. The work must be done carefully and thoroughly to accomplish complete eliminations of the disease within the apiary.

In an area in Ohio where beekeeping possibilities appeared to be of an unusual character, and offered unlimited expansion for progressive beekeeping, American foulbrood was so prevalent among the farmer beekeepers that it meant absolute foolhardy adventure for a commercial beekeeper to attempt operations anywhere within the territory. Through the efforts of a few young, energetic individuals who desired to enter in commercial beekeeping within this area, a clean-up campaign was put in operation.

A preliminary investigation not only indicated the disease situation had in no way been exaggerated, but also revealed another factor not previously anticipated. Through the efforts of several unscrupulous individuals who in no manner were affected, many of those who had bees in their possession were incited to become antagonistic to any efforts to better local conditions. However, through untiring efforts, firm determination and a policy of destroying diseased colonies by the use of cyanogas and fire, American foulbrood has been conquered.

The inspectors' reports in this area for 1929 revealed three infected colonies in two small apiaries. If the rapid increase in colonies per apiary is a criterion as to the approval of those concerned then the project of American foulbrood eradication has been successful, for a majority of the farmer beekeepers have more than doubled their holdings. In fact, the number of colonies for all beekeepers has more than trebled. Honey is now being produced in car lot quantities while in the past production was less than the amount required for local consumption. This unquestionably indicates that where the factor of American foulbrood has been eliminated, there is an incentive for the beekeeping public to expand their operations. Even with such convincing examples not only in Ohio, but in many other states many individuals continue to deceive themselves as to the importance of American foulbrood. Whether this personal deception may be unintentional or rather just the hypocrisy of individualistic attitude toward all reforms remains to be determined. In the meantime, it will be necessary for all beekeepers to change their attitude toward their own importance and wake up to themselves. The final eradication of American foulbrood depends entirely upon their spirit of co-operation with their neighbors and all agencies in charge.

INSPECTION OBSERVATIONS

Howard Shipton, Ames, Iowa

The work during the summer has taken me into ten different counties. With the small amount of funds available for the inspection work it was impossible to spend a great deal of time in any one county. I found it was impossible to take care of all the requests coming from beekeepers located in this scattered area. An effort was made to work where we considered the situation most dangerous.

Disease is well under control in counties where the work has been carried on under the area clean-up plan. In this area some disease was found in some of the larger apiaries which seems to have been carried in the extracting or other equipment. Some beekeepers are inclined to be careless, such as taking extracting supers off without making a thorough inspection first, later finding that they have taken supers from infected colonies and scattered the material into their extracting equipment. There are also a few who set out cappings and wet supers to be cleaned up by the bees. Some few treat diseased colonies and there is some reoccurrence from this practice. Under such conditions disease may be kept under control fairly well but it is hard to eradicate.

In one county where the work was started this year the disease situation was deplorable. One large beekeeper found it necessary to destroy more than four hundred colonies of bees and to melt up all extracting and brood combs. Others have gone out of business entirely on account of disease.

In traveling over the state as an inspector I have found that we have several classes of beekeepers. First, we have the large commercial beekeeper who depends on the bees for his livelihood. Second, we have the beekeeper who keeps bees for experimental purposes only. This type of beekeeper usually makes his living in some other way and seldom expects any profit from his apiary. If foulbrood is found, he enjoys trying out all of the different methods of treating and disinfecting. I find that a great deal of disease reoccurs in these apiaries. I have in mind a beekeeper in the southern part of the state whom I called on during the season of 1928. At that time I found his apiary to be badly diseased. In making a second visit to check up, I found that he had destroyed the bees but had gone to considerable expense for equipment to treat the infected combs. I advised him to melt up the combs at that time as I considered it the best method. When I called on him this summer I found that he had filled the empty hives with three-pound packages of fine Italians from the south. Seven or eight frames containing foundation and two or three of the treated combs had been put in each hive. Disease was found in all the colonies so the bees were destroyed again this fall. After spending several hundred dollars, this beekeeper has been convinced that our method is the best and says from now on he intends to use it.

My instructions given to those having diseased apiaries are varied to a great extent as each apiary is considered to be an individual problem of its own. I have had some experience in handling foulbrood in the western states and have found that a method might be a success in one state and result in an absolute failure in another. Of course this applies to the treating method only. Beekeepers needing assistance should get in touch with the State Apiarist who is familiar with the local conditions. I have destroyed all diseased colonies found in Ida county during the last two years of inspection. This was done with permission from the owner as our law does not require the destruction of diseased colonies. Where the inspection work has been carried on for several years in a county, the beekeepers have become educated to know that the inspector does not come to destroy more than is necessary, but comes to assist or help them in a financial way. We have a very good foulbrood law in Iowa but find that we must have the co-operation of most of the beekeepers in a county to get good results from the inspection work. It takes several years to obtain this support.

A large number of the small beekeepers are unable to detect disease and would not know foulbrood even though it were in their own yards. Some depend entirely upon the inspector for this information. All beekeepers should prepare themselves so that they may know foulbrood and be able to do the most of the inspection in their own apiaries. Bees should have several early or spring inspections so as to find diseased colonies before they are robbed out by other bees. At least two more inspections should be made during the season; one just before putting on supers and one before the honey is taken off.

Our inspection work starts early in the spring and continues until late in the fall. Some beekeepers complain about the late inspection on the grounds that they are unable to treat. There should not be any objections on this account as the owner has had an opportunity to clean his yards before the inspector calls. I have been getting good results from the late inspections. Diseased colonies which have been overlooked in the fall are the ones that do the most harm. Colonies weakened with disease seldom live through the winter, but if they do, the robber bees usually overpower them in early spring. During the late inspection I called on a beekeeper in Ida county who had 99 colonies in one apiary. Honey had been taken off and the bees were being prepared for winter. The owner advised me that he had made a careful inspection not long before and that he felt sure that there was not any disease in the yard. To my surprise I found one colony badly infected with American foulbrood. About one half of the brood seemed infected but I was unable to find any that had reached the scale stage. This would indicate that this colony was one in which the disease had developed very rapidly and might have easily been overlooked a few weeks before. American foulbrood usually advances slowly during the honey flow and in some cases it may look as if the bees have cleaned up the disease. As a rule disease can be found again in these colonies soon after the honey flow.

Most beekeepers are not aware of the fact that infection may be carried in hives or equipment for several years before developing. I believe this accounts for the most of the failures in treating disease. Those treating colonies generally make an inspection in the fall, and if no disease is found they consider them clean. Should disease develop the following year or later the neighbor beekeeper is accused of being careless. In making an inspection at an apiary a short time ago, I found several diseased colonies. The owner told me that it was almost impossible to keep bees there and that he was required to shake his bees every year as his neighbor just across the road was so careless in handling his equipment. He went with me when inspection was made at the neighbors and was very much surprised when no disease was found. In this case one man had destroyed a colony now and then as disease appeared and had very little expense. The other beekeeper had spent considerable money in his attempt to clean up and still had infection scattered through his entire apiary.

I feel sure that it does not pay to treat an apiary where only a small amount of disease is found. If the per cent of foulbrood is large, it may pay to treat the entire apiary under some conditions. Of course the time of year would govern this to some extent.

PROGRESS OF WORK ON THE STANDARDIZATION OF SHIPPING CASES

Warren Whitcomb, Jr., Assistant Apiculturist
Southern States Bee Culture Field Station
Bureau of Entomology, United States Department of Agriculture

The Southern States Bee Culture Field Station of the Bureau of Entomology of the United States Department of Agriculture was established at Baton Rouge, Louisiana, on July 1, 1928, for the purpose of studying beekeeping problems peculiar to the southern states. Two main lines of research were adopted as being of greatest importance. These were, first, a study of shipping methods and shipping packages as a definite step toward the standardization of the shipping cages for bees; and, second, a critical study of the honey plants of the south, their distribution and importance as honey plants, and a study of the factors influencing nectar secretion. This work has made fair progress during the past year, as a result of the active co-operation of beekeepers throughout the south, and, in the case of the standardization work, the co-operation of beekeepers in both the United States and Canada.

The Standardization of Package Shipping Cages

The problem of standardization has immense possibilities in several diverse fields; first, as a means of improving shipping conditions, and of decreasing the loss incident to shipping; second, as a means of increasing co-operation amoung beekeepers by reducing a common variable, the shipping cage, to a standard basis; third, as a guarantee to the receiver and the carrier that the bees ordered from any shipper will be shipped in a cage of known dimensions, for which concise directions for handling and manipulation may be prepared; and, fourth, the work should be an active aid in broadening and improving the market for bees, and in increasing the satisfaction and profit of shipper, carrier, and receiver.

The work has been promoted almost entirely by means of questionnaires. In the spring of 1929 the first questionnaire, covering the business of 1927 and 1928, was submitted to 291 shippers in the south. This was followed in September, 1929, with a second questionnaire, asking for details regarding the shipping season of 1929. In November, 1929, a questionnaire was submitted to 159 receivers of package bees in the northern United States and in Canada. More than 40 different types and styles of cages now in use have been received from beekeepers. The questionnaires from both shippers and receivers have been carefully summarized, and recommendations for standard packages in the various classes will soon be submitted to the beekeepers.

It is planned to make several experimental shipments during 1930 to determine the value of the proposed standards. Several other phases of the package industry will also be carefully studied. The work has progressed satisfactorily so far, but the task of standardizing shipping packages is only one of the numerous problems relating to southern beekeeping which demand and deserve careful study.

THE PACKAGE BEE BUSINESS

T. W. Burleson, Waxahachie, Texas

The package bee business has become one of the major activities of the bee industry. To realize its growth one has only to compare the advertisements of today with those of twenty years ago. Why has this part of the industry become so important? In the first place, honey production in the north as a rule is of better quality than that produced in the south, while on the other hand bees are produced much earlier and cheaper in the south.

The package business is a happy solution of many problems both for the northern and southern beekeeper. As stated above the bees build up earlier in the south and in many localities they reach the peak of broodrearing weeks before they are needed for the main honey flow. In such cases that awful swarming problem which is a nightmare to all beekeepers must be handled. Also in many localities the honey is of an inferior grade and the beekeepers find more profit in selling the bees than producing a honey crop.

On the other hand the northern beekeeper with his wintering problems and short seasons in which to build up his bees to get ready for the honey flow, can procure package bees from the south to make up winter losses, replace killed off bees and make increase.

Many of the northern beekeepers are killing off their bees in the fall, extracting the honey from the brood combs, storing their equipment and spending their winters in the warmer climates.

For a successful transaction both parties should be considerate of each other's interest. The purchaser should keep in mind that good bees and queens are produced after much study and at quite an expense. The weather has to be taken into consideration. Sometimes in the South during the shipping season it rains for weeks, and at other times one of those ice laden winds comes out of the north and stops all bee activities. In either case it is almost impossible to get orders out on time.

If a shipper is to give satisfaction he should know weeks in advance the number of packages of bees and queens to be shipped and know the date that they are to go out.

The reliable shipper, and most all those that are permitted to advertise in the bee journals are, will do all that they can do to give satisfaction. Some general rules should be followed by all shippers, some of which are as follows:

1. Make preparations months before shipping season such as, leaving plenty of honey on the hive, see that all colonies are headed with a young pure bred queen.
2. Good locations are essential for early breeding of bees and queens.
3. Queens should be reared from the very best breeders to be had. In case the shipper cannot rear the very best queens he should contract for them in advance from the best queen breeders.
4. Locate only on the trunk lines of railroads, for the reason that many times the bees are left in the sun for hours at the junction, and in such cases the bees either smother or are so crippled that they are almost useless when they reach their destination.
5. Book orders for only about three-fourths the number of packages that is believed can be shipped.
6. Know how to intelligently cage, feed, crate and care for the bees.
7. Cages should be made of light but strong material.
8. Feed should be made of equal parts of water and the very best granulated sugar.
9. All communications should be answered promptly.

Here for the benefit of those who have never caged and shipped package bees, the writer will give a description of how bees are caged and prepared for shipping.

A truck with a large ventilated screened cage that will accommodate about one hundred packages, has loaded into it the number of packages that are to be shipped each day together with scales, funnels, smokers, queen excluders and supers with the tops screened. Arriving at the bee yard the smoker is prepared with a good smoke and part of the bees are smoked down from the supers, the tops are replaced, then the supers are removed and set off onto an inner cover to protect them from robber bees.

After removing the supers the queen excluder is placed on top of the brood nest, then the screened super, after which the colony is smoked at the entrance until the amount of bees wanted are driven through the excluder into the screened super. In this way all drones and the queens are left in the hive. The super is then removed and the bees are poured through a funnel into the cage which sets on a pair of scales. Then the caged bees are placed either in the shade or directly into the screened cage on the truck (it being very necessary to keep the bees out of the sun rays, as it takes only a few minutes to kill caged bees when it is hot). About twenty colonies are prepared at a time and in this way one hundred or more can be gotten out in a day. When the number of packages wanted have been caged they are then taken to the shipping shed and prepared for shipment.

Arriving at the shipping shed the cages are placed on their sides over drip pans, and the bees are fed all the sugar syrup that they will take. The queen bee together with the feed can are then put into the package. They are crated and shipping instructions and address are tacked on the crate. The bees crated are then put into the coolest place possible until train time. If it is a very hot day they are kept cool with an electric fan.

To haul the caged bees to the express office or railroad station, they are placed on the truck upside down as this keeps the feed from shaking out. Then upon arriving at the station they are again turned back to the upright position. If the shipment is a large one it pays to stay with the express man and assist in loading.

Most all the express agents and messengers like honey, and the wise shipper will see that they get some choice honey occasionally, for it helps them to forget the stings received while loading.

The transportation company is a third party to the transaction and should be considered. While they are giving much improved service and are really giving much time and study in the handling of this commodity, they yet have room for improvement among some of their employees. With the volume of package business at this time, there is no reason for the present charge of one and one-half first class rate for the transporting of package bees.

Package bees should be received at their destination regardless of the condition they are in. If they are in a bad condition a statement from the agent should be had, stating the condition on arrival. This will not only aid the shipper in collecting for the loss in transit, but it will assist the carrier and shipper in determining the cause and place of loss or damage in transit.

For the purchaser to receive the best of service and be pleased with the transaction he should remember that his orders should be placed from one to six months in advance. He should be ready to receive his bees as per date specified in the order. Lastly, he should know how to install and care for the bees until the main honey begins.

Nothing is more annoying to a shipper, after booking an order to go out on a certain date, then to receive a wire telling him to hold up the order and ship at a later date. Queens are ready to be removed from the mating boxes to accompany his order, the cell builders have ripe cells ready to replace the removed queens, and to grant the request of the purchaser disorganizes everything the shipper has planned.

You can readily see that the package and queen business is very much like a factory; when one piece of machinery stops it disorganizes everything and causes dissatisfaction all around.

With the winter problems to be confronted and the fine quality of honey to be had in the North on the one hand, and a plentiful supply of early young bees to be had in the South, together with a better knowledge of handling bees by both the shipper and buyer and a lower express rate, surely the package bee business is just in its infancy.

SOME POINTS REGARDING PACKAGE BEES

L. T. Floyd, Agricultural Extension Service, Winnipeg, Manitoba, Canada

The past ten years has made great changes for us in beekeeping and perhaps the shipment of package bees has had more to do with this than anything else. I have recently had the great pleasure of visiting the source of supply in the state of Alabama. We receive bees in this province from nearly all of the southern states but a large percentage come from Alabama.

A point that interested me most at the places visited was the fact that the package business was a small thing compared with the production of queens. Queens are shipped in every direction, south as well as north. When a shipper reports that he sold 35,000 queens last year it provides some food for thought.

The parties visited had three sources of income, first, queens, then package bees and third the honey. This makes it a big business. With some I received the impression that honey might be worth more than the package business, but in most cases queens take first place, packages second, and honey the last or so it seemed to me.

On my return I asked one of our enthusiasts how he thought he would put up a load of packages and he said, "Well, I would prepare my cans of syrup and queens and go out to the yard and shake the bees as quickly as I could and bring them home and put them in the basement or some cool place until ready to ship." A southerner will smile at this but it shows about how much a man in the north knows about conditions if he has not been on the spot. My ideas were much as this other man stated.

In the first place the only cellar or basement that I saw in the week that I spent in Alabama was in the eight-story hotel where the convention was held. Nearly all the houses in Alabama are built on posts and I was informed that this was a necessity where houses were built of wood.

Then, regarding putting the bees in a cool place. On the day I left Montgomery in the middle of November, the thermometer reached 76 and I inquired regarding March and was informed that March would be much warmer than November as spring was beginning, so I would just like to know where you would find a cool place in May when our package bees are shipped.

Then, as regards the assembling of the package bees I learned that in most cases the truck goes out in the morning to the outyard for the bees while the queen breeder who generally works in the home yard catches the queens and cages them ready for the packages.

Th roads in Alabama are mostly made of dirt or sand and because of the heavy rainfall are rough. I was informed that with the cans placed in the packages at the outyard the syrup would be half shaken out before reaching home, so the syrup and queens are generally given just before shipment.

In the past after some dealings with southern shippers the idea seems prevalent in the north that southerners are poor business men and we would have to just get along as best we could with them. I came back with this idea removed from my mind entirely. I found their convention a most interesting one, perhaps this was because they were good listeners, but I also found most of them ready platform speakers, wide awake and keenly anxious to have as good a standing with their customers in the north as it was possible to secure and I came back with the feeling that where northerners had not been used right there was something wrong in the individual case and not with the shippers as a class. The shipping of package bees is in my opinion simply a method of assisting nature in an artificial spring migration of these interesting insects.

At one of these meetings I raised the question, "Why do the birds go north in the spring? If the south was all right for the winter what was wrong with the summer?" The birds come north for the most important time in the year, when they nest and rear their young. The northern summer, though short, provides ideal conditions for this important period, long days of sunshine, short nights and an abundance of food far beyond their needs. Big honey crops are secured under these same conditions.

In securing package bees we take away part of the risk of winter loss and if we can secure enough honey to make it profitable we remove the loss entirely by killing the bees and storing the combs, extracting the full ones and leaving the partly filled ones for the package bees next spring.

We find that this practice is gaining favor to the extent that our fall count of colonies of bees in the province was ten per cent less than our spring count in 1929. In past years the fall count due to the increase by natural swarming was at least 10 per cent and in some years has been as high as 15 per cent higher, but not so in 1929. One of our operators reported that he purchased 135 two-pound packages on April 15th and killed them on September 15th and secured 28,750 pounds of honey and

300 pounds of beeswax. His profits after the bees and containers for the honey crop had been paid for was over $1,900.00, a pretty nice farm side line.

He and his neighbors have been killing in the fall and buying new packages in the spring for several years and find it more profitable than wintering. Their system has been to leave the honey in the half filled combs and hold it over for the packages in the spring as they get much better results from the honey than from sugar syrup. His success I believe comes also from getting the bees in April. If we are to follow the example of the birds we find that they do not wait until summer but many of them arrive before the snow is gone and while it is still freezing hard at nights. The meadow lark has her young hatched before it stops freezing at nights. I have helped to hive package bees on April 1st in 1927 and again in 1929 and found that once on the combs the queens lay eggs rapidly and fill the combs while the queens in the wintered over colonies in the average case will not lay eggs except when the days are warm enough for the bees to fly.

It may be more convenient to hive package bees later in the season when the bees are flying, but with a little practice they can be hived in the basement or any warm building and confined to the hives until the weather warms up or if packing cases are available the protection will be valuable. In the case of this man I have mentioned, the bees were hived outside without any protection, except from the windbreak of trees. I believe the best results will be secured from early packages given plenty of protection.

One of the puzzling things regarding the handling of package bees and it interests all concerned, is the high death rate of the queens, the large number of queens superceded in the first month. In the north we have the idea that the queens are reared too early and become chilled or for some other reason are not as good as the queens reared later. After discussing this matter with a number in the south, I came back feeling that this was not the trouble, that the weather in March and April was warm enough for the rearing of good queens.

Long continued wet weather at any time of the year might have something to do with holding the queens too long at mating time as the south has more than three times as much rainfall according to the records as we have in Manitoba. I learned that queens of spring rearing are nearly always demanded. Personally I would prefer to take a chance on the tested ones reared the fall before. One shipper raised the point that these queens that had been laying all winter might not ship so well but no one seemed sure of this.

I found that nearly all the shippers were experimenting with methods of shipping queens in empty cages without candy or attendants and believe we will hear more of this in the future. One shipper stated that he had sent 18 queens in a package of bees all caged separately in empty cages and had them delivered in perfect condition. I will not be surprised if the future will find all of our queens with package shipments coming in empty cages without candy or attendants and introduced quickly and surely by simply removing the metal end and leaving the cardboard to be eaten away by the bees.

What advantages do I see in this method? First it saves time for the shipper, he does not need to catch and cage the attendants. All he needs to do is to catch his queen and fasten her in the cage and put it back over the combs or push it in at the hive entrance until he needs her, then she will be better cared for by the bees in the package as they feed her through the wire. Her condition upon arrival makes this plain to anyone.

It is easier to introduce. All that is necessary is to remove the metal and leave the pasteboard, suspend the cage between the frames and leave it until a week later. There is no need to disturb the colony to examine as the bees will eat the paper away by the next day. With candy it may take a week. The queens will be accepted much more readily than with attendants.

I do not claim to have devised this method but I am certainly greatly impressed and believe this change will come as did the change from candy to sugar syrup. It will be just one more safeguard against disease, as some of our most careful men have never trusted the candy, but have removed the queens to clean cages before introducing but by this method of shipping this will not be necessary.

The most interesting United States government work to us in the north is the experiments being carried out in connection with the station at Baton Rouge under Dr. Whitcombe, where the different shipping cages are being tried out in an endeavor to get the best design for long distance shipments. We expect some interesting decisions in the future along this line.

There are still many interesting problems to be solved in beekeeping work and our young men from the colleges seem to me to be sure of plenty of work before we reach the point where we are producing too much honey.

When I bought my first hive of bees about 25 years ago I was warned by a beekeeping neighbor that there was nothing in beekeeping as you could not find a market for the honey.

Ever since I have listened to the doubters still singing the same old tune, it is much like the darkies in the north who sing "Way Down Upon the Swanee River." It has become a habit, it goes with the beekeeping business, just as the above song is one of the things that help to make a "nigger."

SPRING INCREASE AND REQUEENING

R. L. Parker, State Apiarist, Manhattan, Kansas

The possibility of making increase or division of colonies in the spring may not be a new idea to many people in the region of the Missouri river valley south of Omaha or Council Bluffs. Where the building-up period of a colony is long enough, this practice can be carried out very satisfactorily and of much benefit to the beekeeper. If a person should not wish to increase the number of colonies which he has, it would be possible for him to requeen the colonies without dire results. One of the first requirements for a colony that is to be treated in the production of spring increase would be that it be strong in worker bees at the time the division is to be made. If the time from the beginning of the active season of the honeybee; that is, the blooming of the soft maples, stretches over a period of ten to fourteen weeks to the beginning of the honey flow, this manipulation of a colony can be practiced to good advantage. The usual time required for a colony to build up to peak strength is approximately eight to ten weeks. In eastern Kansas, the spring opens up about March 1st. In southern Iowa, it is but a few days later. In the vicinity of Ames, Iowa, the maples, on the average, bloom about March 17th. This is the beginning of the active season for the honeybees. The other end of the time is the beginning of the major honey flow. In northeast Kansas, it begins about May 10th to June 1st. In the vicinity of Ames, Iowa, about June 15th to July 1st. You will see that the period from the opening of the season to the time of the major honey flow in Kansas is ten weeks or more. This is about what it is in southern Iowa.

In the work at Manhattan, Kansas, we have found it most feasible to make division of colonies in the spring sometime during the first two weeks of April. This gives the colony a month to begin brood-rearing and build up to a strength which can be readily divided. The possible time to carry on this work in southern Iowa would be a week or so following that in Kansas. In other words, the two middle weeks of April, or even up to the last week. Weak colonies are not to be tolerated for this kind of work.

The principles used in this new system of management for honeybees is to have the queens which are to be introduced to the division present at the time the work begins. In other words, there is a narrow margin of time in which this manipulation can be carried on profitably. At the most, there is only a two weeks' interval for this work. It is necessary to make arrangements with queen rearers to be sure to have queens at the time you wish. The process of carrying out the work is as follows:

If desired, two queens may be introduced to the divisions. In other words, a colony may be divided so there are two colonies with two new queens as a resultant product. Some may use the old queen which is already in the original colony and then introduce a new queen to the new division which takes on the nature of a colony at the time the work is finished. Only half the brood and bees are placed with each queen. Enough honey to take care of the brood-rearing needs of the spring is placed upon each of the colonies. This should be about 40 to 50 pounds of honey. In making a division, it is well to make one of them slightly stronger than the other in brood, since if you leave one of the divisions on the old location, all of the field bees at that time will come to that division and thus strengthen it by that number of field bees which is lost from the other division. One way to overcome this would be to divide the colony into its two component parts and then to place them upon new locations. In doing this it would be necessary to place obstructions at the entrance of the hives to make the bees orient themselves.

There are certain possibilities in this method of management. One is that young queens may be introduced to these divisions as a measure for swarm prevention; another is that a beekeeper need only carry through the winter one-half the number of colonies which he will operate during the active season. When the time comes in the spring, he will take one-half this number and increase it to double its number by supplying the necessary equipment and queens to complete the object. In the fall, one-half the colonies could be disposed of or united to form the number which were being operated for honey production during the active season. This, in a way, would solve considerable of the wintering conditions, such as cutting in half the number of packing cases necessary to protect an apiary, and also the labor and time involved in packing the colonies.

By placing a new, young queen in every colony in the apiary at the time of expansion, the beekeeper would in this way be requeening his apiary every other year. In other words, one-half of it would be requeened this spring and the other half would be requeened next spring. If this management is attempted during the eight to ten weeks building up period or in the production of the excess population of worker bees, it may defeat the purpose for which it is advocated. To requeen a colony during the eight to ten weeks' period, when it is not absolutely necessary, causes a set-back in the brood-rearing of the colony. As one might state, it, the brood-rearing of the colony which is prior to the eight to ten weeks' building-up period previous to the major honey flow, is in a way marking time. This might be likened to wasted time, since the colony is not stepping off as rapidly as it should when there is a limited time for the building-up period.

One of the instincts of the honeybee which the beekeeper tries to overcome is the swarming impulse. Usually this swarming impulse comes at about the time or just previous to the beginning of the first major honey flow. At this time it is quite essential that the beekeeper carry out the management of his colonies in such a way that the gathering instinct is maintained dominant over that of the swarming instinct. Usually when a young, vigorous queen is heading up a colony, there is very little in the way of swarming instinct present in that colony. Dividing the colonies at this time also has a tendency to equalize the colonies in brood and bees and at the same time set them back enough so they reach the peak of brood-rearing at just about the time of the first major honey flow. In order to carry out this management, it is necessary that the beekeeper analyze the situation correctly over a period of ten years or more.

The possibilities in the management of making spring increase or requeening are such that a beekeeper can double the number of colonies which he wishes to operate in one year, then later in the year to reduce the number by uniting, or other methods, to half of what he was operating for the production of honey. This cuts down the number of colonies necessary to go into winter quarters, saving labor, time, and packing costs. Requeening can be practiced to prevent swarming and at the same time not have the primary building-up period interfered with to hinder the work of the colony during the major honey flow. To carry this out in many sections needs careful study by the individual beekeeper of his locality. By this is meant the weather conditions and the correlation of the honey plants in connection with these weather conditions.

ALABAMA BEES AND BEEKEEPERS IN 1929

Winford A. Ruffin, Auburn, Alabama

As a whole, beekeeping in Alabama for the year 1929 was very satisfactory. That is to say, the monetary returns for the season were fair, even though the production of honey and wax was below normal. The bees generally over the state went into winter quarters in good condition.

Bees came through the winter 1928-29 in excellent condition. Brood rearing was normal and most colonies were up to swarming strength by March 15th. This is about the date we expect the beginning of a good honey flow in most parts of the state. Practically all surplus honey produced in Alabama is stored during March, April, May and June. During these four months there was a total rainfall, at Auburn, of 34 inches. Other parts of the state had similar conditions. In fact, the rainfall for the year was the highest on record. The chart gives the rainfall by month and the total at Auburn for the year 1929 as compared with the year 1887 and the fifty-year average. It can be seen from the chart that July and August were far below normal in rainfall and it was during these months that most of the surplus honey was stored. Evidently there was sufficient soil moisture to produce a normal honey flow even though the rainfall was far below normal during these months.

Rainfall at Auburn, 1929, 1887 and 50-Year Average

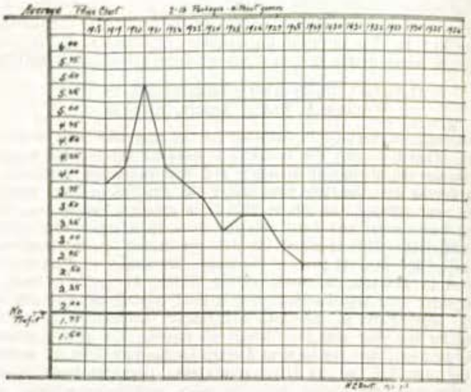
Month	1929	1887	50-Year Average
January	4.28	4.06	4.87
February	9.61	6.79	5.50
March	17.47	2.27	5.57
April	5.29	1.59	4.14
May	7.05	3.73	3.64
June	4.19	2.56	4.21
July	1.63	21.09	5.51
August	1.53	4.32	4.66
September	4.56	7.16	3.08
October	4.04	2.47	2.62
November	6.83	.08	3.08
December	4.74	13.84	4.85
Total	71.22	70.22	53.43

The queen and package business was good. The bad weather during the spring and early summer did not materially affect the production of queens and packages but made shipping rather difficult. The demand for Alabama bees is growing each year. According to Mr. Thomas Atchison, State Bee Inspector, Montgomery, Alabama, 75,000 pounds of bees and 175,000 queens were shipped out of the state this year. It is estimated that the total income to beekeepers of the state for the year was $400,000.00.

The topic that is discussed most among the leading package producers of Alabama in recent years is the declining in price of package bees. The graph, "Ten-Year Price Range for Two-Pound Package Bees" shows very clearly the reason for this discussion. It seems that a very great increase in side-line beekeepers and hazardous price-cutting by a few of the large producers are given credit for this decline.

Activities of the Alabama Beekeepers' Association

The Alabama Beekeepers' Association, early in the year became a member of the American Honey Producers' League, thus demonstrating their faith in honey and honey producers and showing their willingness



The trend of prices of two-pound packages of bees.

to help keep before the public the food value of the product of the bees' labors.

The annual meeting of the Alabama Beekeepers' Association was held in Montgomery, Alabama, November 7 and 8. The out-of-state speakers on the program were Mr. L. T. Floyd, Provincial Apiarist, Winnipeg, Canada, and Dr. Warren Whitcomb, Jr., Baton Rouge, Louisiana.

HONEY PLANT SURVEY IN THE SOUTHERN STATES

E. Oertel, Assistant Apiculturist,

Southern States Bee Culture Field Station

Bureau of Entomology, United States Department of Agriculture

During the season of 1929, at the Southern States Bee Culture Field Station of the Bureau of Entomology of the United States Department of Agriculture, a beginning was made in the study of the honey plants of the south. A number of beekeepers are co-operating in this work by recording the dates of blossoming of honey plants in their vicinity, together with information about the length of the blossoming period, the value of the plant as a nectar producer, its relative abundance, the types of soil upon which it grows, and the kind of honey obtained from each source. Such a study will have to be carried on for a period of years before much information for purposes of comparison can be obtained. In order to ascertain the honey-producing value of the recognized southern honey plants colonies of bees are established in locations where a certain plant is dominant. Such colonies are visited weekly, and all the honey and fresh nectar are removed by extracting. The product is then weighed, and a graded sample is put aside in a glass jar. Comparable values are thus obtained for a honey plant in a particular locality. Meteorological records, including those of temperature, rainfall, barometric pressure, amount of sunshine, wind velocity, and wind direction will be used to determine the influence of meterological conditions upon the honey flows. A herbarium has been started, so that specimens of honey and pollen plants may be properly identified and preserved. Beekeepers in the south are urged to send both known and unidentified honey plants to the Station in order that a complete series of southern honey plants may be available for study.

BEEKEEPING PROBLEMS IN OKLAHOMA

By

G. A. Bieberdorf, Stillwater, Oklahoma

The geographic location of Oklahoma is such as to lead one at first thought to believe it would be ideally situated for the best of beekeeping. On closer observation, however, one may soon discover that the beekeeper meets with many difficulties.

In trying to classify Oklahoma geographically, the beekeeper will soon discover that he cannot place it by the beekeeping practices of either the north or south. The same will be found true if he tries to adjust it to eastern and western customs. The state seems to be on the border line and the most successful beekeeper should be acquainted with the methods of the east, west, north and south. Further investigation will reveal the fact that the entire state's drainage is from the northwest towards the southeast. From the lowest point in the southeastern part of the state, which is only a scant 400 feet above sea level, there is a gradual rise as one goes west until an altitude of something more than 5,000 feet is attained in the extreme northwest portion. The rainfall in the eastern and western parts of the state varies as greatly as the elevation. In the eastern part there is a rainfall of fifty-one inches, which becomes less and less as one goes west until the almost desert-like condition in the west is reached where the total rainfall is but eighteen inches. The result of this condition is a great variation in the flora of the state. The best beekeeping, then, is restricted to only those areas of the state where there is sufficient rainfall to produce an abundant flora. Roughly then, this would include the eastern half of Oklahoma and most of the river bottoms of the western half.

In those parts of the state where there are sufficient nectar-producing plants, the bees are often unable to gather all the nectar produced. This is due to the fact that the high temperature together with the winds will sometimes dry up the nectar before the bees have had time to gather it. It, therefore, often happens that only for a short time during the early part of the morning are the bees able to store honey to any advantage. In the western half the bees are not only handicapped by the drying up of the nectar, but also by the very high winds that are prevalent during the spring and most of the summer. Because of these winds, many bees that leave the hive are lost on their return battling the winds with their loads.

The wintering of bees is not difficult. Many bees are allowed to winter out in the open with no protection whatever. However, one takes considerable risk in not giving the bees some protection. While as a rule, the winters are generally mild, a drop in temperature of thirty degrees in less than twenty-four hours is not at all uncommon. Without some protection, therefore, bees might not have sufficient time to adjust themselves to such rapidly changing temperature. Owing to the usually short duration of the cold spells, it is not recommended that heavy packing be used. Wrapping the hive body with three or four thicknesses of newspapers, as described in circular No. 48 of the Oklahoma Agricultural Experiment Station, is all that is required.

The mild winters and the fact that the bees are able to fly about a great deal during the winter months often causes the beekeeper to make the very serious mistake of not supplying the colony with sufficient stores to carry them through the winter successfully. Too often the usual procedure is to see that each colony of bees has twenty-five or thirty pounds of honey. Under Oklahoma conditions this amount should be at least double. The bees are more active here during the winter months and greater activity requires more food. This greater activity together with the brood rearing which starts rather early at times is one cause for the greater need of food. Young brood has been found as early as the middle of January. This brood is reared under unfavorable conditions and must be fed on winter stores until the early fruit trees come into blossom, sometimes the latter part of February. This brings about a condition that causes the bees to begin brood rearing in earnest. After these early fruit blossoms have disappeared, generally on account of a late frost, there is a dearth of nectar and pollen. The result is that the colony is not supplied with sufficient stores to carry them through this dearth and the bees will die of starvation before the real nectar flow comes from the white sweet clover during the middle of May.

The flora of the state is not such as would permit the bees to gather a surplus of nectar throughout the season. The wise beekeeper, therefore, will be on the lookout and either sow plants to produce a bee pasture to last over a long period of time, or else be ready to move his bees to such localities where the nectar producing plants are abundant at the time of the nectar flow. This may sometimes be accomplished by moving the bees but a few miles. While white sweet clover is the important honey plant in this state, it is not yet as abundant as might be desired. The acreage, however, increases from year to year. Other important honey plants are elm, sumac, alfalfa, basswood, horsemint, button willow, golden rod, morning glory, blackberry, cotton, Spanish needle, smart weed, aster and dandelion.

BEEKEEPING IN THE PACIFIC NORTHWEST

H. A. Scullen, Corvallis, Oregon

During the past ten years or more the writer has received many letters of inquiry from beekeepers throughout the eastern states, asking about the possibility and problems of beekeeping in the Pacific Northwest. When Mr. Paddock wrote the author recently, suggesting that an article would be appreciated for publication in the annual report of the Iowa State Apiarist, it was felt that probably some suggestions along the line of the opportunities and problems of the Pacific Northwest might be as valuable as anything which could be offered, even though this subject had already been treated in previous publications in recent years.

Let us emphatically say at the beginning that we do not advise any beekeeper to move to the northwest expecting to find a paradise for honey production. I believe, however, that our opportunities for production are equal with the average of most sections of the country, but we too have our problems of disease and marketing, and there are many sections of the northwest where it would be impossible to keep bees with profit.

Should one, however, feel that they want a chance to move to a section of the country where living conditions are attractive and where nature has provided a most delightful climate, close to beautiful mountains and pleasant seashore, not to mention hunting and fishing facilities, we believe that we can offer an opportunity for making an honest living.

From the standpoint of climate, which has an extremely important bearing upon beekeeping, we may divide the Pacific Northwest into the arid eastern sections, including Idaho, eastern Oregon and eastern Washington, and the humid district, which includes western Oregon and western Washington.

In the so-called arid district we find beekeeping is confined to the irrigated sections, where alfalfa is grown extensively for hay and sweet clover has become common along the irrigation ditches and in swampy places. The four largest irrigation districts are the Yakima Valley, extending down as far as the junction of the Columbia and Snake Rivers, in Washington; the Umatilla project, and the Malheur project in eastern Oregon, and the Snake River district in southern Idaho. There are

many other smaller districts where there is room for limited amounts of beekeeping, such as in the Okanogan Valley in northern Washington, the Ellensburg district, the Walla Walla district, the Grand Ronde Valley, Wallowa Valley, Baker Valley, Rogue River Valley, and a few other sections of minor importance.

In the humid districts of the western part of the state we find that fireweed is the most dependable and valuable source of nectar. This plant grows in abundance only in the burned-over timber sections of the mountains, where the rainfall is 50 inches or more. Although fireweed grows in other sections where rainfall is less than 50 inches, it is not generally dependable enough to produce an ample surplus of nectar. The rainfall map shown will indicate where this plant may be depended upon. There are many sections of western Washington and western Oregon which would undoubtedly prove valuable as sources of fireweed honey were it possible to reach them by automobile or railroad. As time goes on possibly some of these locations will be made accessible. Somebody may in time be ingenuous enough to develop the use of the airplane for going in and out of such places. Both the alfalfa, sweet clover honey and the fireweed honey are practically water white when pure and of the highest quality.

There is also considerable honey produced in the Western Oregon and Washington Valleys from a mixture of plants, including clover, vetch, raspberry, et cetera, but these are not as important locations because of the fact that there is always a very large amount of the honey which is dark and must be sold for baking purposes. However, some of our beekeepers are finding it profitable to blend the better grade of valley honey with either fireweed or alfalfa-sweet clover honey, and thus produce a light amber honey of very high quality, which finds a ready sale in local markets. At present there probably is in the neighborhood of 100,000 colonies in each of the states of Oregon and Washington, and possibly at least half that many in the state of Idaho. It is doubtful if there could be an increase of more than 50% without considerable crowding under the present conditions. There is, however, some probability that irrigated alfalfa districts will be on the increase in future years, and these will provide additional room for beekeepers.

To turn to some of our problems for a few moments, I will call your attention first to the matter of disease. American foulbrood is found in nearly every beekeeping section of any importance in the northwest. It is the predominating form of disease found in the irrigated alfalfa districts. European foulbrood, although found in some of the irrigated alfalfa districts, is far more prevalent in the humid districts. Possibly this is due to certain climatic and honey flora conditions which haven't yet been worked out. Disease control work in the three northwestern states is not satisfactory, largely because of the inadequate amount of funds available. The state of Washington is probably better cared for than any one of the three states. There inspection work is under supervision of the State Entomologist, who at present is Doctor Webster, located at Pullman, with the Washington State College. In Idaho the inspection work is under the supervision of the State Horticultural Board. In the state of Oregon we have about the most antiquated system of disease control which is found in any state in the Union. It is still the old county system, whereby the county court appoints an inspector on petition of seven beekeepers. Although we have a number of well qualified bee inspectors in the state, this system often makes it possible for the appointment of an inexperienced and injudicious inspector, and funds for the support of inspectors are hard to get. As a whole our inspection work is far from satisfactory, with the exception of a few counties where we have some progressive and up-to-date inspectors who are in most cases working at a sacrifice in order to clean up the disease situation.

In parting I would like to emphasize the importance of disease in the fruit industry of the northwest. Although bees for honey production are important in the state, we feel that their value for pollenization of our famous orchards far exceeds their value as honey producers. As evidence that our fruit growers are realizing the importance of bees, I merely need to call your attention to the fact that only a few years ago one of our leading co-operative fruit growers' associations employed a man whose primary purpose was to supervise the care of bees which were kept by the fruit growers for pollenization purposes. So far as I know this is the only case on record where a fruit growers' association has taken such a step. Furthermore, the State Horticultural Society has invited the Oregon State Beekeepers' Association to affiliate with them in a joint association, realizing that many of the fruit growers are also deeply interested in the care of bees, and that much could be accomplished by close affiliation of these two associations.

We trust that if any beekeepers of eastern states are contemplating moving to the northwest and going into beekeeping that they will feel free to write the author. We will endeavor to help them locate in the most favorable locations.

EXPENSES INCURRED IN HONEY PRODUCTION

E. L. Sechrist, Assistant Apiculturist

Bureau of Entomology, United States Department of Agriculture

The studies on apiary organization and honey production now under way in the Intermountain States and in the clover region are revealing many interesting factors in the expense of producing honey. Following the initial item of interest on the capital invested, the major items of expense are, for small apiaries, containers and supplies; while in larger apiaries hired labor becomes a considerable item of expense and the average expenditure per colony for truck and auto and miscellaneous expenses is also greater than in small apiaries.

As a business increases in size a larger proportion of the operator's time must be spent in supervising the work and managing the business. The problem also arises of keeping labor profitably employed during periods when the bees require little attention, or the alternative of employing short-time labor, frequently necessarily inexperienced.

The larger business, too, can make more complete use of equipment, and can use larger or better units, while the small operator sometimes feels it necessary to use inadequate and less efficient equipment.

On the other hand, the operator of a small business can give more personal attention to the bees, perhaps securing a better crop through intensive work. He may also dispose of his crop on a local market at higher prices than can the larger producer who must ship to a distant wholesale market. While the chance for a smaller operator to obtain a larger income is less, the prospect of his incurring a large loss is also less.

The total cost of operating a colony of bees, among 39 beekeepers and 25,000 colonies of bees, ranged from $2.04 up to $12.50 for different operators. At 50 cents per hour, the lowest labor cost was $1.09 and the highest $4.47. Expenses other than labor costs ranged from 47 cents to $4.47 per colony.

While some men put as much as eight hours time on each colony, others used only two to three hours per colony. Much of this labor was used whether the yield of honey was heavy or light, although a very heavy yield of honey did require some additional labor. The methods of management, the ability of the worker, the distances to be traveled, and the equipment used are factors affecting the amount of labor required.

On the average, in the production of extracted honey, about three and one-fourth hours of work and one-half hour of travel were used per colony. For producing comb honey an average of five and one-fourth hours of labor was requifed per colony and one-half hour for travel.

While the records indicate that the production of comb honey is more profitable than the production of extracted honey, it should be

remembered that only very excellent locations are good for producing comb honey exclusively and that these choice comb-honey locations are very few. It is also true that, almost without exception, no one who is not an expert beekeeper produces comb honey extensively. It is, therefor, only to be expected that the combination of an expert beekeeper and an exceptional locality would result in unusual profits, particularly when it is known that, in such a locality, the expert producer of comb honey is quite likely to produce more sections of comb honey per colony than his less expert neighbor can produce pounds of extracted honey, while, in locations less favorable for comb honey, the average producer might expect to produce about half as many pounds of comb honey as of extracted, his production of comb honey being, also of poorer quality than that produced by the expert comb honey producer in a good comb honey locality.

It should be emphasized that some of the essentials for the production of a fine grade of comb honey are a rapid flow of the quality of honey wanted (usually white honey) combined with freedom from propolis and from honey of undesirable quality. The market demands an increasingly fine quality of comb honey, and only comb honey that will grade high is profitable either to the producer or the distributor.

It is interesting to note that beekeepers who produced both comb and extracted honey secured higher returns than those who produced only extracted honey. The indications are that, when one is located in a region where at least a part of the honey flow is very good, some comb honey should be produced during the time when nectar is coming in most rapidly. Often, at that time, excellent comb honey can be secured at a very low cost, provided the beekeeper has his equipment ready for immediate use. The item of interest on the cost and the depreciation on a hundred or two hundred comb honey supers is not great, and it may well be that, in many localities, it will well repay the beekeeper to have a certain amount of comb honey equipment, ready to be used if the season is good, on selected colonies which, as he will know from experience, can be expected to produce section comb honey profitably. If, after starting a colony with an extracted honey super, section supers are put on and removed as soon as they are filled, and the colony again given extracting supers for the closing of the season from two to five supers of sections per colony may be secured, with practically no partially filled sections and no unfilled sections carried over until the next season. Comb honey so secured should be of the finest quality and should grade high, being well filled and free from propolis and travel stain. In this way, at a minimum of expense, a fine lot of comb honey can be secured from a few colonies, while the beekeeper makes no attempt to force unwilling colonies to work in the supers, but permits them to produce his stock of extracted honey.

While the profit per colony is closely in agreement with the yield per colony, the yield frequently depends as much on management as it does on seasonal conditions. Although it is true that not even a good beekeeper can secure a crop when no nectar is produced, it is also true that, when there is a moderate yield of nectar, the good beekeeper may secure a profit of several dollars per colony while his less efficient neighbor may lose money on the season's operations. Thus, the returns for labor and management for each hour worked by the operator, after allowing 6 per cent interest on the investment, ranged from a loss of $1.61 per colony to a profit of $11.78 per colony, while, under apparently the same conditions in the same locality, but under different management, there might be a difference in profit of more than $3.00 per colony. These exceptional cases, where management can be compared, deserve special study. Although the records of one season are not sufficient to give absolute facts, lines of investigation have been opened which will be followed up in succeeding years.

The largest loss shown was due to a low yield of honey, combined with the loss of a large amount of equipment because of American foulbrood. Another large loss was due to a low yield of honey and a heavy loss of adult bees from disease. Where yields of 90 pounds or more per colony were obtained the results were generally favorable, while for yields of less than 60 pounds the returns were likely to be unfavorable.

Another item which is closely associated with profits received by the beekeeper, although it is not directly an item of expense, is the quality of honey produced, thus depending not only on the floral sources of honey but on the management used in producing the honey. The management should be such that as much as possible of the highest possible grade of honey is produced. Where comb honey is produced the grading of honey should be studied, in order that honey will be produced which will fall into the higher grades, and will not be barred for some fault which the beekeeper could easily have avoided. Similarly, the handling of extracted honey should be such that the honey will be free from wax and other foreign material and uninjured by heat.

While the production of a fine quality of honey may not always give the producer a higher price than his careless neighbor receives, yet it does, if there is a large crop of honey, result in the finer grade of honey being the first to be purchased, while honey which has not been so well produced sells more slowly.

This study of the expenses incurred in honey production is being carried on jointly by the Bureau of Entomology and the Bureau of Agricultural Economics. It is under way for 1930 in the clover region, including Iowa, and as soon as further reports are ready they will be announced through the bee journals. The Division of Bee Culture Investigations, Washington, D. C. will send on request to anyone who is interested a copy of the preliminary report for the work of 1928 in the Intermountain States.

OBSERVATIONS ON CAUCASIAN BEES

John Cordes, Anamosa, Iowa

First, I will say that Caucasians build up more rapidly under most any condition, the queens are very prolific and have the brood very compact and regular, and therefore are probably advertised as excessive swarmers. However, we keep them in Modified Dadant hives and rarely have trouble with the "swarming fever."

They are extremely gentle and remain quietly on the combs while the colony is being examined. They resist robbing as well as any other race even in spite of their extreme gentleness.

They do not drift as we have Italians right at their side, and have never found any Caucasians in the Italian colonies but have found the Italians in their colonies in great numbers.

Our Caucasian colonies averaged ten pounds more honey per colony than our Italians in the same yard. The Caucasians are a little more inclined to build brace combs between the brood chamber and first super as the season comes to an end, but do not propolize any more than other races. The Caucasians have more honey in the brood nest, and more young bees upon their combs at the beginning of winter than our best Italian colonies, and so are our best winterers. Their extreme gentleness and their well provisioning of the brood chamber, coupled with their ability to seek their own lives should further recommend them.

THE CARNIOLAN BEE

Jay Smith, Vincennes, Indiana

I am asked to give my opinion of the Carniolan bee since having another year's experience with them. I will say that I will have to modify some statements made a year ago. As far as robbing was concerned, I stated that I could see no difference between the Carniolan and Italian bee. The last season convinced me that the Carniolan does not rob as does the Italian. The season before when sugar syrup was left exposed, the Carniolans were after it fully equal to the Italian. From this I judged that they were robbing. However, last season, I noticed

that where Italians were forcing their way into a neighboring hive the Carniolans did not take part. They will work on exposed honey or syrup the same as Italians, but when it comes to forcing their way into a hive containing bees, they seldom if ever do it. Last year's experience also convinced me that they do not drift as badly as Italians. In forming queen rearing nuclei, the evidence was very plain that they returned to their own hive and did not seem to get lost and enter the wrong hive as did the Italians. Also the young virgins when returning from their mating flight always found their way to their own hive while there is always more or less trouble with Italians in this respect. However, these are of small economic importance, although very interesting. The claim has been made that they are excellent nurses and build larger queen cells and feed the larvae more lavishly than Italians. I have compared them carefully with the best race of Italians and so far have been unable to detect any difference in these respects. It has been said that they rear brood out of season and that late in the fall after the honey flow is over they use up their winter stores in brood rearing. I was greatly in hopes this was true for I could supply stores and have the hive filled with young bees for winter and spring. But this is not the case and is an impossibility with any race in this locality, for there is no pollen available at that time of the year and no race can rear brood to any great extent without pollen. It is barely possible that there are localities where plants bear pollen in abundance till frost. If that were the case the Carniolans might continue brood rearing. However, I would expect the Italians to do likewise under such circumstances.

When it comes to gathering nectar they are the equal of the best Italian and superior to most strains. I believe they are hardier than any Italian I ever tried and I have tried every strain that appeared to have any merit including some I imported from Italy. They will stand the cold and confinement better than any Italian and they will work when the thermometer registers several degrees colder. They are very hardy and are splendid comb builders capping honey extra white and gather little propolis.

The principal objection raised against the Carniolans is the claim that they swarm excessively. I cannot speak definitely upon this subject, as I have had them but two seasons, more than to say I have given them plenty of room and have had no swarms. Some claim they swarm badly while others say that if they are treated the same as Italians and given plenty of room, but given the extra room two weeks earlier, they swarm no more than Italians. I am inclined to this belief for we know that an abundance of pollen promotes swarming and as the Carniolans are able to get pollen during colder weather than Italians they build up earlier in the spring, fill their hives and swarm before the Italians build up. Even so there may be more of a tendency toward swarming by the Carniolans, I cannot state one way or the other without further experience. The Carniolans are more gentle than the average run of three banded Italians. They are more gentle than the Italians I imported, but not as gentle as some Yellow stock I have bred. A little puff of smoke at opening the hive will quiet them. One's locality, management and personal preference must decide which is best.

PRODUCING QUALITY QUEENS

Chas. L. Ruschill, Colfax, Iowa

I have been observing the pictures of different bee-yards as reproduced in several of our leading bee journals for a good many years, often, yes often we see pictures of a large production colony that have seven or eight full depth extracting or a dozen or more comb honey supers piled one on top of another on its hives, while in its immediate vicinity stand a dozen or more hives with but one or two supers on each hive. Something radicaly wrong somewhere Brother. It lies either in the manipulation of those colonies or the chances are nine to one that it lies in the lack of uniformity in the breeding of queens that are heading those colonies. For that reason I wish at this time to give some of my views and experiences along the lines of queen breeding in particular.

I deem it as unnecessary for me to mention that if we wish to secure the largest possible yields of honey, our colonies of bees must be kept in a pink or prosperous condition, likewise all colonies made use of in queen rearing, including the queen mating nuclei must be in that very same condition in order to obtain the best results. Bear in mind, the best of our pure bred domestic live stock will if kept on a starvation ration for any length of time degenerate to where they are no better than ordinary scrubs.

If I remember correctly, several years ago I read where a Harvard class asked John D. Rockefeller, how much money must a person have to be perfectly satisfied and contented? And the oil magnate's reply was: You must always have just a little more than you have got. The moral of this hits queen rearing square on the head. We must always, year after year endeavor to produce queens that are superior in every way to the best of those which we already possess.

We know in order to produce queens that are as good or better than the best which we now possess we are not allowed to neglect any of the details connected therewith. We know that bees are subject to the laws of heredity the same as other stock, while it is not possible to get positive exactness through breeding, we know that very close similarity is being and has been secured in that way with domestic stock for years. We also know that bees like other stock will 'sport' i. e. some individual queen or colony will develop traits that are far superior to the average, be on the lookout for them. There is not an apiary in the United States that does not contain one or more queens that are far ahead of the average in the same yard. It is from among these best queens that we select our breeders and hope to in turn have their daughters mate with our best drones. I will discuss this drone business a little later on.

If we discover among our colonies a queen with an exceptional production record, the question arises, is she fit to be used as a breeder? That depends to a very large degree, on the breeding of her close ancestors. If several of these possessed to a large degree the same desirable characteristic, we have every reason to expect the queen in question to transmit this desirable trait to her offspring. On the other hand if she is merely an up-shot emanating from a mongrelized scrub line of ancestors the chances are that she lacks the transmitting ability and if so is not fit to be used as a breeder. There is but one absolute sure method of testing a queen for breeding purposes and that is to rear queens from her larvae and keeping a close tab on the performance of the daughter emanating therefrom.

Some queen breeders seem to think that how the queen is reared is of more importance than the breeding thereof. I fail to see it that way. To be sure, the method of rearing that gives us the best all around results is the one we should follow, but any method of queen rearing that lavishly supplies the larvae with royal jelly after it hatches from the egg and properly incubates the cell and nurses the virgin after she emerges from the cell until she is mated and laying should give us good results in so far as the rearing thereof in concerned. On the other hand if we want to develop a strain of bees that will give us larger yields of honey, cap their honey white, that are but little disposed to swarm, gentle, long lived and carry with them a specific color marking, we must not lose sight of the fact that these are inherited characteristics and may not only be maintained but improved upon from time to time by pursuing a judicious course of breeding, selection, and always weeding or culling out those queens that do not come up to our set standard. Lose sight of these factors and the quality of our queens will not be improved to any commendable degree that is certain.

The question is, what system of breeding shall we employ, line or

inbreeding? Both have advantages when wisely used. Line breeding consists of the mating of individual animals of no closer relationship than cousins, while inbreeding takes in any of the closer relations. With bees I consider the latter system, associated with the introducing of new blood in our line every five or six years as the best one to follow. It seems to give us not only the quickest but at the same time the most noticeable results, especially since our aim is not only a high, but at the same time a fairly uniform production record.

When queens are purchased for the purpose of blood freshening, instead of spending ten dollars or more for a single breeding queen, it is better to buy ten untested queens from two different breeders, that is five from each, then keep a close record on the performance of both lots for two seasons. On the third season choose the best queen from whichever of the two lots that established the best record. In our case this chosen queen is used for the purpose of blood freshening only. We do not consider her as a breeding queen. On her third season we rear a batch of queens from her larvae, giving the resultant virgins a chance to mate with our inbred drones. It is from among these daughters that we select our breeding queen because they possess the dual influence of our intensely bred drones and those of the strange queen. The entrances to those hives containing queens that are not of our specific breeding must be guarded with drone traps or the drones in these hives suppressed in any other way.

I take a great deal of stock in this matter of blood freshening. Farmers have been practicing it with their domestic animals as far back as I can remember, and since it pays with high priced animals, it pays a whole lot bigger with queen bees, especially when we take into consideration the price at which queens can be bought and that a good many thousand colonies could be benefited with a single queen bee.

According to my record I have purchased queens from ten different breeders in the past twenty-five years. Some of these were bought merely to satisfy my curiosity as to what the other fellow was offering, while others were secured in search of queens to be used for blood freshening. From my experience along this line, I know that the publicity or notoriety of some who sell queens amounts to more than the goods which they sell, but this holds true with some breeders of practically all kinds of live stock, so we are rather used to it and don't think very much about it. On the other hand I have had some very good queens sent to me, but I never had a queen sent to me that if I saw fit to use her as breeder I would find that many of her daughters and their workers would prove to be far superior to their mother. I consider this as being chiefly effected by the introduction of new blood in our line of breeding.

It is not possible for me to go into the details of queen breeding in this short article as I would like to, so as the minister says, "Just one more word." There is quite a variance of opinion among beekeepers regarding the distance that queens fly from the hive on their wedding flight. My experience along this line seems to indicate, it is all a matter of location. I one time found myself for three years in succession, raising queens in a level prairie location subjected to considerable high winds. In that location fifty per cent of my virgins would fail to return to their hives at all, once they left them, and for all I know, those queens may be still flying but this is hardly probable as it is ten years since I left that place and during that time we have been having some pretty tough weather for queens to be flying around outside of a hive.

My present home yard is located on a hillside that slopes to the southeast at the head of a small ravine, the nucleus hives being on a little lower level than the other colonies, and all are well protected from wind. In this yard whenever I place a ripe queen cell in a nucleus hive I expect to find a laying queen there in due time. The loss does not go over five per cent at any time during the season, and two per cent will more than take care of the mismating, while in the yard formerly alluded to, there was no end to the mismating of those queens that did return to their hives in spite of the fact that outside of my own bees there were but very very few others within a radius of five miles. It is my candid opinion that the bulk of my queens here are mated right in this small ravine within eighty rods of their respective hives.

WHAT RESULTS CAN BE EXPECTED FROM CONTROLLED MATING OF HONEY BEES

H. A. Stabe, Baton Rouge, La.

Beekeepers, especially queen breeders have been interested for a long time in producing better strains of bees. Much has been done in the past in the formation of more or less distinct strains of bees, such as Golden Italians, Three-banded Italians and Leather Italians by selection. However, queen breeders have been handicapped because of their inability to control the male side of inheritance. With the publication of Dr. Watson's paper on artificial insemination of queen bees, this difficulty—theoretically, at least—has been removed. A great increase in the interest in queen breeding has resulted and some beekeepers have gone so far as to predict marvelous results in queen breeding in a few years' time.

Aside from the difficulties of Dr. Watson's technique which are such that, for the present at least, his method can only be used by especially trained persons, the complexities of inheritance, as shown by experiments with other animals, would tend to discount any statements regarding the marvelous improvements that will be made in bees in the near future. Before proceeding any further with this account it may be well to consider breeding tests in other animals in order to visualize some of the difficulties confronting queen breeders.

As we all know the majority of animals develop from a single cell, the fertilized egg, by a process involving countless cell divisions. This fertilized egg is the only direct link between the parents and their offspring. It must, therefore, contain everything necessary in the development of the individual except food. Evidently there is something in the egg which controls the development of characters in the individual. These things are variously called factors or genes. The fertilized egg and all other cells contain bodies called chromosomes. It has been shown that the genes or factors are located on these chromosomes. In any given species of animals, with a few exceptions, the number of chromosomes in the fertilized egg and the body cells of the individuals is constant and just twice as many as in the egg or sperm. Thus in the fruit fly, **Drosophila melanogaster,** the fertilized egg has eight chromosomes whereas the egg and the sperm have only four. The corresponding numbers in man are 48 and 24. In the honeybee, the fertilized egg has 32 and the eggs and sperm 16. Since it has been shown that the egg and the sperm each have a gene for a given character, it follows that the fertilized egg has two genes for each character since it received one from the male and one from the female parent.

With this brief introduction let us consider a simple cross which will illustrate the mechanics of inheritance. Take a black guinea pig from a strain which has bred true for black for several generations. Since this individual is pure or homozygous for black, it follows that both genes controlling coat color are the same and may be designated by the letters, BB. When this individual produces germ cells each germ cell will have one of these genes but, since they are alike each of the germ cells when mature will have one of these genes, B. A white guinea pig may be designated by the letters, bb. All of its germ cells when mature will have one of these gene, b. When a black guinea pig is mated to a white one all of the offspring produced will be black. Since each was produced from the union of one germ cell containing the gene B and another containing the gene b, they may be designated by the letters Bb and are called heterozygous. Since they are all black, black is said to be dominant to white. When these individuals produce germ cells they

will be of two kinds. One-half will contain B and one-half, b. When two such individuals are mated we have the following possible combination of germ cells:

BB—Bb—bB—bb
BB+Bb—bB—bb

The second and third are the same as it makes no difference whether the B or the b comes from male or female parent. We therefore, have the ratio of three black to one white in the second generation, on the average. This ration holds only for large numbers of off-spring and, in a given litter, all of the individuals may be black or, on the other hand, half or more may be white. The whites if bred together will breed true for white showing that there has been no mixing of black with white. The blacks are of two kinds which can be distinguished only by mating each of the blacks to a white individual. Where no whites are produced from this cross we are reasonably sure that the black is pure of homozygous. If two of this kind of blacks are bred together a true breeding strain of blacks will be developed and thus we have recovered our two original strains again after crossing.

In a cross involving two pair of factors the inheritance becomes more complicated. Let us cross a black rough guinea pig, BBRR, with a white smooth one, bbrr. The first generation offspring will all be black, rough and their genetic formulae may be written BbRr. When individuals of this kind are bred together we expect, on the average, the following results:

1 BBRR 2 BbRR 2 BBRr 4 BbRr	9 black rough.
1 BBrr 2 Bbrr	3 black smooth.
1 bbRR 2 bbRr	3 white rough.
1 bbrr	White smooth.

We see from these results that, on the average, we expect only one individual in sixteen to be homozygous for black and rough and only one, for white and smooth. We should also note that one individual in sixteen is homozygous for **black** and **smooth** and one for **white** and **rough.** By breeding tests these latter kinds of individuals can be distinguished from the others of similar appearance. Then by breeding these individuals together, true breeding strains of black smooth and white rough guinea pigs can be produced.

These two samples will serve to illustrate the manner of inheritance. As the number of genes involved in a given cross increases, the number of possible combinations increases very rapidly. With four pairs of genes there are sixteen kinds of eggs and sperm possible, whereas with sixteen pairs of genes there are 65,536 kinds possible. Inheritance is further complicated by the fact that there is interaction between the various genes. In some cases the presence of two or more pairs of genes is required in order that a given character show up in the offspring. In other cases two or more genes may have the same effect. Environment also plays an important role. The queen bee and the worker bee serve to illustrate this very well. With royal jelly as food and a large cell to develop in, a queen is produced; with a small cell and a different food, a worker is produced.

With this brief resume of heredity, as found in other animals, we can proceed to the consideration of heredity in honey bees. Very little experimental data is available. Several attempts have been made in the past to control the male parentage by the isolation of a few colonies.

All such attempts have ended in failure before much data had been accumulated.

There are, however, certain general considerations that will affect experiments in heredity in the honey bee and that are well substantiated. It is a well known fact that the drone develops from an unfertilized egg. Since the queen has 32 chromosomes, this means that the drone has only 16. It also means that he has only one gene for a given character. When sperms are formed, since no reduction division occurs, all of them will be exactly the same. On the other hand, if the queen that produces the drones is heterozygous, she will produce as many kinds of drones as she produces kinds of eggs. That is, if she is heterozygous for four genes, since she then produces 16 kinds of eggs, she will produce 16 kinds of drones. With 16 genes the corresponding number of kinds of drones is 65,536. Furthermore a drone can be used only once for mating with a queen, and in most cases it will be impossible to distinguish the kinds of drones by their appearance.

It is also well known that the queen normally mates only once during her life time. What effect will this have on breeding practices with honey bees? Let us assume a sinple case for illustration. Assume that we have two strains of bees, C and D. Strain C possesses a desirable character, A, but lacks another desirable character, B; while strain D possesses character B but lacks A. The genetic formula of strain C will then be AAbb; that of D is aaBB. If we want to produce a strain possessing both desirable characters we cross the two. The female offspring will all possess both desirable characters but will be heterozygous for both and may be designated thus, AaBb. The drones will all be Ab or aB depending on whether the queen used was AAbb or aaBB. We now have a strain which possesses both desirable characters but it will not breed true. The next step is to cross virgin queens AaBb with AB drones. AB drones are only produced from AaBB, AABB, AaBB or AABb queens so that it is evident that the cross made above will have to be made again later when the queens from the first cross are producing AB drones. Assuming that we have our AB drones and have made the cross AaBb queen by AB drone, we expect the following kinds of females in equal numbers:

AABB—AABb—AaBB—AaBb

It will be observed that all four kinds of females possess both of the desirable characters but that only one-fourth of them on the average are homozygous for both. In the guinea pig the test for the homozygous individuals was to mate them with the recessive. This is obviously out of the question here because a queen can only be mated once. If we mate all of these queens to ab or recessive drones we would undo all our work and be worse off than when we began. Controlled mating over four or more generations with rigid selection will eliminate most of the heterozygous individuals from the strain.

Where selection is being made for recessive characters the process will be much simpler. Individuals showing recessive characters are homozygous and, if mated together, will breed true.

There are some factors which will serve to mitigate these difficulties. One of these is the fact that thousands of worker bees can be secured in a few weeks after a cross has been made. Another is that several generations—four or five, at least—can be secured in a year thus speeding up the process.

The foregoing should not be construed as meaning that no results in the shape of improved races of bees can be expected from controlled mating. It should merely serve to point out some of the great difficulties lying ahead for queen breeders. Selection, for the next few years at least, will remain the mainstay for the queen breeders as it has been in the past. Undoubtedly controlled mating of bees will in time help to produce wonderful results if properly used but we must not expect too much from it in the immediate future.

HONEY DIASTASE AND THE EFFECTS OF HEATING

G. H. Vansell, Davis, California

Diastase in honey, or rather the lack of it, has occasioned loss to honey shipper and producer during the past two seasons. A brief report of findings in this field by the University of California may be of interest to those receiving the annual Iowa report.

The enzyme diastase has the power of converting starch into sugar and is found quite abundantly in many plant products. The method used to measure the amount of diastase in honeys was outlined earlier in the American Bee Journal, 69:293-4, 1929. This will not be reviewed here but the fact is now very obvious that comb honeys vary widely in their diastase content. Certain of the tested honeys are shown in table 1 with the number of minutes required for digestion of a definite quantity of starch under constant temperature conditions.

Table 1

Kind of Honey	Minutes to Digest Starch
Black locust mixture, comb	6
Star thistle, comb	12
Sage (Salvia), comb	24
Nevada alfalfa-sweet clover, comb	25
Idaho alfalfa-sweet clover, comb	32
Hawaiian water white, extracted	34
Nevada alfalfa, comb	51
Belvedere Is., comb	68
Hawaiian extra light amber, extracted	76
Hawaiian white, extracted	480
Orange, comb	Over 1,320

Little, if any, dietetic value can be placed upon the diastase content of honey since normal human saliva is very abundantly supplied with it. No reason for its presence has been found in connection with bee physiology. The source of the material appears to be the pollen mixed in with the honey. The various parts of the bee have been dissected out and examined without yielding evidence that any of the substance is produced therein. A further report on this phase of the work will be found in the Journal of Economic Entomology, 22:922-6, 1929.

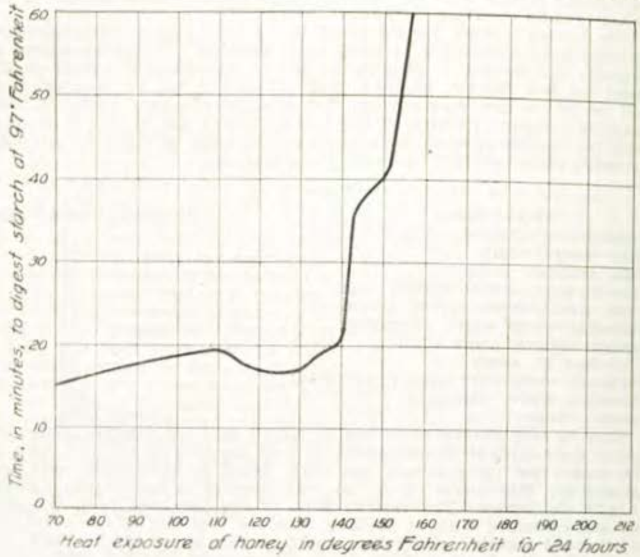
Table No. 2 gives the number of pollen grains per gram found in the same comb honeys tested in table 1. It is to be seen that the amount of diastase is in direct proportion to the number of pollen grains.

Table 2

Kind of Honey	Pollen Grains
Black locust	599,944
Star thistle	30,000
Sage	10,300
Nevada alfalfa-sweet clover	12,221
Idaho alfalfa-sweet clover	5,555
Belvedere Is.	3,000
Orange	2,000

The above evidence is sufficient to warrant a statement that because a honey is low in diastase is no evidence that it has been subject to heat. However, since the two have been associated in Germany, investigations were undertaken to determine the effect of heat upon diastase. Heat inactivates or kills its power to digest starch. Various honeys, some low, some medium, and some high in diastase were subjected to dry heat. The effect of such treatment is indicated in graph 1. The curve was practically indentical for all the honeys examined except, of course, for the value in minutes along the curves depending upon the amount of diastase originally present.

The Fiehe test which is used in Europe to ascertain if honey has been overheated is subject to condition. Furfural, the substance for which the test is positive, is formed from levulose in the presence of acid. A more highly acid honey upon subjection to heat more quickly shows the furfural test. In addition one honey, produced here in the fall of 1928 and canned, unheated, now (December, 1929,) reacts positively to the Fiehe test. The pH (acidity) values of several honeys obtained from 20% honey solutions in distilled water by a Youden quinhydrone



Effect of heating on diatase

apparatus are shown in table 3. There are apparently both free and combined acids in honey.

Table 3

Honey	pH Value
Buckeye honeydew mixture	3.76
Orange	3.69
Idaho sweet clover-alfalfa	3.57
Belvedere Is.	3.56
White Hawaiian	3.55
Light amber Hawaiian	3.55
Imperial Valley alfalfa	3.48
Water white Hawiian	3.47
Black locust	3.47
Extra light Hawaiian	3.41
Sage	3.39

Honey is a product about which much is still to be learned. It is rapidly becoming more wonderful to us as our investigations proceed.

THE PROCESS OF FERMENTATION AND HOW IT AFFECTS THE BEEKEEPER

H. F. Wilson and G. E. Marvin, Madison, Wisconsin

In view of the investigations being made relative to causes of fermentation of honey in storage it is quite desirable that beekeepers in general should have some knowledge of the organisms which are responsible for fermentation. It would be unfortunate if our beekeepers should commonly use the term "honey spoilage" in the presence of the general public, because the average person has been taught to associate "spoilage" with decayed fruits, vegetables and meats, without understanding that spoilage in these cases may be due to bacteria, molds, fungi and other destructive agencies in which the food is completely destroyed. But even these organisms may be useful in producing useful foods or materials.

It is true that yeasts cause changes in the composition of honey and that they produce an unsavory flavor, but when the process of fermentation is completed another product in the form of alcohol is produced in the form of wine and there are those who might prefer the wine to the honey. And, if certain bacteria are allowed to develop in the wine still another complete change occurs, resulting in the production of vinegar. Certainly one could hardly associate the sourness of the final products with the flavor of honey. In the process of making bread it is subjected to the action of yeast, but the action is stopped by baking, although sour dough is the result of more complete fermentation. We have just passed through a period of spreading propaganda on "bee diseases" and foulbrood honey, which was beginning to be noticed and commented on by the users of honey, and if we are not careful, we will add still more sales resistance when we talk about "spoiled honey." Furthermore, every beekeeper should be prepared to explain as far as possible the changes which occur during the process of honey fermentation.

Sufficient investigation has not yet been made to determine the exact conditions under which honey may ferment, but we know that honey may start to ferment in sealed containers after having stood for several months in the warehouse and therefore we must conclude that the yeast cells were present in the honey when it was first put into the containers. This being true, we must investigate and find under what conditions fermentation in honey may occur. Investigations so far show that honey may vary greatly from season to season and honey of one season is more likely to ferment in storage than that from another.

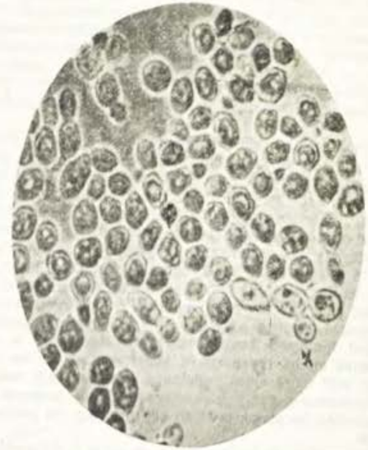
One important fact that we are able to show is that honey extracted early in the season is not ripened and is almost sure to ferment if allowed to stand at room temperatures.

If you wish to produce, well ripened honey do not extract until the cells are all capped. Or, if in a season when the nectar flow is short, leave the combs on the hive until at least two weeks after the honey flow has ceased.

Many different yeasts are scattered about the apiary and in the honey house, so that it impossible to prevent the introduction of yeasts into the honey. An examination of bees in the apiary show that they all carry yeast spores on all parts of the body and tongue and even in the honey sac.

Bottles of honey diluted with 50% water and allowed to stand on the hives will collect yeast and ferment so that we have evidence that yeasts are abundant in the air and the apiary.

With regard to fermentation of honey, the present supposition is that under favorable temperature condition the two sugars in honey separate to a certain extent, the dextrose or crystals settling toward the bottom of the container and the levulose in a liquid form rising to the top. A chemical analysis of the liquid part at the top shows the presence of a high per cent of moisture which makes it possible for the yeasts to develop and start the process of fermentation if the temperature conditions are favorable. If allowed to continue the fermentation will gradually spread through the entire mass and we have what may be called spoiled honey. If the honey is heated soon after fermentation begins, the ferment flavor can be driven off without serious damage. Fermented honey can be used for making vinegar and can



A group of yeast cells found growing in honey as they would appear under a microscope, magnified about 1200 diameters. Notice a yeast cell in the process of budding at "x".

A group of yeast cells as they appear under a microscope, magnified about 1200 diameters.

also be used for baking. There are two satisfactory methods of caring for honey so that it will not ferment. If you do not wish to heat your honey, it should be stored at temperatures below 50° F. and it will keep indefinitely. The safest method is to heat the honey before putting it into permanent containers. There is some discussion about the temperature to which honey should be heated and each beekeeper must determine what is best for his particular circumstances.

Honey can be heated to 160° F. without causing any appreciable damage to color or flavor, but when heated to this point the honey should be immediately removed from the heating tanks and put in pails or cans. Do not stack either pails or cans in piles or else the cans in the center of the pile will retain their heat too long a time and cause darkening of the honey. We believe that the average beekeeper will be more successful in heating to this point although if the heating tank or vat contains a continuously moving agitator so that the honey is uniformly heated to 150° F. or even 140° F. will be sufficient. A temperature of 120° F. if maintained sufficiently long will destroy the yeast but this temperature must be maintained over a long period and results in darkening the honey.

Whenever possible, heat your honey as quickly as possible to the temperature required and cool as rapidly as facilities permit. Placing the cans in a cool storage chamber or even in a vat of cold water is desirable.

The Nature of Yeasts

Yeasts are microscopic single celled plants which are capable of changing sugar into alcohol. They are found everywhere in nature, associated with sugar substances and there are more than 500 known species. Some are round while others are oval or elongated and in some species the cells cling together like strings of beads. They reproduce by a budding process in which daughter cells develop on the side of the mother cell and when the daughter cells reach a certain size they break away from the mother cell, continue growing and in return produce other cells by budding as shown in the photo-micrograph with this paper.

Under certain conditions, unfavorable for growth, such as a lack of food or moisture, spores are developed which carry the species over long periods of inactivity until favorable growing conditions again appear.

THE TEMPERATURE OF INDIVIDUAL HONEY BEES

V. G. Milum, Champaign, Illinois

In previous articles appearing in the Reports of the State Apiarist of Iowa and the 28th Annual Report of the Illinois State Beekeepers' Association, the writer has attempted to review the literature on certain phases of the temperature relations of the honey bee. The cluster temperature, flight temperature and the proper temperature for cellar wintering have been covered in these reviews, hence it seems advisable to add another angle to the subject in that of the temperature of individual honey bees. It is with this idea in mind that the following material is presented, but the writer does not claim to have found all the articles on the subject although he thinks the more important ones have been reviewed.

The literature on the subject of the temperature of individual honey bees that has been consulted has been mostly of comparatively recent date and consists of two types of information, the first which deals with experiments relating to the time that individual bees can be frozen and again brought to life after various periods of time, and the second which deals with actual measurement of the temperature of individual bees. The greater amount of the former type of reports was probably inspired by the ideas expressed by early writers that bees passed the winter in a torpid state in some northern climates as Russia and Canada.

According to Schafer in his Text-book of Physiology, published in 1898, Newport in 1837 stated that the temperature of individual nurse bees brooding over the young bees in the comb was as high as 29.4° C. (84.9°

F.) while the temperature of the cell after the bees left it was 24° C. (75.2° F.) and that of the air 22° C. (71.6° F.) From a report of Newport's observation by Wells published in the Report of the Commissioner of Patents for 1860, it is apparent that the common type of thermometer was used by Newport. Hence, it is difficult to say whether he actually measured the temperature of the individual bees. Schafer said that similar results have been obtained by Reaumur, Huber, Dutrochet, Noboli and Melloni and others. As to Raeumur and Huber, the writer cannot find anything in their writings to justify such conclusions.

The first reference found on the question of freezing individual bees was one by Hunter (Gl. 4:..) in 1876, who reported results as follows: Of six bees frozen 48 hours, none revived; of ten frozen 36 hours, all revived, which were then frozen immediately again for 12 hours and nine revived; all bees have been previously frozen. In 1881, Dadant (A. B. J. 17:242-3) stated that a lone bee is killed in less than 48 hours in a temperature under 40° F. After Dadant made this statement at the North-eastern Beekeepers' Convention, Doolittle (A.B.J. 17:285) remarked that he though Dadant was mistaken, for the effect of cold depended upon the condition of the bees, as to whether they were full of honey or not.

In 1887, Haines (A.B.J 24:36) reported that in one experiment, he could not revive individual bees after they had been exposed over a night in which the temperature dropped to 5° below zero. The same year, Doolittle (Gl. 15:565) reported that out of five different attempts along the "McFadden Line" to determine how long he could keep half-a-tea-cup full of bees alive after being chilled, four and one-half days was the latest time that they could be brought to life again by moist heat, and three and three-fourths days by dry heat, all experiments being made with bees with empty stomachs. By the "McFadden line," Doolittle was referring to a report by McFadden (Gl. 15:343-4) who claimed that bees could be wintered at James Bay in northern Canada on no stores (yet in the hives) by packing them on snow in a cave, with snow packed above them which was allowed to melt. Ten years later, Doolittle (Gl. 25:848-9) said that individual bees or even small clusters of 50 to 100 bees when separated from the cluster, often freeze to death, the isolated individuals always succumbing to the cold with a temperature below 40° F. unless it warms up within 36 hours after they cease to move. He did not think that colonies of bees ever froze to death, except after starvation from lack of stores inside the cluster in long cold periods.

In 1898 Schafer, previously mentioned, apparently quoting from Hunter ("Works," Palmer's Ed. London 1837, 4:427) said that individual bees have so little power of keeping themselves warm that they soon become numb when exposed to the moderate cold of a summer night.

Doolittle (A.B.J. 20:533) reported some brief results of confining bees and queen in mailing cages in the spring of 1884. He found that whenever the mercury went below 65° F., the bees were in a sort of stupor, all clustered closely about the queen, while above 70° F., the bees were restless and humming. At 55 to 73°, he kept these cages without death for 18 days, about three-fourths of the bees being dead at 24 days; whereas at 75 to 94° F., average of 87° F., all the bees died in five days.

In 1898, Miller (Gl. 26:254-5) gave what data he could collect from different sources, not indicated. He claimed that bees were warm-blooded animals, stating that seven bees taken from a colony in the cellar showed temperatures of 81.5° F. Bees enclosed in a glass warmed to 104° F., were all dead in 90 minutes except one whose temperature had been raised to 95° F. Some torpid bees at 47.7° F. were brought to life at 59° F. and then showed an interior heat of 77° F. Miller mentioned Cisielsky whom he said obtained 95° F. as the normal temperature of the bee's body. Apparently, Miller thought the temperature of the bee's body could not fall below 50° without injury to the bee, and therefore the colony attempted to prevent the cluster from dropping below 50 to 53° F.

In 1906, Getaz (A.B.J. 46:834-5) quoted Girard as stating that the temperature of individual bees on the wing is 9 to 13° F. above the surrounding air, that of the thorax being greater than the abdomen.

In 1916, Brunnich (A.B.J. 46:298-9) said that a single bee is soon paralyzed at a temperature of 56° F. Doolittle (Gl. 44:590) stated that ten days to two weeks was the longest period that he could keep bees chilled at a temperature of 40° F. and bring them back to life even when the bees were made to fill themselves with honey.

Further experiments on the results of exposing bees to cold temperatures apparently conducted by the junior author, Mr. E. R. Root, are also reported in the 1923 Edition of "A B C and X Y Z of Beekeeping." Root placed cages of bees containing queens on ice in a refrigerator, the bees being chilled to stiffness. One cage was removed each day for several days, the bees recovering and the queen laying normally when put back into hives. He thought the temperature was probably between 35 and 40° F. He found, however, that 20 minutes of zero freezing was sufficient to kill the bees outright. He buried cages of bees in the snow at a temperature of about 32° F., and found that those left in as much as 24 hours "seemed to be somewhat the worse for the experience." He says that experiments in the summer seemed to show that bees might withstand a temperature of 38° F. for a number of days, but if the cold continues for a week or so the bees will starve to death in their chilled condition.

In the 1919 edition of Beekeeping, Phillips said that individual bees can maintain muscular activity only so long as the body temperature does not fall below 45° F., and that bees can probably survive a maximum temperature of over 130° F.

In 1922, Preuss (Archiv fur Bienenkunde 4:165-6) reported his results and conclusions from measurements of the body temperature of bees by means of a thermo-electric needle or electric thermocouple of very small size. He concluded that the body temperature of bees in his experiments was 8.2° C. (14.76° F.) warmer than the room temperature, but during the full activity of the bees in summer probably somewhat higher.

According to Brunnich (Archiv fur Bienenkunde 4:161-4; Bee World 4:116-7; A.B.J. 63:188-9) in 1895 called bees warm blooded with equal temperature of 35° C. (95° F.), although he recorded a temperature of 10 to 12° C. (50-53.6° F.) in the center of a winter cluster when quiet, and 25 to 30° C. (77-86° F.) when he knocked on the hive. Brunnich thought that the cluster temperature was low because of the bees shrinking away from the large thermometer which Cisielsky probably used. Cisielsky argued that the temperature of the individual bees must be greater than 30° C. else the cluster temperature would not rise so rapidly from 10 to 30° C. Cisielsky found a temperature of 28 to 30° C. (82.4-86° F.) in a handful of bees brushed from a cluster and ground in a mortar. A bee returning to the hive at 13° C. (55.4° F.) gave a temperature of 35° C. (95° F.) in the breast or thorax and 25° C. (77° F.) in the abdomen, measured with a fine thermometer. Cisielsky concluded that the temperature of the bees does not adapt itself to the surrounding air, but is constant. Brunnich later concluded that the temperatures of Cisielsky were too low.

Brunnich (A.B.J. 58:309-311; Zeitschrift fur Entomologie Bd. 4 Heft. 1) measured the temperature of individual bees by means of a very fine needle-like thermocouple of copper and platinum, the point being inserted into the thorax from the ventral side. He reported his results in 1918, and concluded that there is no great difference between the temperature of fanning bees and flying bees. The highest temperature of worker bees recorded was 40° C. (104° F.), this particular bee having been flying at an outer temperature of 18° C. (64.4° F.), while a worker caged at 7° C. (44.6° F.) for 15 minutes showed an inner temperature of 9° C. (48.2° F.). The maximum temperature of drones recorded was 48.6° C. (119.5° F.) at 18° C. (64.4° F.) outside temperature, while that of a white nymph with brown eyes was 45.2° C. (113.4° F.) At a temperature "rather beneath" 37° C. (98.6° F.), Brunnich concluded that brood cannot thrive, but when the surrounding temperature is raised to that point by the bees, the larvae and pupae then become stoves and produce heat. Brunnich suggested that his readings were not broad enough to pass final judgment. Since Brunnich recorded the temperature of the thorax, one can probably safely assume that these readings are higher than those of the temperature of the abdomen of the same bees would have been, because of the greater muscular activity in the thorax. Very slightly different results were given in a review of an apparently similar report of an article in *Bienvater* for 1922, by the Press Mirror for the Bee World for March, 1922.

In 1922 and 1923 Brunich reported that he had not seen the book written by Cisielsky when he made his 1918 researches on the temperature of the bee-body, previously cited. After further experimentation of his own and comparison with the work of Cisielsky, he concluded that the temperature of the bee's body in normal condition is independent of the outer temperature of the state of the bees, being about 39° C. (102.2° F.) for the worker, 45-48° C. (113-118.4° F.) for the drone, and 45° C. (113° F.) for the brood; and that the bees have an acute sense for the temperature of the brood nest and the cluster, with a perfect capacity to regulate the temperature of the hive. In another article in 1922 Brunnich (A.B.J. 62:265) stated that the temperature of the outer bees of the cluster does not fall below 57° F. or else they would chill and die.

Park (A.B.J. 63:232-4) cited the investigation of Phillips and Demuth and Brunnich, concluding that the two sets of investigation might be shown to be computable through further investigation but that they can not be compared directly since they do not cover the same points. Park showed that it is not beyond the realm of possibility that the honey bee may occupy some intermediate position between cold-blooded and warm-blooded animals. The necessity of maintaining a higher temperature than that of the bee's environment is indicated by the type of the bee's food, the presence of a honey stomach, the storage of food, its remaining in the hive and the formation of a cluster in winter. Park asserted that it is probable under the ordinary temperature limits of its environment, that the bee is able to regulate its body temperature, but has little power to retain the heat generated when exposed for any considerable period of time to temperatures below about 45° F.

In a study of the temperature of the individual bee, Chapman and Pirsch (Minn. Exp. Sta. Rpts., 1922, p. 69) found that at bee temperatures lower than 30° C. (86° F.), the body of the bee is warmer than the surrounding air, while at higher temperatures there is a tendency for it to be lower. They concluded that individual bees upon becoming active, radiates the heat of metabolism and consequently the temperature of the bee remains more or less constant. However, they said that if the bee is so enclosed that the heat of metabolism is conserved in the surrounding air the temperature of the bee will be raised by the surrounding air.

In 1923, Pirsch (Journal Agr. Res. 24:275-287) of the Minnesota Experiment Station, reported the results of his studies upon the temperature of individual insects, with special reference to the honey bee. He concluded that the body temperature of a bee is 4.7° C. (8.5° F.) above the surrounding air at 5.5° C. (41.9° F.) and coincides with it between 35° and 44° C. (95-111.2° F.). At or above 52° C. (125.6° F.), the temperature of the bee is lower than the air if not exposed to the high temperature for a long time. He found that the maximum fatal temperature is 46-48° C. (114.8-118.4° F.) and the freezing point at -1° C. (30.2° F.). Pirsch found no appreciable difference between body temperatures of Carniolan and Italian bees. He concluded that bees are not wholly subject to temperatures of their environment, but are capable within certain limits of regulating their body temperatures. He declared that the ability of a colony to regulate its temperature is undoubtedly due to the ability to regulate its body temperature plus the ability to regulate and conserve the heat produced.

Brunnich (Bee World, 7:10-11) in 1925, in reviewing the work of Pirsch, gave the conclusions that he had given in previous publications, after

which he attempted to show that the figures given by Pirsch have no value in determining the true inner temperature of bees. Brunnich pointed out that Pirsch exposed the bees to certain temperatures for an arbitrary period of ten minutes when he tied the bees in cavities in hollow blocks where they were not able to move even a wing, and thus were unable to regulate their temperature by normal reactions. Brunnich thought that Pirsch should have measured the temperatures of the individual bees at succeeding intervals of time after their confinement instead of at the end of ten minutes. That the bees had an inner temperature of about the same as the surrounding air at 35 to 39° C. (95-102.2° F.) according to Brunnich (Pirsch's table as given by Brunnich himself shows 35-44° C.). Brunnich considers as a confirmation of his assumptions that the temperature of the bee-body is about 39° C. (102.2° F.) under normal conditions and deviates only very little upward or downward. However, according to this argument, Brunnich apparently does not consider any occasion when there is danger of the bee being exposed to temperatures below 14° C. (57° F.) as a normal condition, for he indicates such an idea when he says that bees may become chilled even at this temperature and that they do not fly as a rule when the temperatures are below 10° C. (50° F.), because the danger of the sinking of their body temperatures is too great. Brunnich has been previously cited as saying that the temperature of the bees on the outside of the winter cluster never dropped below 57° F. If Brunnich were to examine some unprotected colonies at various temperatures below freezing we venture to suggest that he would find many chilled bees on the edges of the cluster.

Himmer (Erlanger Jahrbuch fur Bienenkunde 3:44-115) in 1925 reviewed much of the literature on the temperature of various animals and gave his conclusions regarding the temperature of individual bees. He considered that the honey bee had no constant temperature, but during complete rest its temperature approached that of the surrounding air, while with muscular activity it rose much above the temperature to which it was exposed, the warmest part of the body being the thorax. The highest observed body temperature of drones was 38.3° C. (100.9° F.); of queens, 30° C. (86° F) of worker bees 37.2° C. (99° F.). The body temperature of winter resting bees are various, those of the cluster shell or periphery being colder than those in the center of the cluster which have greater ability to produce heat with their maximum body temperature being approximately the same as that of summer bees. In summer, the bees attempt to produce and maintain a temperature of 35° C. (95° F.) in the brood nest. Older bees have more ability to produce heat than young bees, according to Himmer, while wax bees have a temperature production ability of 13.12° C. (23.6° F.), clustering bees of 12.4° C. (22.3° F.), young bees not yet flying or stock bees 10.20° C. (18.36° F.), and young bees from one to two days of age only 1.43° C. (2.57° F.)

The previous statements by various authors show many differences of opinion regarding the body temperature of individual honey bees. While the writer has not made a special study of this particular phase of honey bee temperatures, after reading the literature he is inclined to conclude that the honey bee is essentially a cold blooded animal when considered as an individual, since when it is not engaged in actual muscular activity, especially that of flight, its body temperature tends to follow that of the outside air. This has been shown by the experiments on the temperatures of individual bees by various authors, and by the fact that an individual bee upon coming to rest, after a flight at a temperature of 46° F., soon becomes chilled and numb. Exposure to chilling temperatures eventually causes the death of individual honey bees, at a variable length of time depending upon the degree of cold. At higher temperatures heat is produced in the bodies of the individual bees by the metabolism of carbohydrate foods, the rate depending upon the amount of body activity, manifested by flight, fanning of wings, shaking of the body, respiration, and other forms of muscular action.

VARIETAL DIFFERENCES IN NECTAR FROM GLADIOLUS

O. W. Park, Ames, Iowa

Every beekeeper knows that certain species of honey plants produce more honey than others, but does he know whether all varieties of a given species yield equally well? Studies related to this question have been in progress at the Iowa Agricultural Experiment Station during the past two years. During this time, more than 25 horticultural varieties of a single species of gladiolus *(Gladiolus primulinus)*, grown in the formal gardens at Iowa State College, have been studied.

While gladiolus is not an important honey plant, it is visited freely by honey bees, and for the purpose of these studies, it was found to have certain advantages. Nectar is produced in sufficient quantities to be easily obtained and numerous varieties were already at hand. If these studies show marked varietal differences in nectar production, similar work may then be undertaken on some of the more important honey plants.

Nectar production is influenced by a considerable number of variable factors outside of the plant itself. These may be grouped, for the sake of brevity, and referred to as light, air and soil factors. Differences due to variations in light and air conditions were reduced to a minimum by collecting each group of samples within a brief period, usually lasting from 30 to 40 minutes, in the early afternoon, which is the time of day when light and air factors normally are most nearly constant. The soil factors were considered uniform for the following reasons. The same general section of the garden had been devoted to the growing of gladioli for several years. The area involved was limited and the relative location of the several varieties was different for the two seasons.

Differences due to variations in the plants and flowers, other than varietal differences, were overcome to a considerable extent by taking composite samples composed of the nectar from 25 individual flowers.

Four groups of samples were taken in 1928 and a similar number in 1929, each group containing samples secured from 20, or more, varieties. Owing to the preliminary nature of this study, only five varieties were represented in every one of the groups, hence, only these five are considered in this paper.

In order to provide a basis for comparing these varieties, three arithmetic means were determined for each variety, as follows:

(1) Quality of nectar (per cent of sugar).
(2) Quantity of nectar per flower.
(3) Sugar yield per flower.

When compared as to quality of nectar, the results indicate that further data will be required before it can be determined definitely whether certain varieties characteristically produce richer nectar than others. There are indications, however, that such probably is the case, although the differences may not be great.

The quantity of nectar yielded by the highest producing variety was just three times that of the lowest, while the production of the other three varieties fell about a point approximately half way between the extremes just indicated.

In sugar yield, the rankings were the same as for quantity of nectar except that the varieties which ranked, respectively, second and third in nectar production, exchanged places when compared as to sugar yield. The weight of sugar obtained from the highest producer was nearly three times that obtained from the lowest, and the yields of the remaining three varieties again fell about mid-way between the extremes.

It may be tentatively concluded, therefore, that certain varieties of *Gladiolus primulinus* yield considerably more nectar than others and that, under similar conditions, the amount of sugar produced depends to a greater extent upon the quantity of nectar produced than upon its quality. The results suggest the desirability of similar studies on other and more important honey plants. If, for instance, certain varieties of sweet clover or alfalfa should be found superior to others of the same species for honey production, plants could then be bred for nectar production in addition to such desirable characters as are sought by the agronomist. Let increased honey production go hand in hand with increased crop production in general.

TO WHAT EXTENT DO NECTARS VARY?

O. W. Park, Ames, Iowa

Practically all of the few scattering analyses of floral nectar which have been made, heretofore, have been on samples taken from different plant species under widely different conditions. Hence there has been no basis for the formulation of any comprehensive idea concerning variation in the percentage of sugar in nectar. During the past four years, studies have been made on more than two thousand samples of nectar at the Iowa Agricultural Experiment Station. The purpose of this paper is to make a brief preliminary report on the extent to which variation has been found in the sugar content of floral nectars. No attempt will be made at this time to discuss the causes of such variation.

The writer[1] has previously shown that sugar content of nectar from a given plant species, varies from hour to hour throughout the day. While all species studied so far appear to show this diurnal fluctuation, individual species differ as to the range through which such varation occurs. For example, here at Ames, the sugar content of the nectar of common milkweed *(Asclepias syriaca)* has been known to change from 15 per cent at 6 a. m. to 65 per cent by 11 a. m. but, to date, trumpet creeper *(Tecoma radicans)* nectar has not been found to contain more than 40 and rarely less than 20 per cent sugar. Variations other than diurnal fluctuations, would be most readily discovered from data into which diurnal variation did not enter. For this reason, samples to be compared were collected within the shortest possible time, two persons often being engaged in collecting simultaneously. Data thus obtained form the basis for the remainder of this discussion.

Composite samples of nectar taken in rapid succession from a number of different horticultural varieties of gladiolus *(Gladiolus primulinus)*, growing side by side, showed some variation but only within comparatively narrow limits. Although there are indications that certain verieties tend to produce a more concentrated nectar than others of the same species, further data will be necessary before this may be stated as a fact.

The extent to which variation occurs within a given group, may be stated conveniently in terms of the *coefficient of variability*. This coefficient is obtained by dividing the *standard deviation* (which may be thought of as a kind of average variation) by the *mean* of the individual items, and is expressed in per cent. Thus, a coefficient of variability of 1 or 2 per cent indicates little variation, while one of 95 per cent shows that the standard deviation is almost as great as the mean, and indicates a very wide variation.

Individul nectar samples taken in rapid succession from individual flowers of a single horticultural variety of *Gladiolus primulinus*, were compared as to sugar concentration. Three groups of 30 samples each, gave coefficients of variability of 27, 28 and 38 per cent, respectively. These figures indicate greater variation than might have been expected from individual flowers of a single horticultural variety.

In order to obtain data on the variation from floret to floret of the same umbel or head, nectar samples from common milkweed were used. Ten samples, each from a different floret of the same umbel, were taken for comparison. Coefficients of variability were determined for 26 such groups of samples. A study of these 26 coefficients of variability shows 7 per cent as the least, 32 per cent as the greatest and 14 per cent as the mean. It is evident that sugar content of nectar varies considerably from floret to floret of a given umbel.

Summarizing it may be said that the concentration of floral nectar has

[1]Park O. W. Studies on the Sugar Concentration of the Nectar of Various Plants. Iowa State Apiarist Report, 1928:80-89. 1929.

been found to vary from hour to hour, from species to species, flower to flower and even from floret to floret of the same umbel.

NINE YEAR REVIEW OF DEMONSTRATION APIARIES IN IOWA

A. D. Worthington, Ames, Iowa

In 1920 the Extension Department of Iowa State College in co-operation with the U. S. Department of Agriculture outlined a project entitled "Increased Honey." This is better known in Iowa as Demonstration Apiaries. For several years previous to 1920 Apiary Management had been given beekeepers in lectures, however, it was felt by the beekeepers they were only receiving theory and they were often uncertain if these principles would prove as successful in giving returns in dollars and cents. It was also realized that where the management of bees could be put into operation before the eyes of the beekeepers and also have the beekeepers actually assist in putting the operation into effect on the bees they would remember the methods and be more likely to use them in their own apiaries. Therefore, the project demonstration apiaries were offered the beekeepers in Iowa.

The demonstration apiary is a project offered by the Extension Service and conducted through the county farm bureau. The apiary consists of 10 colonies of bees owned by a local beekeeper who co-operates with the bee specialist. Five colonies are used for demonstration and the methods advocated are put into actual practice on them. The 5 other colonies are handled as the beekeeper wishes and are used as a check against 5 colonies on which methods advocated by the specialist are put into operation. The Demonstration Apiaries are secured in a county by a number of beekeepers requesting the project through their local representative the county agent. If there are only one or two beekeepers interested, these beekeepers can write the Extension Specialist and he will come to their county on state expense and see if interest enough can be worked up to hold the demonstration apiary meetings in their county the following year. The beekeeper at whose place the demonstration apiaries are established agrees to equip the 5 colonies in movable frame equipment, or secure what equipment the specialist recommends in handling of the same. The co-operator (beekeeper who owns bees) agrees to notify his neighbors of the demonstration and do all in his power to get them interested in attending the meetings. The Extension Service furnishes the county agent a list of beekeepers in his county, and these beekeepers are notified of the meeting. Also the local papers have notices of the demonstration in them several days previous to the specialist coming to the county. The dates for the meetings are arranged in the winter and sent to the county agent for his approval. The dates are arranged so that the specialist will come to the county just previous to the time the seasonal management should be put into operation so that the beekeepers attending the meeting can return home and immediately put into operation what they have seen demonstrated at the meeting.

The object of the demonstration apiary is to put into actual practice the theory which is given with the project work. Also to sell to the beekeeper the methods advocated and get them to put these methods into actual practice. If the work which we give will not do better than local methods we are anxious to know it. On the other hand we want to actually prove that the methods advocated will give better results than local methods.

The demonstrations are made as practical and simple as possible which has proven a benefit in the acceptance of the methods. The seasonal demonstrations are as follows: The first meeting is held in January or March. This is primarily an organization meeting. The demonstrations are established, the benefits, results expected, and an outline of season's work discussed with the beekeepers. The real object of this meeting is to

establish the demonstration apiaries and to sell to the beekeepers the need of the bee work and the benefits they will receive from same. It is one of the most important meetings and if you can create interest enough at this meeting to have a good attendance at your first actual field demonstration the beekeepers will be interested enough to follow the project through. The second meeting is held in April or May and the subject of spring management is discussed. Five colonies of average strength are selected and five similar colonies are selected for check colonies. The five colonies are taken one at a time, for example, it is May 1st and colony No. 1 has been wintered in two hive bodies, the packing is removed, the bees are found to be in the second story. On examination they have six combs of brood, no disease, a good queen. However, she is a hybrid; there are medium in bees or they are just ready to go into the body below. The body is reversed and if there are poor combs they are removed and replaced with good brood combs. Or in other words the actual need of the colony is put into operation. Handling the bees or the actual manipulation of the combs and bees by the specialist are closely watched by the beekeepers, therefore, you find that one of the most important factors at your first meeting is to actually demonstrate unconsciously the controlling of the bee, handling of the frames and an orderly, systematic operation of the colony. If the demonstrator works without vell or gloves and controls the bees, he has from that point made a big stride in selling what he has to say, or in other words the beekeeper is skeptical. If you show him you can handle the bees he at once believes what you are saying and realizes you are practical as well as scientific.

At the third meeting held in June or July the subject of Swarm Control and Diseases is discussed. The same as in the second meeting the actual need of the colony is demonstrated. If disease is not present a discussion and demonstration with empty hive, combs, etc., are given. If disease is present the whole apiary is taken under control and cleaned.

The fourth meeting held in July or August and the subject of Fall Management is discussed and demonstrated.

The fifth meeting "Wintering of Bees" is discussed and demonstrated. As above stated the actual need of the colony is put into operation to demonstrate the above mentioned phase of beekeeping. The results of the five colonies are compared to the results of the five check colonies and in 99% of the cases the results show conclusively that the methods advocated are practical, economical and give the beekeeper increased returns in dollars and cents. This is not a reflection on the methods used by beekeepers as it is a demonstration to show if proper care and attention is given at the right time, not only will the beekeeper receive more honey but he can save time and cut down on the cost of production. Often the yield runs from 50 to 100% above the check colonies. Two to four demonstration apiaries may be conducted in a county. The demonstrations are to continue two years at each apiary established.

There have been 454 demonstration apiaries completed in Iowa. These demonstrations have been conducted in 94 different counties. Only five of the counties in Iowa have not conducted the demonstration apiary project. A total of 2,231 demonstrations have been conducted with an attendance of 38,189 persons.

The demonstration apiaries have proven successful in getting the beekeepers to use methods advocated. It is a rare thing to find a beekeeper in Iowa who is not practicing some phase of beekeeping or some method he received directly from attending demonstration apiaries or from his neighbor who received this method from attending demonstration apiaries. The number of beekeepers giving their colonies winter protection has greatly increased. Some form of swarm control is practiced by thousands of beekeepers who obtained their method from demonstrations. In visiting thousands of beekeepers in Iowa each year the improvement in beekeeping is very noticeable. Requeening is a common practice. Increase made by securing package bees is followed by many beekeepers. Box hives are nearly a thing of the past. If beekeepers have them they are ashamed of the boxes and are anxious to get rid of them. The methods advocated by the Extension Service are sold to the beekeepers. The problem is still to get more beekeepers to put into practice the methods they have accepted. This is being done by continuing to show them the results and benefits they will get when they use the methods advocated.

There are 200 beekeepers in Iowa who were co-operators, having from 10 to 25 colonies, who have developed into beekeepers having from 100 to several hundred colonies. There are well into the thousands those who have developed small apiaries of 25 to 100 colonies through help from the demonstration apiary project.

Disease has been controlled in Iowa by this educational project. The apiary inspection records previous to 1920 showed that the per cent disease was from 10 to 15%. Since demonstration apiaries have been established the per cent of disease has been kept in check. There is no doubt that without educational work disease would have been 30 to 40% as it has been found in Iowa in areas where no educational work has been done. Beekeepers attending the demonstrations have become familiar with the symptoms and treatment of disease and have either requested help as soon as it started or have cleaned the disease themselves.

It has paved the way for a successful disease eradication campaign. I feel certain that every apiary inspector will agree that disease cannot be eradicated by the apiary inspector alone. The success depends to a large extent upon the co-operation of the beekeeper. For example in Dallas county where in 1926, 26 apiaries were found infected with American foulbrood six or seven local beekeepers visited each diseased apiary and assisted the owner of the bees and the inspector in cleaning up the disease. After two years an inspection was made and not one cell of disease has reoccurred in these apiaries. Not only did they help but every beekeeper invited them to assist in treating or destroying the disease. It was co-operation of 26 beekeepers.

Dallas county in 1922 when the demonstration apiary project was started had only 3 or 4 men who could really be called beekeepers. After conducting the demonstration apiaries 7 years in the county there are 50 beekeepers with well kept apiaries ranging from 20 to 150 colonies. Dallas county produces well above 200,000 pounds of honey. On doing apiary inspection work every beekeeper whether having 1 colony or 100 colonies is anxious to see the apiary inspector. The only trouble we are having is that the beekeepers feel neglected if the inspector fails to visit his apiary each year. Co-operation and having a knowledge of the symptoms, spread and treatment of disease simplifies the cleaning of disease on an area basis. The demonstration apiary project gives this knowledge to the beekeeper.

Where bees are well kept, and the owner considers them as a means of income he expects to get the market value or the full value for the product. Not only does he expect to, but he finds after he gives them good attention they produce a better product. The comb honey is by far a better grade. The extracted honey is clean and by management he keeps his dark, poor grade of honey separate from his clover and basswood honey. He finds that he can put his honey in neat attractive packages and have little trouble in asking a good price for his product.

The demonstration apiary project has greatly improved the price of honey sold locally. For example 7 year ago it was a rare thing to see honey in grocery stores. Today in Ames there are 30 grocery stores all of which have honey for sale and the majority have it in a conspicuous place. Besides the grocery stores in Ames two filling stations and one honey stand are offering honey for sale. Nearly all honey that is in the stores is of excellent quality and put up in neat attractive containers. This increased use of honey has been greatly caused in local communities by the demonstration apiary publicity and the continuous driving at the beekeepers to properly prepare their honey for the market. There are a number of county organizations placing bee and honey exhibits at their local fairs. The best displays are put on in the form of a booth as a project of the county farm bureau.

In the demonstration apiaries over a period of 9 years the average yield per colony has been 140 pounds about one-third being comb honey. This is approximately double the state average per colony. In the well kept apiaries of which there are approximately 14,000 in Iowa the yield will run close to 100 pounds per colony or 70 pounds of comb honey, 110 pounds of extracted. This is a big increase over what was received in these apiaries previous to demonstration apiary project. This increase is produced with very little more expense. In other words the cost of production has been decreased. These apiaries are building up where the poor beekeeper with a small yield is fast going out of the bee business. The small 1 to 10 colony apiary carelessly kept is fast disappearing in Iowa.

The demonstration apiary project has insured a friendly feeling among the beekeepers. In visiting some 10,000 apiaries in Iowa in the last 7 years I have only once had to use authority to inspect or treat an apiary. In other words 99% are willing to co-operate in having their bees inspected and diseased colonies treated or destroyed.

In Iowa we have wonderful co-operation in any type of bee work. If we have any real opposition it has not shown itself or we are unable to find it. With the success of the demonstration apiary project in securing co-operation and support of the beekeepers it makes it possible for a successful area clean-up or the solving of new beekeepers' problems.

A nine year review of demonstration apiary results may be summed up as follows:

1—Result demonstrations conducted in 94 counties with 38,189 beekeepers attending these demonstrations.

2—5,000 beekeepers developed to real honey producers.

3—The apiaries are controlling disease and are paving the way to a successful disease eradication.

4—There is an increase in the quality and appearance of honey sold at retail.

5—It has cut the cost of production of honey.

6—The project has increased the consumption of honey.

7—It has developed co-operation.

THE CONTROL OF BEE MOTHS IN IOWA

F. B. Paddock, Ames, Iowa

The bee moths (*Galleria mellonella* Linn. and *Achoria grisella* Hub.) constitute one of the hazards of the honey producing industry in Iowa. Their ravages in the bee hives have been recognized by beekeepers from early times. Their destruction while never disastrous is never the less constant and considerable, in fact it seems to be increasing. The moths are general in distribution, they seem to survive in almost any climate and are not menaced by predaceous enemies or parasites. Methods of artificial control seem to be wholly inadequate to cope with these pests, serving merely as a means of temporary check.

Historical: The very earliest records of beekeeping indicate the presence of the greater moth in the apiaries and the destruction caused by it. Virgil in his writings on agriculture refers to the moth but it is evident that there was confusion between the insect loss and that caused by disease. Insects at this time were referred to as Tiniae. The Roman writer on agriculture, Columella, at the beginning of the Christian era tells of the loss to beekeepers by moths, then called Papilio. It seems this term was applied at that time to the adult stage of all moths and butterflies. Pliny also wrote of the depredations of Papilio in the bee hives.

Samuel Purchas writing in 1657 reviews the early history of the greater moth and records some of the points of life history. Reaumur called attention to the destructive powers of the moth. He classified this moth as a false moth in contrast to the true moths, of which the clothes moth was used for example. He says the papilio of the wax moth is of the tribe *Phalaenae*, "who fly at night and burn themselves in the candle." He further makes a definite statement concerning the lesser, as follows: "There are two sorts of these caterpillars who devour wax but I shall speak only of the more common, the larger." Linneus in his tenth edition in 1758 placed the greater moth as *Phalaena mellonella* but he does not list the lesser. Four years later Modeer in discussing the diseases and pests of the apiary in Sweden refers to *Phalaena mellonella*, and in 1764 Blom also of Sweden calls the moth of bee hives *Tortrix cereana*. The greater moth was mentioned by economic writers throughout Europe but no distinction was made to indicate the presence of the lesser. Fabricius in 1793 lists also the lesser moth in his System of Entomology and in 1818 Hubner established the present generic position. In his System, Fabricius set up the genus *Galleria* to contain *mellonella*.

It is interesting that these two species of early insects should have attracted so much attention from both economic and systematic workers. Both species were early recognized as destructive, both without close relatives and both finally placed in restricted genera for their special benefit. There was considerable confusion among the early workers for there is a rather long list of synonyms, the most part in regard to the species name. The genus *Galleria* stands today with only the single species of *mellonella* representing it and in the same family, closely related, is the genus *Achroia* with only the species *grisella*. Forbes places these and four other genera in the sub-family *Galleriinae* of the family *Pyralididae*.

Distribution: It may be said that the greater moth has a world wide distribution for it seems to be generally present wherever bees are kept. A few restrictions have been noted in regard to altitude and perhaps climate in the British Isles. It is interesting to trace the modern spread of the greater moth as into South Africa, Australia and New Zealand where rather definite dates of introduction are established. The lesser moth has a reputed world wide distribution but such a statement may need modification in details, especially until more definite information has been secured. This is made difficult because the species are not always identified so that the presence of moths may indicate one or both species. It would seem from the evidence obtained thus far that the lesser does not exist in the restricted areas of altitude and if it is in the new territory the introduction is very recent. There is no reason to expect that any territory will remain free from the lesser moth. These two species of moths seem to be general in distribution over the state with no evident limiting factors.

Life History and Food Habits: This confusion in the identification of the two species by the producer is due to the close association of the two species. Outside of the fact that both species persist in connection with bee hives there is not much common in their food habits or life history. The producers of Iowa fail to distinguish these moths as two distinct pests of the apiary, considering any insect which causes damage in the apiary as a wax moth. The greater moth seems to establish itself first in an area, gaining entrance to the hives of weak colonies and thriving in the unused portions of the brood nest. The eggs are laid on the comb, on the underside of the thicker edge of rim of the cell. Thus it escapes detection by the bees. The larva is extremely small but can gain entrance to the comb by at least two methods; it may come out on the rim of the cell and burrow toward the center of the comb in the area between the cell walls, or it may eat directly through the cell wall and then towards the midrib in the fashion of leaf miners working between the two surfaces of a leaf. During this period the larvae are safe from the attacks of bees. A web tunnel is constructed wherever the mid rib is eaten which serves as necessary protection. This tunnel construction follows closely until the mid rib is destroyed then the larvae work toward either

surface of the comb. During this period silken webs serve as protection with the old tunnels available in case of extreme need.

The actual food of the greater worm is still not completely defined. The earliest writers considered that this pest actually consumed the honey after the period when it was realized that the worm did not cause the actual destruction of the bees. Purchase in 1657 says, "The moth with her mealiness somewhat offends the bees, but except the hive hath few bees, or be altogether empty, she doeth no great harm." Reamur in 1744 writes of "the caterpillars who devour wax. In order to strengthen the galleries adds fragments of wax." Huish in 1817 says, "The food of the larva is not wax but pollen and other such as bee cocoons. Pure and clean wax is never attacked by the moth, it is not found on new combs but most often attacks refuse. It gnaws wax but does not eat it." The early observations were right on the whole. The greater moth does not seem to be able to exist on pure wax or foundation. There is a decided preference for the brood combs with extracting combs serving as a second choice. The larvae do not appear to consume pollen for in new and light brood combs the tunnels seem to avoid the cells of stored pollen. It seems quite probable that they do prefer all brood cells, perhaps for the refuse but such food is not essential. In an early infestation particles of wax may be found on the outside of the tunnels and in the refuse under the combs, but when the infestation becomes excessive all of the refuse is reworked for every particle of wax.

The lesser moth usually appears after the greater has been established in an area. It does not seem to wage any fight to become established in a hive, in fact it often does not appear in ruins until after the greater has completed its work. Under natural conditions it seldom attacks combs, acting more as a scavenger, existing from the refuse accumulated by the greater. It has been taken from combs that were covered with an extremely heavy mould and apparently the greater larvae had passed up such combs. After an infestation of greater moth has been conquered the work of the lesser is soon visible. A healthy infestation of lesser was taken from a sample of slum gum obtained from a foundation factory. It would seem that such material would not contain much food and in fact it had not been infected by the greater over a period of five years. A frame of partly drawn queen cells was attacked by the lesser moth at the laboratory. The destruction by the lesser is most noticeable in pure wax. It will attack blocks of pure wax stored for shipment to the foundation mills, and it will readily attack exposed foundation. It has been considered a pest of stored section honey for years. Here it consumes the caps, which are of purest beeswax, and the honey runs from the cells, causing "leaky honey." It is reported by Forbes to "feed on" dried apples, raisins, crude sugar, and apparently also dried insects." Experiments are now in process to check this list of foods. Such a wide range of food would prove interesting and would complicate the control problem.

Economic Importance: The loss caused by bee moths in Iowa has been considered a serious handicap to honey production for several decades. It has never been possible to establish an actual loss for so many beekeepers in the state have little information on cost of honey production. It is true that weak colonies are usually attacked and such colonies have no great value. But the wax or combs destroyed in such colonies is just as valuable as the combs of strong colonies and would produce as much if the beekeeper would manage better. In this sense it cannot be said that the bee moth is a scavenger. The probable relationship of bee moth activities to the spread of disease among bees is being studied and it is hoped results will be available in the near future. The loss of combs in weak colonies must be a big factor and the loss of stored combs, either brood or extracting is much more than is appreciated by the producers. The destructive power of the greater moth is enormous, six or eight larvae will render a comb unfit for colony use, either for brood chamber or super. These pests remain ever present and a constant handicap to production.

Therefore, it is necessary for the modern beekeeper to know these pests in all of their stages and to wage an intelligent warfare against them.

Control: The natural factors of control have been ineffective with the bee moths in Iowa. Climate, in the large sense, seems to have been a restricting factor in other parts of the world. Altitude is considered the reason why area of Austria, Hungary, Sweden and the Rocky Mountain region of the United States are free from this pest. There is evidently some factor of climate, perhaps excessive dampness, which holds the pests in check throughout Great Britain. These factors have served as natural checks with a few other pests in areas over the world.

It is especially interesting to have a pest of such antiquity as the bee moths, so free from predaceous enemies and parasites. Literature records no enemies of any stage of either species of bee moth. One correspondent has recently indicated that the common field cricket probably fed on the larvae of the greater moth. Spiders have been reported as feeding on the greater larvae. If both of these enemies were actually operating it must be on a restricted basis and they certainly do not serve as an economic factor of control. Ten species of parasites have been reported on the greater moth larvae, the only stage of either species to be attacked. The parasites occur evenly distributed in three families with one exception are primary parasites. However, these parasites are common on other species of economic pests, with one exception. Only three species of the recorded parasites are known to occur in the United States, at widely distributed areas and never have become established at any point. Effort has been made to establish two species of parasites in the laboratory at Ames. One species did not establish itself and the other species was taken the second year but has not been seen since.

Fumigation has been used as a means of combatting bee moths for over 200 years. During that period practically every common material has been tested for its effectiveness in killing all stages of pests. These materials have met with varying success, depending on the environment. The problem of fumigation is associated with stored combs, both brood and extracting, and stored section honey. This means that the major part of fumigation is given during the times of the year when only moderate temperatures prevail. One fumigation is given during the fall and another during the spring, with very little work during the summer and none during the winter.

Experiments have been conducted recently to determine the effectiveness of some of the newer materials and to check further on some of the older materials. The results of these trials covering a period of two years indicate some of the difficulties which are involved in the fumigation of combs in stacks of bodies or of supers. Temperature is a factor of prime importance for all fumigants lose their effectiveness at temperatures usually prevailing at time of customary treatment. Para was not effective below 75°, carbon bisulfide is only partially effective at 71° and calcium cyanide was not fatal at 70°. With a stack of even six Langstroth hive bodies a relatively high, slender container is given for fumigation. Many of the gases are heavier than air, so fall rapidly to the bottom of the enclosure, usually remaining there until dissipated. Therefore, a killing concentration is not effected in the upper bodies of the stack. When bodies are piled in the ordinary manner there is considerable leakage at each joint which totals a relatively high per cent of loss of fumes during the dissipation of the material so that it is difficult to attain a lethal concentration under practical conditions.

There are then three factors, often working together, any one of which could account for unsatisfactory results in moth fumigation. In view of these considerations it will be necessary for Iowa producers to rearrange the program for their comb fumigation. The work should be planned effectively early in the fall and with temperatures much below 90° F. It will be necessary to increase the dosage of materials used. If an effective kill is obtained in the fall combs should be safe until spring when reasonable temperatures again prevail. It may be necessary to use lower stacks of combs for fumigation and extreme care must be used to have the stack more confining to gas even if it is necessary to cover the joints.

Repellants offer a valuable aid in protecting combs from moths. Para is especially effective during the portion of the year when low temperatures prevail. It is a practice in Russia to dip combs in a strong salt solution before storage. These combs are soaked in water in the summer before using. This custom is considered practical over there but probably would not appeal to the producers of this state. Experiments are under way now to determine the effectiveness of this practice as repellant to the bee moths.

More effective measures of artificial control are necessary to reduce the ravages of these insects in Iowa. The factor of strong colonies in the yard is less effective so long as the insects can persist in liberal numbers in stored combs under the customary plan in this state. It is in this part of the campaign that more definite results must be obtained and it is in this part that all factors can be controlled by the producer.

WHAT CO-OPERATION OFFERS AND DEMANDS

E. G. Brown, Sioux City, Iowa

Owning Your Market: Co-operation gives this chance as no other system can. Selling individually one has a customer one year and the following year someone else supplies him because of quantity and price and if you have a large crop one year and small the next, you hunt for customers one year and are unable to supply them the next.

Experience also shows that some of the best honey selling months of the year are August, September and October while July is able to supply a fair volume of business if it can be taken care of. The average beekeeper is too busy to think much about marketing at this season, much less to spend much time at it. If he is connected with a well organized co-operative association whose manager and operating force are ready to take charge of this work as soon as the bulk crop can be turned over to them, the public will be consuming much honey that otherwise would never be eaten. The producer who is trying to do both producing and marketing has two jobs that overlap, and the consequence is that neither one is properly cared for, whereas under the co-operative system, he can give the proper attention to the harvesting of the crop and the preparation of his colonies for winter, knowing that his market is well looked after and that the sales work is being pushed where the market is the best.

There is almost always a difference in the honey from different apiaries and a co-operative association can blend the same kinds of honey from a number of apiaries and can maintain a more uniform output. It is possible to carry on advertising on a collective plan which would be out of the question in an individual way.

Marketing has become a year-around job and demands someone with special training along that line but the producer needs to own his own market and marketing system, so that he knows whose honey is marketed and that it is going out in a way that will build a greater demand for honey and that he is getting his full share of returns for his product.

The experience of the Mountain States Association has shown that the export market was less than half developed and a well organized sales agency can continually find new locations and ways to market honey.

The co-operative marketing experience of the last four or five years has proved that working collectively, the producer has a much better chance to secure the full market value of his product. The past has shown that many producers were not governed by market requirements in selecting the style of packages or the kinds of honey produced but were governed by their own fancies. The manager of a co-operative association knows what the demands of the trade are and can line up his membership to produce as nearly as the seasons will permit, the kinds and quality that will fit his market requirements. For best results there must be an understanding among the producers as to what kind of honey the market demands and in what form it is wanted.

In honey production there is very little difference in the expense of producing high quality and inferior quality but the net financial returns from quality production is much greater, and there is no greater depressing factor in the present honey market than the inferior quality honey offered to the public for table use.

To obtain the benefits that have been set forth, co-operation also demands some sacrifices. One of the most important of these is the financing of the organization. The provisions of the Federal Farm Board make this much easier than in the past, but it is necessary that the producers place their crops at the disposal of the marketing organization and instead of each man setting up his own grading rules and standards, the members will have to conform to those set up by the association.

Every consumer should realize that co-operative marketing is the greatest factor in the world for the improvement of quality and quality marketing and that consumers should be as much interested in the development of co-operation as the producers.

The production of quantities greater than the consumption demands has always been a demoralizing factor in markets and if any attempt is going to be made in controling production, it will require organization to enforce it and at least 85% of the production should be under such control.

PRODUCTION OF EXTRACTED HONEY

Winfield Scott, Cedar Falls, Iowa

It has been said that he who knows and knows that he knows is sure of success, and that he who does not know and knows that he does not know can attain success by hard work and study, but that he who does not know and does not know that he does not know is helpless and doomed to failure. Now beekeepers can be found who belong to each of the above classes. If those who belong to the second group can profit by the experience of an amateur this paper will not have been written in vain; for I am just a beginner in the field of honey production and many errors have been made in my methods to date.

My policy in extracted honey production is to begin in the summer previous to that in which the flow is expected. When the main honey flow is over, the brood nest and the food chamber are brought together again. At this time the colony is examined to determine if the queen is strong. If she is not doing satisfactory work a new queen is introduced which is a precaution taken over and against a regular policy of requeening at least every two years.

At the time of this examination the queen is confined to the lower chamber. This saves the food chamber for future needs and it usually gives the queen plenty of room for brood and the workers some room for the storage of honey in case there is a flow. If the season is fair this will enable the colony to go into winter quarters with something like eighty pounds of honey. The food chamber has a high grade of white honey and the brood chamber honey of a somewhat poorer grade. This will be used during late October, November and December and there will be but little danger of digestive troubles since there will be no opportunities for flight during some of these months. Success in having the brood chamber well filled has been fair. Some of the colonies have had but little reserve in the brood nest but at this, it has never been the policy to feed for winter needs. It is impossible to say wherein the difficulty lies; perhaps the flow of nectar is insufficient and this is always an element of risk or perhaps the morale of the colony has been destroyed due to some faulty managerial operation. This is one of the problems which must be solved in the near future. As a result of this plan, the majority of the colonies go into winter with the queen in fine condition, with 20 to 30 pounds of honey in the brood nest and 60 in the food chamber.

The next step in the plan concerns the wintering problems which is carried out as simply as possible. The colonies are arranged in groups of two and packed in tar paper cases, using either leaves or straw. It is impossible to date to tell any difference between the colonies packed in straw and those packed in leaves. The packing material is used liberally and not a colony has been lost due to winter management. It is easy to see that colonies so managed will come out in the spring with great strength and as a rule swarming has begun in early May. This has been a drawback to the plans and if this problem continues the amount of honey for storage will be reduced or else the winter protection will be reduced. I have thought of carrying only one-half of the colonies through the winter with the expectation of making divisions thereby doubling the number about the first of May. This ought to work out well since it would create a desire to work with a renewed vigor and at the same time eliminate some of the desire to swarm. This is only a guess on my part and might cause a serious loss in honey production. At any rate many colonies are too strong early in the season and finally become unmanageable due to the great height of the supers before the season closes. This would not be objectionable if the yard were near the house or extracting plant but the bees are kept some six miles out of town and it has not been convenient as yet to begin extracting early.

Room has usually been given during the dandelion and apple blossom flow. If so the colonies remain in this condition until about June first at which time the queen is placed below. The brood is thus allowed to emerge from the frames in the brood chamber which leaves it empty for the first white clover flow. As soon as this is filled it is raised and empty supers placed beneath. From now on the food chamber is kept above and empties added as needed for each Saturday the brood nest is examined for swarm control and the necessary changes made. Extreme measures are sometimes used to prevent swarming and sometimes the morale of the colony is destroyed. This will be overcome in a few years if possible. If swarming occurs the swarm is returned to the original hive in a few days, after the hive from which the swarm emerged has been properly treated. If the working instinct has been kept at a maximum the colonies are ready for a big season. Ventilation is provided at bottom and at the top.

When the honey flow is over the supers are removed and stacked carefully. Late in the afternoon they are taken by truck to the garage in town where the extracting is done. The extractor is a four frame power machine, reversible. Two uncapping knives are kept in hot water near by. The caps are allowed to fall into a large circular receptacle, with wire screen bottom, and about the size of a tub. The honey drains down into a tub. The uncapped frames are placed and the machine started. The honey flows out through a screen basket. This removes all of the larger bits of comb. The pails which receive this honey are emptied into a screen made of inner wires and which sets in a sugar bay. All of this is suspended in the tank. The honey which comes through this is allowed to remain in the tank as long as possible. However, it has been found that this will not produce clear honey. It is impossible to tell why but this will have to be improved. Perhaps the honey has been drawn too soon but the tanks are of 400 and 600 pound capacity and do not allow sufficient time for one who is extracting through the week. At least the extracting process is unsatisfactory and better ways must be found.

Another source of trouble has been in the management of the pails, five and ten pounds respectively. They are handled too often excessively and thereby entail extra expense. Some plan for the direct removal of these pails from the tanks to a place where labels can be placed on them, then to the storage room where they are to remain until placed on the market must be provided.

Cedar Falls and Waterloo have a good honey consuming population. The good stores have regular sources from which they have long since received their supplies as needed. I have not tried to reach these stores since a cut in price would be necessary. This would hurt the business of some other beekeeper and not do me any good since the price would then be in the neighborhood of the chain store price. This leaves me a market of the lower price level usually in the chain stores or in the high pressure grocery stores where large purchases at minimum prices and large turn over at a minimum profit constitute their policy. The price I receive is but little if any better than the wholesale in sixties when all cost factors are considered. Just what the future sales policy will be is not at all certain. Many friends like to have my honey because it is put up in an attractive way. Every sale must be a satisfactory one or the honey can be brought back. However, these friends cannot consume all of my honey. The local stores like to have it with my name on the package but the Waterloo merchants do not care for the name. In fact the largest groceries often have a brown band of paper one-inch wide extending around the pail with 65 or a 120 written in with a lead pencil. This is the price in cents. My pails, however, have a label which covers one-half of the surface and carries the usual information concerning the value of honey, the place to keep it, and the procedure if it candies.

Just as a wide guess it is ventured that the more attractive pails and packages will finally take the trade if it is kept before the customer. Since honey production is a side line there is some question whether I should try to build up a trade when the amount which will likely be produced will go on the market with but little more attention than that given by neighbors who care next to nothing for appearance.

My conclusions are: 1—Large yields of 200 to 250 pounds of extracted honey per colony can be produced if the bees have a good queen and plenty of stores for the winter; the colony can be brought through the winter too strong; 2—Much lost motion will result if the apiary is an out one if the plans are not carefully laid; 3—The marketing problem is not a serious one if the producer will only keep in mind the requirements of his customers; 4—The bee widow may be as real as the golf widow.

COMB HONEY PRODUCTION

John W. Schlenker, Des Moines, Iowa

I have learned to realize the difficulty of writing an article that will benefit both the beginner and the advanced. It has been decided therefore to take up some of the problems of the more advanced beekeeper.

It will be assumed the bees have wintered about average. It is then important to provide stores to all colonies that are short, to insure plenty of bees at the right time.

It is very important that the beekeeper learn to understand floral conditions so to anticipate when honey flows will start and stop.

A very common mistake made by many beekeepers is to put sections on too soon. Experience has shown that the best time is after the flow of white honey is well started. Up to this time swarming is controlled by taking sealed brood from the strong and giving to the weak, if any, or making increase if desired. All colonies should occupy two eight-frame bodies by the time the white flow gets well started. In this way all the inferior honey is kept out of the sections ,and most of it will be converted into bees. By this time swarming will also be well past. Now take off the top story containing most of the honey, and considerable brood, see that the queen and most of the bees and brood are left below and put two comb honey supers in its place, the top story can be used to strengthen increase made earlier or piled up three or four stories high with a ripe queen cell, to make increase and provide extra stores for wintering. In about three days both supers should be at least well started, if not, the bees probably want to swarm so see that all queen cells are cut, and take a super from another hive doing good work, bees and all, and exchange, empties below. Supers should be added underneath as long as prospects justify until about four or five are on, after that the first ones should be ready to come off, and empties should be added on top if needed. Sections should not be on the hive more than a month, and less is better if they are finished with this system. Outside sections have often been completely capped before the center ones were entirely drawn. If certain colonies persist in wanting to swarm, requeen and use them for extracting for not all colonies are profitable in comb honey production. Those making poor combs are also requeened with stock from satisfactory comb producing colonies.

When it appears that the season is about over, have all comb honey supers off, and replace with extracting supers for in this manner nothing but fine, white honey is stored in the sections. Do not infer that it is right or good business to sell poor honey in the extracted form except possibly to bakers.

The great problem now is to raise the quality of honey rather than increase the output. No amount of advertising will make people buy it they do not like it for the buying public, and many merchants, do not know what honey should be. It is therefore up to the beekeeper to sell only good honey and give instructions how to keep it good. There are merchants in Des Moines who have bought fair comb honey at $2.50 and $3.00 per case. Nobody can make a living producing at that. Other small producers will come in with all grades and qualities and sell to the grocers at any price he will pay. Much of this honey is unfit for food, and kills the demand.

Our supply dealers and text books are to blame for much of this as they recommed comb honey production for beginners, but at the same time admit that it requires expert knowledge and experience to produce it properly. That is about as sensible as sending a boy to college before he goes through the grades. The excuse given is that it takes too much equipment for extracting. A beginner will get much more, and better honey, if he uses a queen excluder and extracting frames instead of solid separators.

State of Iowa
1930

REPORT OF THE

State Apiarist

FOR

The Year Ending December 31, 1930

Also Report of the Convention of the Iowa Beekeepers' Association at Shenandoah, November 12-13, 1930

F. B. PADDOCK, STATE APIARIST
Ames, Iowa

Published by
THE STATE OF IOWA
Des Moines