Two Queen Hive System from Package Bees

by

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The Alaska beekeeping season is extremely short; a late spring and cool weather retards early population building, resulting in entrance into the nectar flow with the hive population at less than full strength. Logical solutions to this problem include:

1. Selecting a race of bees that is more suited to working in cooler weather with short seasons and has a history of the breed having a rapid population buildup.

2. Starting packages earlier in the spring and artificially stimulating the queen to begin brood nest expansion through the use of sugar syrup and pollen substitute.

3. Adding bees to the hive population prior to nectar flow from combining hives, adding brood or introducing a second laying queen to a split hive.

Literature searches indicate that hives reach full strength when populations reach between 40 and 60 thousand bees. Colonies of less than 40 thousand bees are not generally assured of securing a good honey crop. Additionally two colonies combined produce more honey than two separate colonies of equal strength. Hive population studies show that honey production increases in proportion with the population of the hive to a certain point and begins to fall off when the colony becomes too large. Populations of greater than 120 thousand bees in one hive produce less honey than the same number of bees divided between two colonies.

From this information we can surmise that the optimal population for gathering a honey crop is somewhere near 100 thousand bees. The question arises: how do we get there by the first of July? My experiment on finding a solution to this problem is outlined below.

The basic premise is that since all the bees in the hive come from a single queen, then two queens could produce twice as many eggs and therefore twice as many bees. Assuming that our hive population never reaches above 50 thousand during the nectar flow, combining two hives would result in more honey gathered than the hives would gather singly. However, there are disadvantages in combining hives to create larger and more productive ones. These problems include relocation of at least one hive, disruption of the colony, and the problems associated with introducing large numbers of foreign bees to another colony. In addition, the colony becomes physically larger and more difficult to manipulate.

The basic configuration of a double queen hive involves two brood chambers with a queen in each chamber. Some type of device is used to separate the queens from each other. Screen boards, excluders, supers full of honey have all been traditionally used to separate the queens.

The queen in a two queen system faces danger from two sources. First, the queen could encounter a group of bees that are unfamiliar with the queen and they could kill her. Secondly, one queen could come in contact with the other queen and be killed or damaged in the resulting fight.

Most beekeepers know that bees recognize each other through the exchange of smells and taste of the pheromones produced within the hive and shared with all the members of the hive. Management of a two queen system often involves mixing bees in a controlled fashion until all the bees share the same pheromone or scent and recognize all the bees as members of the hive. At this point the queen is in much less danger of being balled or stung by the surrounding workers.

In addition it should be noted that bees seem to be more accepting of a queen that is

actively laying and even less likely to reject her presence in the hive. Laying queens are occasionally found together in the same hive, leading one to believe that the drive to fight with a rival queen diminishes when both of the queens are actively laying eggs.

My experiment with starting a 2 queen system from a single 3.5 pound package involved 14 hives. Seven hives were set aside as controls and managed in the traditional way that most Alaskan hives are run. Seven hives were run as double queen hives. The purpose of the experiment was to compare the honey production between the two management systems. I was especially interested in the production of brood and the population buildup within the various hives. The apiary was laid out to minimize unwanted variables from entering into the experiment. Hives were laid out in pairs, two pairs to a platform with ten feet between platforms. Hive pair orientation was varied so that there was at least 35 to 45 degrees variation between pairs. This was to eliminate the possibility of drifting bees. Distance between pairs of hives on the same platform was about three feet. A pair of hives consisted of a single queen hive next to a double queen hive with a foot of space between them. All of my supers were painted by my children and the colors present were all that are placed in the rainbow. There was no attempt to separate color patterns and this was accepted as a random variable beyond control. Carniolan queens were selected as the predominant breed for the entire apiary. Weekly estimates were made of the amount of brood laid by all queens. The method of estimating the amount of brood was to examine the face of the frame to see if significant portions were filled with eggs, larvae, or capped brood. No actual measurements were taken, just general impressions. It was felt that if the apiary was inspected by one person on a single uninterrupted visit that all frames would have the same general interpretation. In other words, a frame full of eggs may not have every cell with an egg in it, but a frame that would be considered full in one hive would also be considered full in another hive if looked at by the same person on the same day. Careful records were kept at harvest and each hive was given a number. As the supers were pulled off the hives the frames were brushed free of bees, placed in an empty super and were weighed on a scale. The weight of a wet super of the same type and number of frames was subtracted from the original weight to determine the amount of honey that was removed from the super. The total honey weight for a hive was determined by adding the resulting amounts for all the honey supers from the same hive. The small amount of honey that borders the frames of brood in the brood chamber were ignored in the experiment for all hives.

Hives were prepared by placing a deep super on a bottom board with a small entrance centered along the bottom edge of the board. This bottom board was placed on top of an empty super to get the entrance of the hive at the right height for future hive configuration. The hive was divided into two chambers with a single piece of 1/8 inch paneling that centered on the entrance of the hive. This board was cut to fill the entire space from the bottom of the hive to a snug fit under a queen excluder placed on top of the super. The two outer frames were removed and replaced with styrofoam inserts to insulate the hive and more importantly, force the brood nest to use the frames in the center of the super. A package of bees was shaken onto the center of the dividing board on the top bars of the hive and carefully worked apart with the hive tool so that there were two equal piles of bees. A queen was released by an indirect method into each half of the super. This was done with the mini marshmallow method of replacing the cork in the queen cage with a mini marshmallow and allowing the bees to eat the queen free. It was estimated that the queens were free within 24 hours or less. A queen excluder was placed on top of the super and a feeder jar was placed on the excluder centered over the divider board. This way the bees

could share a common food source without coming in contact with each other. A styrofoam panel was cut to fit on the metal part of the queen excluder that had a hole cut the same size of the feeder jar. This had a dual purpose, first was to provide some insulation to keep the brood nest warm. The second purpose was to keep the bees from crawling through the excluder and entering the colony of bees on the other side of the divider. An empty super was placed around the feeder jar and styrofoam, and a top cover was placed on this. Single hives were configured the same way with exception of the divider board.

When the double queen brood nest became crowded, the styrofoam and the divider board were removed. The frames of one half of the brood nest were transferred to another super along with the queen from that brood nest. This super was placed on top of the queen excluder. The upper super was shifted back to allow bees from the upper super to have a lower entrance above the excluder. Bees in the lower super must go through the excluder to exit the hive from the top. The bottom entrance for the hive still exists, but since the empty super that was under the hive has also been removed, the bees are oriented to the upper entrance of the hive when they return from the field as it is the same height above the ground as the old entrance. As the brood chambers become congested a second super is added to the lower half and additional supers are added to the upper half. The upper queen was allowed to use the honey supers to raise brood for a full brood cycle. This allowed the brood to hatch in the deep super and provide available space for the queen to lay eggs again. After a couple of weeks (about 5 weeks from harvest) a queen excluder was used to limit the range of the upper queen to keep her from laying in the upper honey supers and to keep her in the lower super. Three weeks prior to harvest the queen excluders were removed, and the queens were placed in cages. At time of harvest there were only a few isolated drones that hatched out in the honey room.

Data tables below show the brood buildup as well as the amounts of honey that were harvested from each hive. For interpretation of the tables (S) represents a single queen hive while (D) represents a double queen hive.

Brood Buildup Tables

Date 5/2/01 Hived bees
Date 5/10/01 Queen check - eggs in all hives except #3
Date 5/11/01 Added queen to hive # 3
Date 5/19/01 Hive check -Brood evaluation, 1.5 hours total, 1/2 hour preparation, average 6 minutes per hive

type	eggs & larvae	capped brood	capped & hatched	relaid
S-#1	1.5	2.5	0	0
D-#2	1	5	0	0
S-#3	1	0	0	0
D-#4		6 with eggs	0	0
S-#5	1	2.5	0	0
D-#6	1	4.5	0	0

S-#7	2	2	0	0
D-#8	1	4.5	0	0
S-#9	1	2.5	0	0
D-#10	1.5	4.5	0	0
S-#11	1	2	0	0
D-#12	1	4	0	0
S-#13	1	2	0	0
D-#14	1	3	0	0

6 singles used for average (hive # 3 removed from data - new queen)

TOTAL	AVERAGE
8 frames of eggs	1.33 frames of eggs
13.5 frames of capped brood	2.25 frames of capped brood

7 doubles used for average

TOTAL	AVERAGE
6 frames of eggs	.86 frames of eggs
31 frames of capped brood	4.43 frames of capped brood

Question: Did the egg rate drop off in the double hives because the bees could not cover the brood nest or did she run out of room?

Date: 6/2/01 Hive check - Brood evaluation, Added Supers- one deep to lower queen, 1 shallow to upper queen

type	eggs & larvae	capped brood	capped &hatched	relaid
S-#1	1	3	2	0
D-#2	0	2	4	0
S-#3	1	3	0	0
D-#4	1	3	2	0
S-#5	0	1	4	0
D-#6	1	1	4	0
S-#7	some	2	2	0
D-#8	2	0	5	0
S-#9	1	1	2	0
D-#10	1	0	5	0
S-#11	0	1	3	0
D-#12	2	1	4	0
S-#13	0	2	2	0
D-#14	0	0	5	0

Singles

TOTAL	AVERAGE
3 frames of eggs	.5 frames of eggs
13 frames of capped brood	2.2 frames of capped brood
15 frames of capped and hatched	2.5 frames of capped and hatched

Doubles

TOTAL	AVERAGE
8 frames of eggs	1.1 frames of eggs
8 frames of capped brood	1.1 frames of capped brood
29 frames of capped and hatched	4.1 frames of capped and hatched

Date: 6/9/01 Hive check

Almost impossible to to estimate bee population with exam of brood nest. General impression is that there were MANY more bees in the double queen hives than in the single queen hives. Population studies suspended at this time.

Question: Could hive population study have been continued by counting the number of frames that had the bottom of the frame covered with bees?

Date 7/12/01 Caged queens - pulled 18 frames from the hives to make room for queen cages - honey yield was 78.75 pounds

Single hive yield 26.25 pounds

Double hive yield 52.5 pounds

Date 7/19/01 Queen cell search - 8 hours total

found many queen cells in single hives but less in double hives (some doubles had none)

Date 8/11/01

Honey Harvest Tables

S10 = a shallow super with 10 frames
D9 = a deep super with 9 frames
D5/S4 = a mixed deep, 5 frames of deeps with 4 frames of shallows for comb honey production

Hive #	Super type	weight	Yield	Total Pounds
1(S)	S10	38	23	
	D5/S4	38	23	46
2(D)	D9	45	25	
	S9	43.5	29.5	
	S10	48	33	87
3(S)	S9	26	12	
	S10	42	27	39
4(D)	S9	42	28	
	S10	45	30	
	D9	47	27	85
5(S)	S9	21	7	
	S10	26	12	19
6(D)	D10	44	24	
	S10	53	38	
	S9	44	30	
	S9	34	20	112
7(S)	S10	39	24	
	S9	35	21	45
8(D)	D3/S1	29	17	
	D4/S1	38	18	
	S10	51	43	
	D10	46	26	97
9(S)	S9	35	21	
	S10	35	20	41
10(D)	D5/S4	42	22	
	S9	39	25	
	S10	43	28	
	D9	40	20	95
11(S)	S9	39	25	
	S10	30.5	17	42
12(D)	S9	32	18	
	S9	32	18	
	D10	46	26	
	D10	34	14	81
13(S)	S9	22	8	
	S9	26	12	20
14(D)	D9	39	20	

S10	47	32	
S10	51	36	88

Single hives --- 252 pounds total -- Average 36 pounds per hive

Double hives --- 645 pounds total -- Average 92 pounds per hive

Production increase by adding a second queen 2.5 times more honey

Conclusion:

Population builds up much quicker in a double queen system resulting in a honey crop that is more than double compared to a single queen hive. It is possible to start a two queen hive from a single package of bees. The additional cost of an extra queen may well be worth the expense involved.

It is also interesting to note that the hive that started raising brood late due to a failed queen (hive #3) still produced a honey crop in spite of the late seasonal start (May 10th)

Why it worked:

Very careful attention was paid to prevention of swarms. Much advice was supplied from beekeepers (both national and international) about the propensity of two queen systems to swarm with huge volumes. Thorough hive inspections were carried out weekly with a frame by frame search for queen cells and cups. All cells and cups were removed when found. As the colony became larger the time taken to accomplish this task grew. Single brood chamber (one deep) exams in May were as short as six minutes per hive. Hive checks in July were greater than half an hour per hive. My goal in hive checks was aimed at efficiency with the question in mind - how many of these colonies can one beekeeper manage for a seasonal occupation?

There were many more things to take into consideration when dealing with a double colony. Certainly the work that is involved is significantly greater. In addition, there is a need to have more equipment involved. A total list of equipment for a double queen colony the way that I managed it is as follows:

3 deep supers &1 shallow super for brood
2 queen excluders
1 hive divider board
styrofoam inserts for frame replacement
jar or bucket feeder and styrofoam cover
top board
honey supers will vary depending on location and flower sources

There are a number of reasons that the experiment worked the first time for me and may not work for anyone else, or may not work for me again. As with all things that depend on the cooperation of wild animals, there are many things that are beyond our control or comprehension. Random chance may even explain much of the results.

It is possible that the single queen hives didn't have enough time to reach the threshold population of 40 thousand due to the late start of the season. The question remains, given 2 or 3 extra weeks would there have been that much difference between the two hive types? Perhaps

the single queen hives would have caught up to the double queen hives if given the earlier start.

The genetics of the queens provided by my supplier may have traits that other queens may not. It is possible that the queens that I used were less prone to either swarming or their desire to fight with each other.

Factors of weather and pollen source in the early spring may have played a significant role that escaped my attention for the development of brood.

Certainly there is the increased need for closer monitoring of the hive and the increased work and complexity of manipulating a double hive. For the beekeeper that has hives away from the house or the inability to regularly attend them the potential for swarming is fairly large and may not be the best method of keeping bees. A fair bit of work space is involved in the hive tear down for a hive check and the hive is apart for a longer time than with a normal colony. There is also the need to be more careful when the hive is reassembled to make sure that the queens are where they are supposed to be. Finding the queen in a single hive is often difficult enough, but is much more difficult in the double hive when it has reached its full population. For those who do not cage the queen in preparation for harvest, hive population may exceed the ability to control the congestion that is likely to occur, and swarm control may become a problem.

One last note that should not be omitted from this report is a mention of the valuable advice that was given to me by Tang and Ben Johnston and should be heeded by all beekeepers - when you experiment with beekeeping never do it with the whole apiary. The potential for disastrous failure looms great and if there is tremendous success the beekeeper never knows if the success was due to the beekeeping or if it was just a good year.

I wish all beekeepers the best of luck in the following season in whatever method of hive management they choose to employ.

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