

Getting started with beekeeping
for pollination and honey
Ben Phillips, MSUE

The diagram illustrates the anatomy of a bee's head and mouthparts at the top. Below, it shows a bee on a flower, with arrows indicating the path of pollen from the flower to the bee and then to another flower, demonstrating the process of pollination.

Wild honey bees & biology

- 7 species evolved from colony forming "vegetarian" wasps

Apis dorsata
Apis mellifera
Apis cerana

Apis florea

The image shows three species of honey bees pinned to a vertical scale. From top to bottom: Apis dorsata (largest), Apis mellifera (medium), and Apis cerana (smallest). A separate inset shows Apis florea on a yellow flower.

Wild honey bees & biology

- 7 species evolved from colony forming "vegetarian" wasps

The image shows two photographs of wild honey bee colonies. The left photo shows a colony on a tree trunk with many bees flying around. The right photo shows a close-up of a colony on a tree trunk, with bees clustered around the entrance.

Taming the honey bee

- Skep trapping
- Langstroth and "bee space"

3/8 inch - 1/4 inch is appropriate bee space

Too big or too small gets filled with comb or propolis

The diagram shows two bees between two vertical lines, illustrating the concept of "bee space". To the right is a photograph of a traditional skep, a dome-shaped beehive made of straw or woven twigs.

Castes

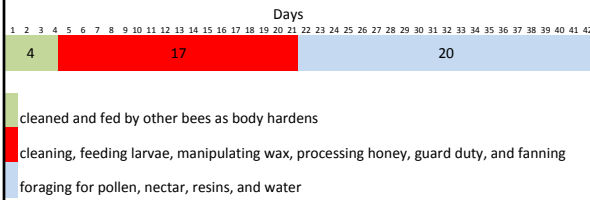
Day 1: Egg
Day 3: Egg hatches
Day 5: Larva
Day 11: Prepupa capped
Day 15: Pupa
Day 21: Adult worker
15 - 38 day life, summer
140 - 320 day life, winter
Day 24: Adult drone
8 week life
Day 16: Adult queen
2 - 5 year life

The diagram shows the developmental stages of a honey bee. It includes side and top views of the larva and pupa, and photographs of the adult worker, drone, and queen. A metric ruler is used for scale.

Queen Cells
Drone Cells
Worker Cells

The photograph shows a close-up of a honeycomb. Red arrows point to specific cells: Queen Cells (large, hexagonal), Drone Cells (larger than worker cells), and Worker Cells (small, hexagonal).

Worker duties



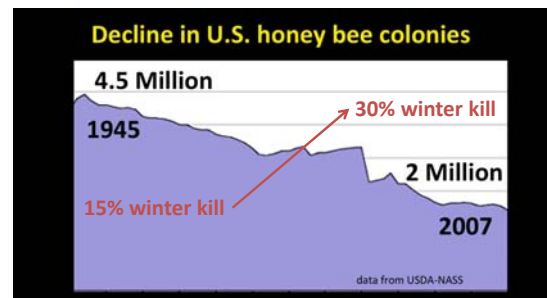
Queen duties

- Only leaves the hive to swarm and mate
- Lays up to 2500 eggs per day
 - A new mated queen can change entire hive population's temperament in about 40 days
- Dark hive, no real ears
 - Uses pheromones to keep everyone linked

Drone duties

- Leaves hives to mates with queens in a Drone Concentration Area (DAC)
 - Mysterious process
- Can't forage
- Can't eat on its own
- Gets kicked out by winter because they aren't necessary

What broke?



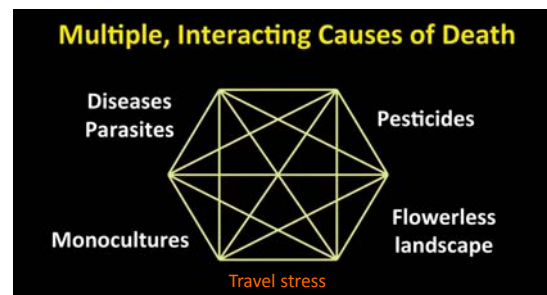
Spivak, 2013

Honey bee losses 2013

- Bee Informed Partnership losses between Oct 1, 2013 and April 1, 2014

State	Winter Loss %
Illinois	61.4
Indiana	65.44
Michigan	60.93
Minnesota	47.84
New York	50.4
Ohio	58.09
Pennsylvania	43.7

What broke?



Spivak, 2013

Inner Covers




Standard

Provides proper bee space above frames

Acts as a vent and an optional escape

www.bees-and-beekeeping.com

Inner Covers



Customized


Provides proper bee space above frames

Acts as a vent and optional escape

Choices for placing feeding jar

www.honeybeesuite.com

Inner Covers



Customized

Provides proper bee space above frames

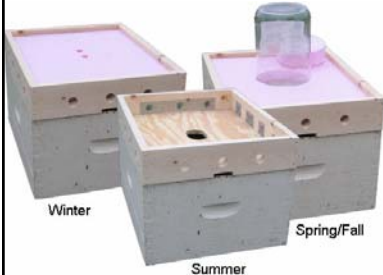
Acts as a vent

Feeders can be placed anywhere

Could modify a queen excluder

www.honeybeesuite.com

Inner Covers



Customized

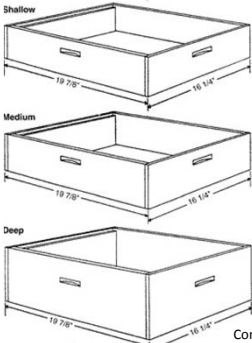
Provides proper bee space above frames

Acts as a super vent with cross-breeze

Can be insulated with thicker foam

www.emgoldbeekeepers.com

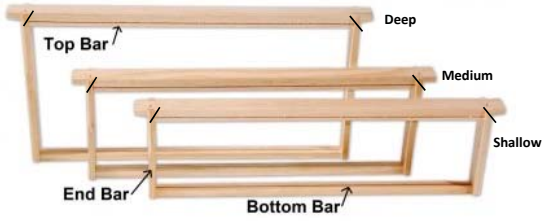
Boxes and Supers



	Weight when full	
Shallow 5 11/16"	10 frame ~ 40 lbs	8 frame ~ 32 lbs
Medium 6 5/8"	~ 50 lbs	~ 40 lbs
Deep 9-5/8"	~ 80 lbs	~ 64 lbs

Comb honey section super can be even shallower

Frames



Top Bar, **End Bar**, **Bottom Bar**, **Deep**, **Medium**, **Shallow**

*Pro tip: Put extra nails going through end bar and up into top bar

Frames




Foundationless

Close to how bees naturally build

Need starter guides

www.beebehaviour.com

Frames




Romanov foundationless

Cutting guides

Standard container sizes

www.beebehaviour.com

Frames



Kelley cut comb


Independent square sections in a 5.5" super

7 "frames" per 10 frame super

Standard container sizes

www.honeybeesuite.com

Frames



Bee-O-Pac comb system

Fits regular medium super


8 frames per 10 frame super

Comes with clamshell

www.bcbeesupply.ca

www.beebehavior.com

Frames



"Ross rounds" cut comb

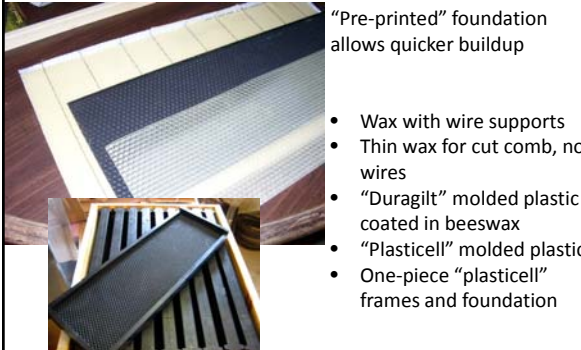
Independent round sections in a 4.25" super

8 frames per 10-frame super

Standard container sizes

www.honeybeesuite.com


Frames



"Pre-printed" foundation allows quicker buildup

- Wax with wire supports
- Thin wax for cut comb, no wires
- "Duragilt" molded plastic coated in beeswax
- "Plasticell" molded plastic
- One-piece "plasticell" frames and foundation


Frames



"Pre-drawn" foundation is even less work for both the bees and the beekeeper

- One-piece "HoneySuperCell" (HSC) frames and foundation
- heavy

Frames




Drone trapping frames attract Varroa mites. Remove drone frames exactly 4 weeks after insertion, and "freeze and replace".

Pierco plastic frames and foundation

6 – 6.6 mm cells trigger queens to lay drones

www.scientificbeekeeping.com

Frames



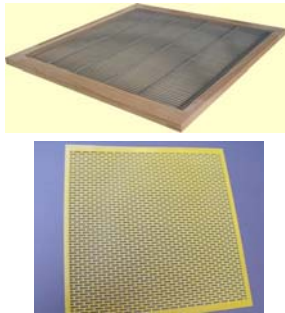
Drone trapping frames attract Varroa mites. Remove drone frames exactly 4 weeks after insertion, and cut out drone brood

Randy Oliver custom frames

Bees will produce volunteer drone comb in a concentrated area when provided for. Forcing bees to build more comb increases trapping period.

www.scientificbeekeeping.com

Queen Excluder




Used to restrict the queen to the lower boxes

Remove before winter!

Its effectiveness is debatable


Pollen traps



Entrance trap


Can "turn on or off"

Can use bottom board pest monitoring tactics



www.beesource.com

Pollen traps



Top-mounted trap

Some models can "turn on or off," otherwise must remove to stop collecting pollen

Can use bottom board pest monitoring tactics

www.blueskybeesupply.com

Pollen traps



Bolt locks the block in "on" or "off" position

Bottom-mounted trap
 Can "turn on and off"
 Cannot use bottom board pest monitoring tactics when installed

www.beesource.com

Propolis collectors



Placed on top of hive in autumn as bees are trying to seal everything up

Crack lid to let light in, and the bees will work to fill the gaps in the trap with propolis

Remove, freeze, scrape

Bottom Boards



www.dadant.com



Basic
 Entrance reducer is for regulating hive temperature and blocking mice
 1/4" hardware cloth folded in a "V" shape wedged into entrance blocks mice in winter

Bottom Boards



www.humbleabodesinc.com



www.crystalbeesupply.com

Screened (1/8" cloth)
 Better venting
 Allows for sticky trap monitoring of Varroa mites
 Could also use Vaseline on sheet plastic or wood

Bottom Boards



www.eheartwood.com



Lunch tray

www.beebumbler.com

Screened (1/8" cloth) with tray
 Better venting
 Allows for sticky trap monitoring of Varroa mites AND trapping small hive beetle


Feeders



www.bushfarms.com

Bottom board feeder
 Basically basic bottom board modified with a strip of wood (syrup dam) behind the entrance, and edging the boxes forward to pour syrup or sugar
 Can drown bees
 Can cause robbing


Feeders



Boardman feeder


Simple

Can cause robbing



www.bushfarms.com


Feeders



Frame feeder


Internal accessibility can be difficult

Provide "ladders" to prevent drowning



www.bushfarms.com

Feeders




Inverted container or baggie feeder

Need an extra deep box

Creates vacuum and drips slowly

Doesn't require special equipment

Holes on baggies face up



www.bushfarms.com

Feeders



Miller feeder


Can drown bees

Goes on top, and may require extra hive body




www.bushfarms.com

Feeders



Candy board feeder


1/4" mesh on a 1 x 3" spacer, with escape hole

Replaces inner cover (could use queen excluder attached to shallow super)

Questionable absorption and insulating properties

www.beverlybees.com www.bushfarms.com

Feeders



Communal feeder

Good for a bigger apiary (10+ hives) with new nucs, during dearth, or going into late fall

Need to prevent drowning with open pails

Alternatively, drill holes in every other "compartment"

www.bushfarms.com

Extraction Equipment



Brush

Extraction Equipment



Fume board

Chemically-assisted
bee evacuation

Lightly apply chemical
to fabric on one side,
let sun bake the top to
volatilize it and send
bees out the bottom
entrance

The active chemical in fumigants is benzaldehyde (almond oil), or butyric acid

Extraction Equipment



Handheld, backpack, stationary
blowers

Removes bees from supers, and leaves
lots of crawlers on the grass



Wax melters



Nothing is standardized

Assess your needs, and
materials at hand



Alternative Hive Models



Warre hive, "The People's Hive"

Foundationless and stackable

Somewhat standardized, artsy



Alternative Hive Models



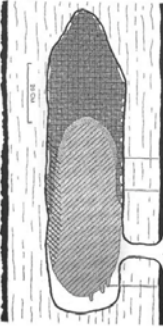
Warre hive, "The People's Hive"

Quilt box has multiple vent
holes, a cloth bottom, and is
filled with an insulating and
moisture absorbing material

A gabled roof box telescopes on
top and sits flush

Burlap "top bar cloth" replaces
an inner cover

Alternative Hive Models



Honey storage
 Pollen storage
 Brood nest
 Drone comb
 Propolis envelope
 Peripheral gallery
 Entrance smoothing
 Entrance
 Queen cell

Warre hive, "The People's Hive"

"Nadiring" or bottom-supering keeps bees building downwards like they would in a tree, and keeps capped honey comb from getting dirty

www.warre.biobeas.com is dedicated to the Warre hive philosophy and practice

Seeley & Morse (1976). The nest of the honey bee (*Apis mellifera* L.)

Alternative Hive Models



Top-bar hive

Foundationless and rackable

Horizontal buildup

Little standardization, cheap!

Alternative Hive Models




A top-bar hive COULD HAVE

Boards to regulate buildup, like adding supers

Framed foundation

Pull out mite inspection board

Alternative Hive Models




A top-bar hive COULD HAVE

Feeder adaptations

A queen excluder

Alternative Hive Models



A top-bar hive COULD HAVE

A pollen trap


Entrances at the ends, and/or the middles

Michael Bush is a successful top-bar user and writer... www.bushfarms.com/beestopbarhives.htm

Alternative Hive Models

A useful shaped tool for working top-bar and Warre hives

Angled blade lowered between combs that are stuck to the edges of the hive, turned flat to the wall, and pulled up. Pushing down would break comb from top-bar.



"Frame lifter" end of this hive tool can be used

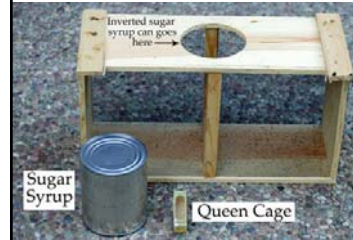
Alternative Hive Models

For any of these alternatives, it would be best to start with package bees because nucs will most likely come from commercial beekeepers using the common Langstroth hives.

However, many of the desired functions of these alternative systems can be easily adapted to Langstroth dimensions...



Getting bees



Packages
1-3 lbs of bees with syrup and an unfamiliar queen
All confused
Needs transferring and more feed immediately

Getting bees



Packages
Remove feed, and queen cage
Shake into box
Place queen cage between frames



Getting bees



Nucleus
1-3 lbs of bees on drawn comb frames with their own honey, and a laying queen
Can live like this for weeks or months

Getting bees



Nucleus
Put all the frames in your set up hive
Make sure queen is in your hive
Leave nucleus near new hive until all bees move into new hive

Types of Bees


Types

- Carniolan
- Italian
- Caucasian
- German
- Russian
- Buckfast
- Hygienic queens (foulbrood, chalkbrood)
- Varroa Sensitive (VSH)

Thoughts

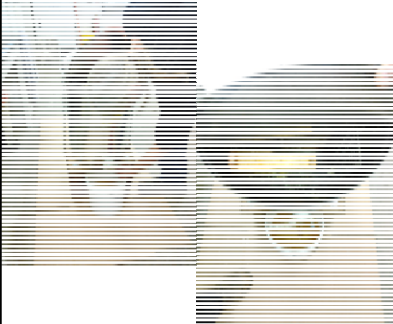
- Lots of cross breeding makes it hard to predict true behaviors
- Most starter beekeepers are just getting Italians or Carniolans from commercial keepers
- Specialty queens

Production of Honey




Uncap the honey cells
Scratchers, rollers, knives

Production of Honey



Regional bee clubs can purchase and share an extractor
Filter or not

Production of Honey



Or, remove entire combs, crush in muslin, or cheesecloth, or nut milk bags, and let it filter into a bucket.

Crop Pollinator Attributes

- Easily manipulated and managed populations in human environments
- Gregarious, with peak of activity coinciding with that of the crop
- Visits a particular crop in preference to other species

PICK 2!

Free, 1970

Honey Bee Hive Recommendations and Cost by Crop

Crop	Average hives per acre	Cost per rental hive (avg \$)
Tomatoes, Eggplants, Peppers	(1)	\$63.20
Squashes, Zucchini	1.5	\$54.00
Cucumbers	2.2	\$58.85
Melons	1.8	\$67.50
Pumpkins	1.5	\$80.70
Strawberry	3.5	\$58.45
Blueberries	3	\$69.10
Apples	1.5	\$53.80
Cherries	1	\$55.00

Value to Michigan

Crop	Total Acreage in Michigan	Crop Value in Michigan	Pollination Cost
Tomatoes, Eggplants, Peppers	7,300	\$45,030,000	\$461,360
Squashes, Zucchini	6,000	\$20,249,000	\$486,000
Cucumbers	33,500	\$51,577,000	\$4,337,245
Melons	600	\$1,113,000	\$72,900
Pumpkins	6,800	\$13,230,000	\$823,140
Strawberry	383	\$4,826,000	\$78,352
Blueberries	11,571	\$118,700,000	\$2,398,668
Apples	23,084	\$201,650,000	\$1,862,878
Cherries	24,292	\$19,013,000	\$1,336,060

Crop Pollination by Bees (Delaplane & Mayer, 2000)
Eastern US (2010) and Pacific NW Survey (2011) of beekeepers

Avoiding bee conflicts

- Follow label restrictions
- Use least toxic options of insecticides and fungicides.
OSU extension bulletin available at: http://bit.ly/OSU_ReduceBeePoisoning.
- Limit sprays during bloom.
- Apply in the late evening/night.
- Do not use dust formulations.
- Minimize drift into flowering borders.



Rufus Isaacs 2014

What should a beekeeper expect from a grower?

- Early commitment concerning number of colonies, anticipated calendar time period, and length of need.
- Provide sites easily accessible for delivery, any-time maintenance, and removal of hives.
- Advise beekeeper of the spray program, and provide 48 hours notice of spraying so bees can be covered/removed if needed.
- Accept liability for damage to the bees from spray, livestock, and/or vandalism.
- Pay the beekeeper in an agreed upon time period, and for any additional movement of colonies in or around the crop.

Rufus Isaacs 2014

Slide from Donald Lam, West Michigan beekeeper

What should a grower expect from a beekeeper?

- Strong, healthy hives.
- Bees delivered to and removed from the crop area in a mutually agreed upon time period.
- If asked, the beekeeper will open and demonstrate the strength of any hive(s) selected by the grower.
- Place colonies in mutually selected locations.
- Leave all gates, etc., the way the beekeeper found them.
- Leave all sites in original condition.

Rufus Isaacs 2014

Slide from Donald Lam, West Michigan beekeeper

SAMPLE HONEYBEE CROP POLLINATION CONTRACT

• CROP _____ Year _____

• Crop Grower _____

• Address _____ Phone _____ Cell _____

• Beekeeper _____

• Address _____ Phone _____ Cell _____

• Agree to the placement of _____ honey bee colonies for the fee of \$_____ per colony at _____ (location) _____

• From _____ (date) _____ to _____ (date) _____

• Under the following conditions:

1. A standard honey bee pollination unit includes a) a laying, healthy queen, b) eight frames covered with adult honey bees of which c) at least four frames contain all stages of bee brood development. If some or all colonies fail to meet the pollination unit standard, a percentage can be determined and the total pollination fee adjusted. (Note: Allow for some natural variation among colonies during the pollination period).
2. During the pollination period, no agricultural insecticides shall be applied on the blooming crop. If an emergency spray application is required, the grower shall provide the beekeeper with no less than 24 hour notice for the protection or removal of the colonies.
3. Colonies must be placed in locations accessible to the beekeeper, and allowance must be given for beekeeping management and inspection.
4. 50% of the pollination fee will be paid on the delivery date of the colonies, and the remaining 50% paid halfway through the pollination service period.

Grower's signature _____
Date _____

Beekeeper's signature _____
Date _____

Another example at: <http://www.emscollege.com/pollination/PollinationContract.htm>

Slide from Donald Lam, West Michigan beekeeper

Pests of Managed bees

- Hive demolishers
 - Wax moth
 - Old or stored comb, weak hives
 - Makes tunnels
 - Ice fishing bait




Pests of Managed bees

- Hive demolishers
 - Mice
 - Skunks
 - Bears
 - Pileated woodpeckers




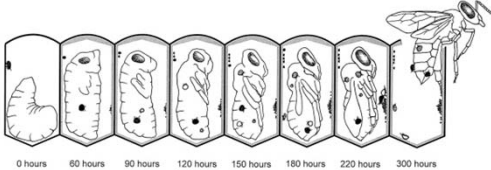
Pests of Managed bees

- Hive demolishers
 - Hive beetles
 - Infested honey frames or weak hives will get “slimed” as they eat comb and honey
 - Sneaky and hide from bees in nooks and crannies
 - Can be trapped in oil pans under bottom board or in cotton wash towels looking for cover



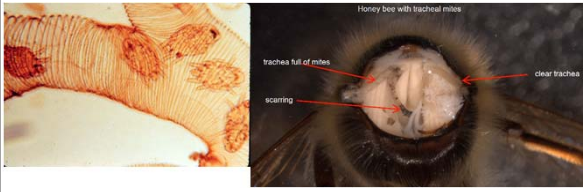
Pests of Managed bees

- Parasites
 - Varroa mite
 - Sucks blood and transfers 11 viruses
 - Monitor with powdered sugar or screened bottom board
 - Look for deformed wings and crawling bees outside hive


Pests of Managed bees

- Parasites
 - Tracheal mites
 - Restrict breathing and flight



Pests of Managed bees

- Diseases
 - Nosema
 - Bee dysentery, spreads, affects digestion, shortens life
 - Look for fecal staining inside and on hive bodies
 - Forager abandonment of queen and nurse bees




Pests of Managed bees

- Diseases
 - Chalkbrood
 - Fungus kills brood and thrives in moist cool environments
 - Bees can usually handle it



Pests of Managed bees

- Diseases
 - American and European Foulbrood
 - Turns brood into goop and eventually becomes crispy
 - Highly infectious between hives...burn treatment



“Organic” considerations

- Untreated wood
- Essential oils
- Organic feed or supplements
- Smoker fuel
- Frame foundation
 - Wax comes from somewhere
 - Plastic is petro-based

Despite all efforts, “organic” honey or wax could not be legally supported with bees flying up to 5 miles

Initial costs

- Boxes
- Frames
- Tools
 - Smoker
 - Hive tool
 - Brush
- Veil
- Bees
- Treatments
- Cultural controls



Thanks!

Saginaw County Office
Ben Phillips
989.758.2502
phill406@msu.edu

Pests of Managed bees

- Demolishers
 - Wax moth (*Galleria mellonella*, *Aphomia sociella*, *Vitula admandsii*), and hive beetles (*Aethina tumida*) in HB and BB
- Masqueraders
 - *Psithyrus* in BB
- Parasites, predators
 - Mites (*Varroa*, *trachael*) in HB
 - Nematodes (*Sphaerulia bombii*) in BB
 - Wasps *Melittobia* in BB
 - Flies (*Conopidae*, *Phoridae*, *Sarcophagidae*: *Brachicoma spp*) in BB
- Diseases
 - Nosema HB and BB
 - *Apicystis bombi*, *Crithidia bombi* in BB