AGRICULTURAL ALTERNATIVES

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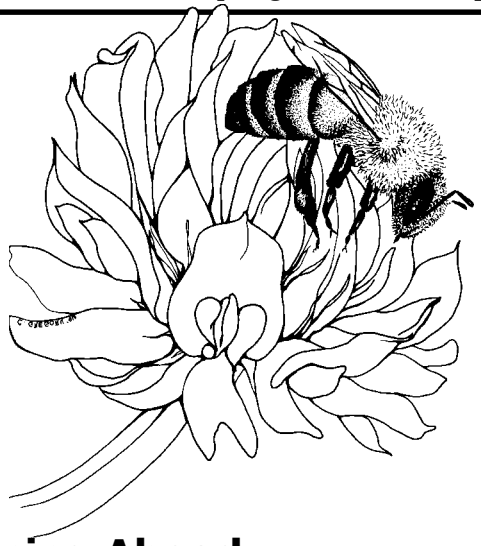
Beekeeping

Honey bees produce or collect a variety of products that benefit people. These products include honey, beeswax, pollen, royal jelly, and propolis. Although honey bees can be managed to produce large quantities of these products, they are especially valued for the major role they play in pollination. While other insects and animals also are pollinators, people have had little control over the actions or numbers of these pollinators. Honey bees' colonies, however can be placed wherever and whenever they are needed. Also, honey bees have additional advantages over other pollinators, such as their availability in large numbers and their instinctive pollen-hoarding behavior. Without the pollinating service of honey bees, the cost of many fruits, vegetables, legumes, and seeds would be many times what it is today.

Although the figures vary widely depending on the source, about 150,000 beekeepers own approximately 3 million colonies of honey bees in the United States. These beekeepers make their living in several ways. Many beekeepers move their colonies several times during the season to produce a variety of honey crops or to pollinate various crops for a fee (apples, peaches, blueberries, or strawberries, for instance). Other beekeepers sell equipment, nucleus colonies, and package bees, or rear and sell queens as a source of income. A few individuals are strictly buyers and packers of honey.

Around 200 million pounds of honey valued at about $140–170 million is produced annually in the United States. Honey is priced according to its color (water white, extra white, white, extra light amber, light amber, and dark amber), with recent prices averaging between $0.50–0.75/lb wholesale in Pennsylvania. About 3.9 million pounds of beeswax worth about $7 million also is produced annually as a by-product of the honey harvest. Beekeepers in other parts of the world rely on the sale of beeswax for the bulk of their return from beekeeping.



Planning Ahead

Good planning is an important part of successful beekeeping. As a new beekeeper, you need to consider the following before purchasing honey bees.

- The number of colonies you will start with
- The location of your apiary and the amount of site preparation that will be necessary
- How and where you will purchase your bees, options include package bees, nucleus colonies, or established colonies
- The equipment needed (such as hives for bees and protective equipment for the beekeeper) and where it will be purchased
- Your budget
- Local and state laws concerning the keeping of bees
- Potential markets for your honey, beeswax, or other products
- Registration of honey bee colonies with your state department of agriculture

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The number of colonies you start with will depend on whether you are planning to keep bees as a hobby, as a sideline for additional income, or as a commercial venture. Many sideline and commercial beekeepers started out keeping bees as a hobby. As a beginning beekeeper, you should start small and let your operation grow with your enthusiasm and experience. New beekeepers often want to start with a single colony, but it is better to begin with at least two or three colonies. While the initial cost is higher, the time required to manage two colonies is no greater than the time required to care for one, and some of the management problems you may face can be corrected with the assistance of a second or third colony.

Marketing

Honey

Producing honey for profit is highly dependent on successful marketing. Successful marketing of honey requires a well-organized marketing plan consisting of at least the following:

- Production of high-quality honey
- Attractive containers and labels
- An effective advertising program
- Dependable service for customers

Most honey in the United States is extracted and sold as liquid honey. However, honey can be prepared and marketed in five different ways:

- Extracted honey
- Section-comb honey
- Cut-comb honey
- Chunk honey
- Finely crystallized or creamed honey

Equipment needs vary depending on the type and quantity of honey you wish to produce. Most beekeepers produce extracted honey. It is more profitable to produce this type of honey under conditions where honeyflows are generally light. Beekeepers who do not want to invest in extracting equipment can produce cut-comb honey, which is relatively easy to process. Section-comb honey, however, requires more equipment, close attention to colony management, and more frequent manipulation of bees than the production of extracted honey. In addition, beeswax, particularly crafted beeswax (candles, ornaments, etc.) is becoming an important source of income for many beekeepers.

Markets for honey and bee products are extensive. You should plan to start small and expand as market demand increases and/or you obtain more/better markets for your products. For detailed marketing information and useful resources, contact the National Honey Board (see section on “More Information”).

Pollination

Renting hives to growers for pollination services can be an important source of income for beekeepers. Contact your local county extension agent or university beekeeping specialist to inform them of your interest in renting your colonies for pollination. To avoid misunderstandings, it is desirable for beekeepers and growers to have a written agreement when honey bee colonies are being rented for pollination services. Such a contract will help to prevent misunderstandings and will ensure a better pollination service. Key points that should be included in the contract are:

- Approximate date to move bees into the crop, or the time relative to a certain condition of bloom, and the approximate date on which bees are to be removed
- Location of crop
- Number and strength of colonies
- Pattern of colony placement
- Rental fee and the date(s) on which it is payable
- Beekeeper will provide colonies of a *minimum* standard to be specified in the contract
- Grower not apply bee-toxic pesticides while bees are in the crop, but, if necessary to do so, the beekeeper will be given a 48-hour notice
- Grower will warn the beekeeper of other spraying in the area
- Grower will reimburse the beekeeper for any additional movement of colonies in, out, or around the crop
- Grower will provide right of entry to the beekeeper for management of the bees while on pollination site.

Acquiring Bees

The best time to purchase bees is in the spring. New honey bee colonies can be acquired in the following ways:

- Established colonies
- Nucleus colonies
- Package bees
- Swarms

Each of these options has distinct advantages and disadvantages. Your decision should be based on your particular production expectations and personal preference.

Established colonies

Over-wintered or established colonies cost the most, but can be a good buy. Before you can purchase the bees, they must be inspected by a state bee inspector to ensure that they are disease free. Weak colonies and dilapidated equipment should be avoided. The advantages of established colonies include:

- The equipment is already assembled
- The queen is present and laying (the quality of the queen can be evaluated by her brood pattern)
- A honey crop is possible the first season
- Information about the history of the colony may be available

Disadvantages include:

- Equipment or bees may be diseased (however, inspection by a knowledgeable individual, such as a state apiary inspector, should alleviate this concern)
- Strong colonies may be difficult for a beginner to handle
- Equipment may not be standard
- Combs and frames may be old and may need to be replaced

Nucleus colonies (nucs)

Nucs consist of four or five frames of brood, honey and pollen, adult bees, and a laying queen. All frames should be covered with adult bees. The advantages of nucleus colonies include:

- They are less expensive than established colonies
- Queens usually are new and can be evaluated by their brood pattern
- If there is a strong nectar flow, nucs usually can produce a honey crop the first year
- They may be purchased locally
- Nucs are not as strong as established colonies; so they are easier for beginners to handle

Disadvantages are similar to those of established colonies.

Package bees

Package bees are caged worker bees with a queen, produced mainly in the southern United States by package bee producers. They consist of either 2, 3, or 5 pounds of bees, a queen (in a separate queen cage), and a canister of sugar syrup used for food by the bees during transport. The 3-pound package is usually the best buy. Package bees should be ordered in January to insure delivery by the desired early spring date. Packages are shipped in special screen mailing cages through the U.S. Postal Service.

Advantages of package bees include:

- Packages are cheaper than established colonies or nucs.
- They are easy for beginners to handle
- There is little possibility of the bees having a serious brood disease

Disadvantages include:

- There is little chance the bees will produce a honey crop the first year
- Because there is no brood, it is not possible to evaluate the queen
- Due to the stress of shipment, queens are often superseded, which can lead to queenlessness
- Introducing package bees into hives may be difficult if the weather is poor
- The bees must be fed until the start of the nectar flow

Swarms

Swarms are another way to get started. Swarms can easily be collected and placed in prepared equipment. It is wise to requeen swarms as soon as possible since old queens head most swarms. The advantages of swarms include:

- Swarms are free
- They are usually easy and fun to collect
- Although some swarms can be quite large, they are easy to handle

Disadvantages include:

- Since there is no brood, the queen's brood pattern can not be evaluated
- Depending on the size of the swarm, the bees are unlikely to produce a honey crop the first year
- Swarm availability is unpredictable

Diseases and Mites

Bees are subject to certain diseases, parasites, predators, and pests. Most pests and predators of bees are easy to control, but diseases and two recently introduced parasitic mites are a great threat to the industry. Diseases may be grouped into two categories: those affecting the brood and those affecting the adult bees.

Brood diseases can be harmful and include American foulbrood (AFB), European foulbrood (EFB), sacbrood, and chalkbrood. The prevalence of American foulbrood makes it difficult to keep bees profitably unless this disease is controlled. Adult diseases include virus and nosema.

Most states have laws prohibiting the keeping of AFB-infected colonies or selling or removing infected bees or equipment. In most states, inspectors are authorized to enter any place where bees are kept to examine hives, bees, and equipment. Inspectors are authorized to prescribe treatment for diseased colonies and order the destruction of those in which the disease is too far advanced to warrant treatment.

Due to vigorous disease control programs, beekeepers suffer few major problems with diseases. The biggest obstacle facing beekeepers today is the presence of parasitic mites (varroa and tracheal). Mites and diseases associated with these mites were not found in the United States until the early 1980s. During the fall and winter, these mites can cause high mortality rates in bee colonies if not properly treated. Beekeeping, whether for fun or profit, is no longer possible without close attention to the control of these parasites.

Initial resource requirements (first-year establishment based on a 10-hive unit in a 50-hive production system).

• Apiary sites	
• 10 package bees (3 lb each) plus shipping	$500.00
• Capital investment	
Brood boxes, frames, and foundation	$467.00
Top, bottom, and inner covers	$250.00
Supers with frames and foundation	$623.00
Protective clothing	$40.00
Hive and tool/smoker	$35.00
Feeder	$23.00
Queen excluders	$57.00
Fumeboard	$25.00
Extractor	$950.00
Bottling tank (300 lb) with cover & strainer	$715.00
Uncapping tank	$195.00
Uncapping knife	$67.00
• *Total equipment investment*	$3,442.00
• Building	
Adapting and upgrading existing facility	$1,500.00
• *Total start-up cost*	$5,442.00

The tracheal mite is an internal parasitic mite that lives and reproduces within the thoracic tracheae or breathing tubes of adult honey bees. These microscopic mites penetrate the tracheae of honey bees and feed on their blood. Feeding by the mites damages the tracheal walls, which blocks the bees' breathing passages. These breathing tubes supply the flight muscles with oxygen. As a result of mite feeding, the flight muscles may atrophy, and the bee may be unable to fly or control its body temperature. Pathogens also may be introduced into the bees' bloodstream by feeding mites.

The varroa mite is considered by many to be the most serious honey bee pest. This mite is an external parasite that is visible to the naked eye. The brownish-red, oval (shaped like a tiny clamshell) mite feeds on the blood of both adult bees and the brood. Heavy parasitism results in bee mortality, subsequent weakening of colonies, and often death.

Efforts to stop the spread of these two mites have been largely unsuccessful, but research into various chemical controls and alternative control techniques such as the use of resistant stocks look promising. For more information on parasitic mite control, contact your county extension office or your university beekeeping specialist or visit the MAAREC Web site at http://maarec.cas.psu.edu.

Sample Budget

Included in this publication is an annual beekeeping budget that summarizes the receipts, costs, and net returns for 10 mature honey bee colonies. It should be noted however, that successful side-line operations typically maintain 50 to 500 colonies. The initial resource requirements explain the start-up costs. There will be no receipts from an operation until the second year. This sample budget should help ensure that all costs and receipts are included in your calculations.

Costs and returns are often difficult to estimate in budget preparation because they are numerous and variable. Therefore, you should think of this budget as an approximation and make appropriate adjustments in the "Your Estimate" column (on right) to reflect your specific production and resource situation. For example, you may decide not to rent your colonies for pollination. More information on the use of budgets can be found in *Agricultural Alternatives: Enterprise Budget Analysis.*

For more information

Associations

National

American Beekeeping Federation
13637 NW 39th St.
Gainesville, FL 32601

American Bee Breeders Association
PO Box 215
Hayneville, Al 36040

American Honey Producers Association
PO Box 386
Minco, OK 73059

The National Honey Board
421 21st Ave. 203
Longmont, CO 80501-1421
Phone (303) 776-2337
Fax (303) 776-1177

Regional

Eastern Apiculture Society
Box 300
Essex, NY 12936
Phone & fax (518) 963-7593

State

Most states and many counties have beekeepers' associations. Information about these associations may be obtained by contacting county agricultural extension agents or state apiculturist.

Books

ABC & XYZ of Beekeeping. A. I. Root Co., Medina, Ohio. 1990. ISBN 0-936028-01-7

The Hive and the Honey Bee. Dadant and Sons, Hamilton, Illinois. 1992. ISBN 0-915698-09-9

How to Keep Bees and Sell Honey. W. T. Kelley, Co. Clarkson, Kentucky. 1991

The Beekeepers Handbook. D. Sammataro and A. Avitabile. Cornell University Press. 1998. ISBN 0-8014-8503-7

Honey Bee Biology and Beekeeping. D. M. Caron. Wicwas Press. Cheshire, Connecticut. 1999. ISBN 1-878075-09-8.

The Biology of the Honey Bee. M. L. Winston. Harvard University Press, Cambridge, Mass. 1987.

Fundamentals of Beekeeping. Penn State Cooperative Extension, Publications Distribution Center, 112 Ag Administration Building, University Park, PA 16802. Updated 2000.

Honey Bee Parasites, Pests, Predators and Diseases. Penn State Cooperative Extension, Publications Distribution Center, 112 Ag Administration Building, University Park, PA 16802. Updated 1999.

MAAREC Resources

These materials are available from MAAREC-member county extension offices, the University of Delaware Department of Entomology and Applied Ecology, or the Penn State Department of Entomology.

1. General
- 1.1 Bees Are Beneficial
- 1.2 Information for Bee-Ginners
- 1.3 What Is the Africanized Honey Bee

2. Starting with Bees
- 2.1 Tips on How to Handle Bees
- 2.2 Beekeeping Equipment & Supplies
- 2.3 Queen & Package Bee Suppliers (not included—under revision)
- 2.4 Sources of Information/Assistance for Beekeepers
- 2.5 Agricultural Alternatives—Beekeeping
- 2.6 Beekeeping for Beginners
- 2.7 Keeping Bees in Populated Areas/Tips for Suburban Beekeepers

3. Bee Management
- 3.1 Early Spring Management
- 3.2 Fall Management
- 3.3 Dividing Honey Bee Colonies
- 3.4 Swarming—Its Prevention & Control
- 3.5 Transferring Bees
- 3.6 Removing Bees
- 3.7 Bait Hives
- 3.8 Honey

4. Diseases/Pests
- 4.1 Chemicals Approved for Legal Use in Honey Bee Colonies for the Control of Parasites and Pests of Honey Bees
- 4.2 Tracheal Mites
- 4.3 Pests of Honey Bees
- 4.4 Stinging Insect Control
- 4.5 Wax Moth
- 4.6 Small Hive Beetle
- 4.7 Varroa Mite
- 4.8 Integrated Pest Management (IPM) for Beekeepers
- 4.9 Bee Diseases & Their Control

5. Pollination
- 5.1 Hives for Hire
- 5.2 Pollination
- 5.3 Moving Bees
- 5.4 Pollination Contracts

Videos and Slide Shows

Price List 2001—All prices include shipping/handling

Varroa Mites: Life Cycle, Detection and Control. 1999. A 16-minute video describing the details of the varroa mite biology and control. Available from Information and Communication Technologies, 119 Ag Administration Bldg. University Park, PA 16802. Phone (814) 865-6309. $25.00

Why Honey Bees? 1993. Video for the public on the importance of honey bees and the current challenges beekeepers face. Available from Information and Communication Technologies, 119 Ag Administration Bldg. University Park, PA 16802. Phone (814) 865-6309. $35.00

Honey Bee Diseases. 1998. Slide set of 53 slides and a detailed script on identification and control of honey bee diseases. Available from the Penn State Department of Entomology, 501 ASI Building, University Park, PA 16802. Phone (814) 865-1895. $60.00

Honey Bee Parasites, Pests and Predators. 1998. Slide set of 67 slides and a detailed script on the identification and control of honey bee parasites, pests and predators. Available from the Penn State Department of Entomology, 501 ASI Building, University Park, PA 16802. Phone (814) 865-1895. $60.00

Publications

Beekeeping Resource Manual. 2001. This manual features a presentation outline of 11 basic topics that could be covered in a beekeeping course. Available from the Department of Entomology and Applied Ecology, University of Delaware, Newark, DE 19713, for $10.00 or on the MAAREC Web site.

Fundamentals of Beekeeping. 1984. Text covering the basics of beginning beekeeping. Information on parasitic mites is currently not included. Available from Penn State Publications Distribution Center, 112 Ag Administration Bldg., University Park, PA 16802. Phone (814) 865-6713. $5.00

Honey Bee Parasites, Pests, Predators and Diseases. 1999. An 84-page pocket-sized color field guide describing the maladies of honey bees and their control. Heavy duty paper, intended for field use. Available from Penn State Publications Distribution Center, 112 Ag Administration Bldg., University Park, PA 16802. Phone (814) 865-6713. $9.00

Computer programs

BeeAware2000: A Master Beekeeper CD-ROM for the Management and Care of Honey Bees. *BeeAware* is a CD-ROM packed with information on honey bee management, accompanied by hundreds of high-quality images and illustrations. Included on this CD is detailed information on honey bee biology, starting new colonies, beekeeping equipment, seasonal management, pollination, queen management, and detailed information on the identification and management of diseases, pests, and parasites. Additional information includes the references used to make the system, a list of apiary inspectors of the U.S. and Canada, and a glossary of all the technical terms used in the system. For additional information or to order, contact the Penn State Department of Entomology, 501 ASI Building, University Park, PA 16802. Phone (814) 865-1895. $50.00

Correspondence Course

Beekeeping, AG 5126. Noncredit course. 2000. This course covers in detail the life history and habits of the honey bee, methods for successful production of comb and extracted honey, seasonal management, rearing of queens, control of bee diseases and enemies of the honey bee, preparing the comb or extracting honey for market, and marketing methods. Available from Penn State, Department of Distance Education, Independent Learning, 207 Mitchell Bldg., University Park, PA 16802. Phone (800) 252-3592. $36.00

For information on these and other extension materials visit the MAAREC (Mid-Atlantic Apiculture Research and Extension Consortium) Web site: http://MAAREC.cas.psu.edu

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Prepared by Maryann Frazier, senior extension associate in entomology; George L. Greaser, senior research associate in agricultural economics; Timothy W. Kelsey, associate professor of agricultural economics; and Jayson K. Harper, associate professor of agricultural economics.

Sample Honey Production and Pollination Budget (established operation)

Summary of estimated costs and returns for 10 mature hives.

Item	Unit	Amount	Receipts or costs per unit	Total receipts or costs (one crop)	Your estimate
Receipts					
Honey (extracted)[a]	pounds	600	$2.00	$1,200.00	_____
Pollination fee[b]					
Spring	hives	10	$30.00	$300.00	_____
Summer	hives	10	$25.00	$250.00	_____
Wax	pounds	5	$2.00	$10.00	_____
Total receipts after establishment				$1,760.00	_____
Variable costs					
Bees (replacement bees)[c]					
Package (3 lb)	hive	2	$45.00	$90.00	_____
Queens (replacement)	queen	2	$12.00	$24.00	_____
Parasite and disease control					
Terramycin	6.4 oz pkg	2	$4.75	$9.50	_____
Varroa chemical control	pkg of 10	4	$28.00	$112.00	_____
Fumidil-B	2 gm bottle	1	$27.00	$27.00	_____
Menthol	10 1.8 oz packs	1	$21.95	$21.95	_____
Sugar	pounds	50	$0.50	$25.00	_____
Jars	cases of 24	21	$10.10	$212.10	_____
Labels (supplier & quality id)		500	$0.10	$50.00	_____
Chemical for fume boards	quart	1	$16.50	$16.50	_____
Paint	gallon	2	$22.00	$44.00	_____
Buckets	5 gallons	10	$5.00	$50.00	_____
Vehicle (fuel, maint., depreciation)	miles	150	$0.45	$67.50	_____
Marketing (advertisement) plus bee management and production information	one year	1	$100.00	$100.00	_____
Registration fee ($20) for two years	one year	0.5	$20.00	$10.00	_____
Total variable costs				$859.55	_____
Fixed costs					
Brood boxes with frames and foundation				$46.70	_____
Top, bottoms, and inner covers				$25.00	_____
Honey supers with frames and foundation				$62.00	_____
Protective clothing				$4.00	_____
Hive tool/smoker				$3.50	_____
Feeder				$2.30	_____
Queen excluder				$5.70	_____
Fume boards				$2.50	_____
Extracting equipment (based on 50 hives)					
Extractor ($945)[d]				$94.50	_____
Bottling tank (300 lb with covered strainer) ($715)[d]				$71.50	_____
Uncapping tank ($195)[d]				$19.50	_____
Uncapping knife ($67)[d]				$6.70	_____
Upgrading existing facilities ($1,500)[ef]				$75.00	_____
Total fixed costs				$418.90	_____
Total costs				$1,278.45	_____
Returns					
Returns over variable costs				$900.45	_____
Net returns				$481.55	_____

[a]Retail price. [b]Rental fee may vary depending on the crop. [c]Estmated 20% loss each year. [d]Depreciate over 10 years. [e]Depreciate over 20 years. [f]Building may not be necessary. Sideline beekeepers often convert a garage, basement, or outbuilding into a honey house.

Net returns from honey sales alone.

	Prices				
Quantities (lb)	**$1.50**	**$1.75**	**$2.00**	**$2.25**	**$2.50**
400	$(678.45)	$(578.45)	$(478.45)	$(378.45)	$(278.45)
500	$(528.45)	$(403.45)	$(278.45)	$(153.45)	$(28.45)
600	$(378.45)	$(228.45)	$(78.45)	$71.55	$221.55
675	$(265.95)	$(97.20)	$71.55	$240.30	$409.05
750	$(153.45)	$34.05	$221.55	$409.05	$596.55

NOTES:

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This publication is available in alternative media on request.

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