

## Beekeeping Assistive Technology



Assistive technology enables beekeepers with medical impairments to manage hives and sell honey. There are many opportunities for sideline apiaries with 20 to 100 beehives to produce honey and provide pollination services to local farms. These hives may be spaced over several miles at various farmers' fields. Revenue comes from renting out pollination hives and selling honey products at on-farm stores, community farmers markets, local retail outlets, or online.

Arthritis, back injury, carpal tunnel syndrome, amputation, paralysis, and other medical conditions restrict beekeepers from completing necessary tasks. Functional limitations include mobility to the hives, bending over to inspect frames, lifting hive bodies, grasping frames, moving hives, gripping hand tools, and hand cranking extractors. While specialized machinery exists for commercial beekeepers, smaller apiaries require more manual labor. It is just not “worth it” to spend annual gross sales to purchase one machine.



Successful beekeepers inspect their hives regularly for bee health, pests, and honey production. This requires mobility across rough terrain to access the hives, then unstacking the hive bodies (weighing up to 90 pounds) and pulling out frames. The challenge of mobility and the physical strain of inspecting hives reduces the willpower to do so and could lead to failure of the enterprise.

This report recommends assistive technology helpful to beekeepers with medical impairments. It is not meant to replace an on-site apiary assessment and accommodations tailored to a specific beekeeper. Please call Michigan AgrAbility at 800-956-4106 to schedule an assessment if this would be helpful to you.

## ***Income, Supporting Organizations, and Customer Contribution***

***Income*** from a common sideline beekeeper with 20 to 200 hives will range from \$0 to \$100,000 per year. A beekeeper's income will depend on how the apiary is managed, what the financial goals are, and the products sold. An average work week in spring, summer and fall could be 20-40 hours per week, while winter work will be much less. If the goal of the apiary is physical activity rather than employment, the scope of the enterprise will be much less as well as the hours of work.



***Supporting organizations*** that assist workers with medical impairments in addition to AgrAbility include Michigan Rehabilitation Services (MRS), Disability Network of Michigan, Farmer Veteran Coalition, Veterans in Agriculture Network, and Michigan State University Extension (MSUE). Local businesses will often give special pricing if a beekeeper is a military veteran or has a disability. MRS specifically helps workers with medical impairments to find and keep jobs. They require medical documentation, and that the apiary business generates at least minimum wage half time.

Disability Network can help identify other community resources, assist with accessibility in the home, and advocate for a person with a disability. The Farmer Veteran Coalition and Veterans in Agriculture Network help veterans returning to civilian life to learn about agriculture as a viable career. MSUE has vast resources and information on agricultural techniques and finances.



If direct funding cannot be secured for all the necessary equipment, low-interest loans for assistive technology are available through the Michigan Assistive Technology Loan Fund. Loans up to \$30,000 can be approved by the committee. Poor credit that is due to the consequences of a disability will be taken into consideration. For more information, visit [MATLF | Michigan Assistive Technology Loan Fund](http://MATLF.org) or call (800) 827-4843.

***Customer contribution*** is critical when seeking other organizations to support the apiary. When beekeepers invest their own money and time into the business, it indicates the purpose and dedication with which they are operating the enterprise. Customer contributions to the apiary are efforts being made personally to improve the accessibility of the beekeeping worksite. Examples are:

- Purchase of shallow or medium supers for easier lifting.
- Moving hives to locations accessible by vehicle.
- Purchase of an ATV to reduce walking.
- Purchase of a hive lift.
- A powered extractor instead of hand cranked.

## ***Specific Recommendations for Apiary Accessibility***

The specific beekeeping tasks limited by the impairments described above are addressed below with detailed recommendations. These are the necessary methods, plans, tools, equipment, and accommodations needed by the beekeeper to continue working **because of the disabling condition**. This is not a comprehensive list because apiary tasks are too numerous and varied to list in their entirety. However, by providing the recommendations listed below, a sideline beekeeper will be able to perform the most important tasks with greater efficiency and increase the likelihood of long-term apiary success.

## ***Ergonomics & Secondary Injury Prevention***

DESCRIPTION: Working safely is always a high priority. When a beekeeper has medical impairments, it is especially important that safety measures are taken to prevent secondary injuries. Beekeepers should follow medical advice and participate only in those activities with a minimal risk of mishap. Always carry an emergency phone.

- Rank accessibility improvements with a ***SMILE***
  - Safety, both yours and your co-workers'
  - increased Money earned or savings
  - value of you Independently doing the task
  - tasks you Like doing, and
  - how Expensive improvements would be
- ***Ergonomic principles*** are especially important to address awkward positions, high force tasks, repetitive motions, and vibrations.
  - Rest at regular intervals during the day and sit on a stool.
  - Alternate repetitive, awkward, and strenuous tasks.
  - Use proper workstation height and store items below shoulder level.
  - Keep commonly used items within 17 inches of the worker's body.
  - High-force hand tools should have 1 3/4" diameter handles.
  - Use long-handled tools to increase leverage and reduce stooping.
  - Add handles to containers and use carts to move quantities of materials.
  - Stand on anti-fatigue mats and wear boots with high-quality insoles.
  - Lift with correct posture, and do not twist while lifting.
  - Carry loads close to your body and split them into smaller loads when possible.
- ***Universal*** Workstation Design Recommendations
  - Step-free entry into buildings and pathways free of clutter.
  - Lever-style handles on doors instead of twist knobs.
  - Store frequently used items 18 to 48" above the floor, keep mobile toolboxes near workstations, and don't use overhead racks requiring ladders.
  - Use multi-height workbenches with adjustable seating, ideally with switches and outlets at the front of the work bench.
  - Floor-marking tape to organize storage areas and uncluttered workspace.

- Label toolboxes and draw outlines of tools on racks for organization.



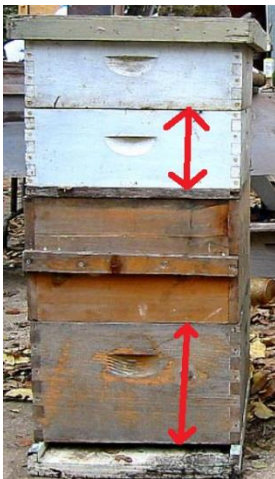
*Globalindustrial.com sells an ergonomic workbench and tool balancer to support heavy tools. Item #[WG249497](#). \$94.95*



## ***Lifting Hive Bodies***

PHYSICAL LIMITATION: Lower & Upper Extremity, Endurance, Back

DESCRIPTION: Beekeepers with limited mobility, endurance, or back strength need to move hive bodies for inspection, transport, and honey harvest. Individual hive bodies can weigh up to 90 pounds when full of honey. The lower boxes are usually full of brood and the queen lives there laying eggs. The upper boxes are filled with honey during the spring and summer. Entire hives may be moved to different fields to aid in pollination, or individuals may need to be lifted to inspect hives for pests or to harvest the honey.



*The shallow and medium sized boxes are far easier to lift than the deep boxes at the bottom of this hive.*

### ***Shallow Hive Bodies***

The most basic assistive technology for lifting honey is to use smaller hive bodies. Shallow hive bodies are 5 ¾” tall instead of medium or deep hive bodies at 6 5/8” or 9 5/8” tall, respectively. Shallow hive bodies weigh around 40 pounds when full of honey, while deeps weigh over 70 pounds. Ergonomic studies of grape harvest workers found that decreasing harvest-tub size from 57 to 46 pounds reduced musculoskeletal injuries by 50% (Meyers et al. 2006). Using smaller hive bodies will have the same impact. This will require more supers and frames to gather all the honey flow, but the health benefits are significant. [Bush Farms](#) has more resources on frame height.

### ***8 Frame Hive Bodies***

Another way to reduce the lifting weight of hive bodies is to use 8-frame bodies instead of 10-frame bodies. These are narrower, and thus hold less honey, but are easier to lift. Adam Ingrao, director of the [Heroes to Hives](#) program at Michigan State University recommends 8 frame equipment for all veterans he works with that are dealing with back, neck, knee, and ankle injuries. The difference between a 10 and 8 frame deep can be up to 10 lbs.



*This hand truck from [handtrucksRus.com](#) would lift whole hives. Item #[HTK2351](#). \$689.95*

### ***Whole hive Moving***

Beehive lifts can be divided into two major categories: whole-hive lifts or individual hive body lifts. Whole hive lifts are simpler, less costly, and more limited in their usefulness. Individual hive body lifts can grip a hive body at any level and separate them at that level for specific management tasks (in addition to moving the whole hive if desired). Whole-hive lifts require a ramp to load hives onto a trailer because they simply tilt and roll.

A heavy-duty, long-plate, two-wheel dolly with wide, all-terrain tires can be used to move whole hives. The hives need a solid bottom board and cleats two inches off the ground, so the dolly can be inserted under the hive before tilting and rolling to a new location.



*Hand hold dollies such as this one from [mannlakeltd.com](http://mannlakeltd.com) lift from the sides of the hive bodies. Item #[MH-105](#). \$659.95*

Hand hold dollies are whole hive lifts with spring-loaded tongs that slide into the grips on both sides of the bottom super. When the dolly handle is pulled back, the bottom hive body lifts the entire hive. A ventilated bottom board can be used with hand hold dollies.



*This two-person hive carrier is a low-cost accommodation that divides the weight in half. Item #[MH-107](#). \$97.60*

### ***Individual Hive Body Lifts***

A two-person hive lift has handles on both sides and tabs that catch on to the hive handgrips. Although typically used to lift whole hives, it can move individual hive bodies depending on what level it grips the hive. The handles are lowered around the hive, then as they are lifted by both workers, the tabs grip the hive and raise it up. This low-cost accommodation divides the weight in half but requires two people.



*Manual and electric versions are available from [beehivelifters.com](http://beehivelifters.com). \$1150 (manual) or \$1650 (electric).*

The Kaptar Lift moves entire beehives *and* lifts individual hive bodies. It can be a hand crank or electric lift and it rolls on two wheels. Once tilted against a hive, the grip pads are raised to the desired hive body, then squeezed tightly with a locking compression lever to grip the hive. The hive can then be lifted and moved to a trailer or vehicle without manual lifting. The challenge is the narrow wheelbase, which causes the lifted hive to be unstable when moving across rough terrain. Dual wheels or attaching the Kaptar Lift to the front of a cart would create a very stable platform for lifting hives.



The beekeeper-designed lifter can be used to move beehives or individual hive bodies. It can be custom fabricated at the apiary if there is access to a welder and tools. It operates like the Kaptar Lift, with a two-wheel dolly base. A cable winch raises arms that straddle and grip the supers. The grip arms are squeezed against the hive with a woodworking clamp. A tab on the arms slides into the hand holds on each side of the hive body. Components would cost about \$200, and it would take a fabricator about 6 hours to build this lifter. The total cost would be around \$650. Watch it work [here](#), or search “hive lift demo” by user BardwellFarms on YouTube.

## *Cranes*



*This DC-powered lifter jib crane has a 400-lb capacity.  
Item #[52837](#) on [northerntool.com](#).  
\$1179.99*



Sideline apiaries can benefit from smaller versions of the truck-mounted cranes used by commercial beekeepers. Small manual or electric cranes are readily available to mount in the bed of a pickup truck for less than \$1000. These cranes can be modified and installed on a small utility trailer also. The crane shown above can reach 40 inches and lift 400 pounds. Industrial articulating cranes can reach 8 feet to the side but cost four times more.





*A crane option for hive lifting tongs could be to modify an EZ Dual Changer (Item #51) from [biermansales.com](http://biermansales.com). \$450*

However, it can be difficult to find a crane attachment that can pick up the hive bodies individually or the whole hive. The attachment needs to lift such that the crane cable is directly centered over the top of the hive. This keeps the hive balanced upright while lifting. A scissors mechanism on the grip attachment causes the weight to ‘squeeze’ the arms against the hive while lifting. This lift attachment shown is a homemade design from [this video](#). Alternatively, find it by searching “portable hive crane” by user The Wombatsplace on YouTube.

These setups range from \$500 to \$3000.

## ***Hand Tools***

PHYSICAL LIMITATION SERVED: Upper Extremity, Strength/Endurance

DESCRIPTION: Gripping tools to pry open hives is a challenge for beekeepers with arthritis, carpal tunnel syndrome, or hand injury. Using wood blocks to prop hive bodies apart during inspection so they do not re-stick on the propolis can reduce repetitive motions.



Longer tool handles increase leverage and decrease force on the hands. Additional information on ergonomic tools may be found on [this blog](#) at [twohiveshoney.com](http://twohiveshoney.com) and search “ergonomics”.



*A frame grip (SKU [FG1](#)) lifts frames with one hand, while the 15-inch giant hive tool (SKU [HT4](#)) provides greater leverage. Both are available from [betterbee.com](http://betterbee.com). \$12.95 and \$13.95, respectively.*

A giant hive tool is 14 or more inches long for extra leverage. The J-hook helps lift frames from the super after the pry-bar has been used to break the propolis seal between boxes. A frame grip allows a worker with weak fingers but strong hands to lift frames from supers.



This [winter sports grip aid](http://www.activehands.com) from [activehands.com](http://www.activehands.com) is \$79.95.

Grip-assist gloves help workers with impaired grip strength to securely hold tools. They use Velcro to hold the hand in a fist without straining muscles. Hammers, hatchets, wrenches, and other frequently used hand tools have small diameter handles that are especially difficult to hold securely. This would help when holding a capping knife, pry bar, hammer, or other tools for a long time.

## **Bee Yard Mobility**



Woody Glover's bee yard (Stephen Clay McGehee) from [volusiabeekeepers.org](http://volusiabeekeepers.org) (Volusia County, FL)



PHYSICAL LIMITATION SERVED: Lower Extremity, Strength/Endurance

DESCRIPTION: When honey production is primary, layout and pavement and location of bee yards are primary. Since the bees are typically kept in the same yard year after year, locate the

yard convenient to the apiary buildings. It is valuable to invest in accessible surfaces around the hives. If pathways around the apiary are difficult to use, the beekeeper will expend much energy walking before doing necessary tasks because of the rough terrain.

Weed cloth around hives is low-cost (\$250) and will keep vegetation from growing but may still be soft enough to operate a wheelchair on. Crushed and well-compacted gravel (\$800) will also suppress weeds and provides firm footing to walk on. Both weed cloth and gravel will require periodic maintenance.



Although highest cost, concrete pathways allow people with mobility impairments to conveniently travel between buildings and around hives. Concrete pathways require no additional maintenance for future use and are in the range of \$3000. Contact your local excavator or concrete supplier for more details.

### ***Beehive Access***

PHYSICAL LIMITATION SERVED: Lower & Upper Extremity, Endurance, Back

DESCRIPTION: All-terrain mobility is a concern when renting out hives for pollination. Hives are moved to various places around fields with rough edges. It is a challenge getting to the site, then lifting hive bodies, moving hives, inspecting frames, filling feeders, and other tasks.



The simplest solution is to make sure hives are only set up on locations easily accessible by vehicle and on smooth flat ground. This is not a feasible situation for many sideline apiaries renting out hives for pollination services. The market farmer down needs hives beside his vegetable fields a quarter mile back a long lane and off-road. Now what? An ATV with supply rack would help and runs about \$4000 and up.

A well-outfitted cart or all-terrain utility vehicle is a great solution for managing off-road beehives. The cart can be pushed manually or power-driven. A pushcart can also serve as an all-terrain walker for workers with mobility challenges or poor balance. All necessary tools and supplies for the task at hand can be carried on the cart, eliminating multiple trips back and forth to get the correct tools. This also helps workers with poor memory. The “Walker' Cart for outdoor mobility” [video](#) posted by Michigan AgrAbility on YouTube offers a good demonstration. It costs about \$600.



*A similar option is available from [globalindustrialsupply.com](http://globalindustrialsupply.com) (model [WBB3132953](#)); \$655.*

A two-level cart can store tools and supplies on the lower level, while the upper level can serve as a mobile worktable to set hive bodies on during inspection. Hive tools can hang on pegs around the sides of the cart. A stool can be mounted directly to the side of the cart, or simply carried on the cart for use in the field. Sitting down to inspect hives on a work platform helps prevent awkward posture while searching for the queen and doing other beekeeping tasks.

A cart could be equipped with a hive-lift mechanism, but this much equipment and weight would be difficult to push around on rough terrain. A powered cart with all-terrain wheels might be feasible in such a situation.



*This steel cart has a 600-lb capacity and includes two batteries. Item [DO-OROAD-400](#) on [platformsandladders.com](#). \$5013*

## ***Workshop***

PHYSICAL LIMITATION SERVED: Lower & Upper Extremity, Endurance, Back

DESCRIPTION: A comfortable workspace is crucial to ensuring indoor tasks are completed in a timely and efficient manner.

### ***Heated Workspace***

A shop heater helps people with limited strength and endurance to preserve energy while repairing equipment. A wood stove or propane heater would be most economical and practical for the apiary repair shop. Beekeepers spend winter days doing maintenance and repairs on equipment to prepare it for the next season. Insulation or partition curtains can help reduce heating costs in larger buildings used as equipment storage and repair shop together.



*Natural Gas Workshop 50,000 BTU heater with LP conversion kit. Item #[27457](#) on [northerntool.com](#). \$549.00*

### ***Rolling adjustable stool***

A rolling shop stool work seat allows a worker to work in an adjustable sitting position. Beekeepers often work in a sitting position for extended periods of time to do equipment repairs, fabrication projects and other maintenance work in the shop. This is a challenge for those who have poor balance and reduced strength and endurance. The rolling seat allows them to move from one position to another without standing up.



*Adjustable rolling stool up to 24" height. Item #[61230](#) on [northerntool.com](#). \$99.99*

### ***Adjustable height worktable***

Mobile lift tables can raise and lower heavy loads and be rolled from place to place around the workshop. Workers can use these in several ways. First, when doing repair projects on the cart, they will be able to adjust the height of the table, so their back is not strained from working in awkward positions. Second, the cart can be used to unload heavy items from the back of trucks and trailers. For instance, an air compressor could be rolled from the truck onto the lift table cart, then lowered to within 15 inches of the floor. Finally, these carts can be used to lift and carry individual boxes and jugs from skids to shelves with little manual lifting.



*32"x19" mobile lift scissor table. Model #[T9F168074](#) on [globalindustrial.com](#). \$499.95*

### ***Floor cushions***

Floor cushions in the apiary shop provide padding to stand on while doing maintenance and making repairs on tools and equipment. Standing and walking on concrete surfaces for long duration causes fatigue and stress to a person's legs and back joints. A padded floor would cushion the effects of standing for so long each day.



*24"x36" anti-fatigue floor mat.  
Item #[171306](#) on [northerntool.com](#).  
\$49.99*

## **Honey Extraction**

PHYSICAL LIMITATION SERVED: Lower Extremity, Back, Strength/Endurance

DESCRIPTION: Aside from purchasing a \$20,000+ automatic extraction system, there are several good options to reduce physical strain. First, and most simply, work with honey in a warm room so it flows. The shop heater shown in the workshop section of this report can be used to warm the room with the frames to be extracted, and the process will be much less difficult. Depending on your location, there may be a beekeeper's co-op with rental equipment or facilities to extract honey. A commercial apiary may 'custom extract' honey for smaller beekeepers for a fee.



*This 6-Frame Power Extractor Kit comes with the extractor/stand, bottling bucket kit, electric knife, uncapping tub, and capping scratcher. Item #[M00410KIT](#). \$1485.95*

If these are not options, then a powered extractor is better than a hand cranked extractor. One sideline beekeeper used a cordless drill to extract honey in five-gallon pails in this [YouTube video](#) called "DIY Drill Powered Honey Extractor" by user featherworks. However, this is not feasible for extracting honey from more than a few hives with either a drill-powered or hand-cranked extractor. Small, powered extractors can be purchased for about \$850 and will relieve the beekeeper with arthritis of turning a crank for hours at a time.





*Electric uncapping knife.  
Item #[M00343](#) on [dadant.com](#). \$208.95*

Another important tool is a heated knife. With hand impairments, reducing the force needed and the time spent gripping a knife to remove the honey cap will be especially important. The heated knife will slice the wax much more easily.

### **Summary of Recommendations**

<b>Farm Site Recommendation</b>	<b>Estimated Cost</b>	<b>Frequency</b>	<b>Longevity</b>
	<b>\$ (for quantity shown)</b>	<b>Uses per year</b>	<b>Useful years</b>
Safety & Secondary Injury Prevention		1000+	Lifelong
Lifting Hives	\$75 to \$3000	1000+	10
Hand Tools	\$85	1000+	10
Bee Yard Mobility	\$300-\$3000	1000+	3 to 20
Beehive Access	\$200-\$2000	1000+	5
Workshop	\$970	1000+	10
Honey Extracting	\$1000	1000+	20

## **Conclusion**

Assistive technology in the apiary will increase the likelihood of success for a beekeeper with medical impairments. Beekeeping is a satisfying enterprise and can be done by workers with functional limitations or disabilities. Modified tools and equipment enable tasks that would otherwise be impossible or unhealthy for the worker.

This report provides a general description of each idea or product presented to aid in understanding its operations and or construction. These descriptions are solely intended to improve comprehension and are not to be viewed as either a set of plans or a substitute for plans. Prior to actual design or fabrication of a complex or potentially hazardous modification, it is recommended that a professional engineer be consulted.

The information provided is believed to be accurate but is in no way guaranteed. The author assumes no liability in connection with any use of the products discussed and makes no warranty (expressed or implied) in that respect; nor can it be assumed that all safety measures are indicated herein or that additional measures may be required. The user, therefore, must assume full responsibility, both persons and property, for the use of these materials including any which might be covered by a patent.

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Please note that prices were current as of February 2024.