

HEALTHY FARMERS, HEALTHY PROFITS PROJECT

1. Organisations involved

University of Wisconsin-Madison's Biological Systems Engineering Department

The U.S. Centers for Disease Control and Prevention

National Institute for Occupational Safety and Health (NIOSH)

2. Description of the case

2.1. Introduction

Farmers and other agricultural workers are constrained to spend much of their time in various unacceptable postures such as stooping, kneeling or squatting and may experience fatigue, muscle and back pain. The risk is increased by manual handling of loads, unfavorable ambient factors, long working hours, etc. Again even light work-related musculoskeletal disorders (MSDs) can contribute to worse injuries later in life.

The Healthy Farmers, Healthy Profits Project started in 1994 striving to help farmers create safer, more efficient and more profitable workplaces. It is funded by grants from the U.S. Centers for Disease Control and Prevention's National Institute for Occupational Safety and Health. Team of the project is comprised of researchers and outreach specialists who have been working with dairy farmers since the conception of the project (vegetable farmers since 1996, berry farmers since 1999 and nursery growers since 2003). The team is searching for new tools or methods that could improve farmers' health, safety and profits. After finding such tools or methods they are evaluated and promoted by various means. Data on farmers' perceptions and adoption of each solution is obtained by an annual mail survey and helps to focus efforts of the team. It should be noted that the University of Wisconsin, NIOSH and project staff themselves has no financial involvement with the design, production or distribution of these tools.

2.2. Aims

Aim of the project is to help farmers prevent pain and injury so they can keep farming, perform daily household tasks and enjoy life. Cost-effective solutions for farming are also promoted. Target audience of the project is nursery, berry and small-scale fresh market vegetable growers in the Midwestern United States and dairy farmers in Wisconsin.

2.3. What was done, and how?

Primary task of the project team is to find and evaluate tools or methods that could improve farmers' health, safety and profits. Solutions are suggested by the growers themselves or searched by the staff from other industries or come from collaborating with growers in development of new methods. The said tools are evaluated comparing the old way with the new. Differences in crop quality, work efficiency or job quality should be visible. After finding proper tools or methods information on them is spread through publications, extension agents, conferences, radio, project website and grower-to-grower exchanges. Each tool or method is described in one-page 'Tip Sheet' (see Figure 1).

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Figure 1: Example of a 'Tip Sheet' on the tool that prevents MSDs (Source: Meyer et al., 2001)

A strap-on stool for field work

Stoop labor is unavoidable on berry and vegetable farms, since at times the plants and soil need to be touched by hand. If you spend too much time stooping, kneeling or squatting, you may experience fatigue, muscle soreness or injuries. One alternative is to use an adjustable, strap-on stool that lets you sit while you work.

How does it work?

The one-legged stool features a nylon belt that fastens around your waist, and has straps extending from the belt to the seat of the stool that adjust to fit your body. Once you have fastened the belt and adjusted the straps, the stool moves with you and is easy to sit down on again in a new location. The seat is made of durable hard plastic, and the single metal leg is adjustable to three different heights for performing a variety of tasks. The lightweight stool features a 3 1/2" wide, spring-like base, so that you do not sink into the ground.

Strap-on stool benefits:

Less fatigue and discomfort.

Prolonged stooping or kneeling to harvest and weed are some of the activities which put vegetable and berry growers in one of the highest risk groups for occupational injuries. If you do these tasks while sitting, you eliminate



She Hapkins of Janesville, WI, uses her "backbone stool" for picking raspberries.

muscle strain and lessen strain on your back, hamstrings, and torso. Your body doesn't get tired as quickly and you can comfortably work for a longer time.

Harvest posture analysis for picking strawberries	Without stool	With stool
Time spent in unacceptable postures	82%	65%
Time spent in marginal postures	16%	34%
Time spent in acceptable postures	2%	1%

Posture analysis was completed as part of the Work Efficiency Institute using the Orono Work Analysis System (OWAS).

Lets you change positions.

Using a strap-on stool lets you move from sitting to standing, and then back to sitting, and then forward-leaning sitting, and then to kneeling. If you change your position often, you can alleviate muscle stress and prevent pain. The strap-on stool lets you give your knees or back a rest. Customers at Pick-Your-Own (PYO) farms might enjoy using strap-on stools. They might find the harvest experience more fun and comfortable with a stool, and possibly pick for a longer time in the process.



A series of tip sheets on labor efficiency for vegetable and berry growers.

By Astrid Newenhouse, Bob Meyer, Marcia Miquelon and Larry Chapman

Both hands free. Some growers sit on an upturned five-gallon plastic bucket or use a padded kneeling stool to give their backs and knees a break. The disadvantage of these types of seats is that every time you move to a new place in the bed or row, you need to pick up your seat and reposition it. Since the strap-on stool fits snugly to your body and moves with you, you have both hands free to harvest, weed, or carry your harvest container.

Affordable. The price for a strap-on stool ranges from \$22-\$38. If the stool saves you the cost of just one visit to the doctor, or enables a handful of U-Pick customers to stay in your fields for longer, then it will pay for itself very quickly.

How can I get a strap-on stool?

The strap-on stool we describe here is designed for milking cows. It is manufactured by Kinna, a Dutch company, and is called the Pick-A-Stool, Farm Milking Stool, or Strap-On Milk Stool. You can also build or modify your own stool to fit your needs. This strap-on milking stool or similar ones can be obtained from:

- Your local farm supply store or dairy equipment dealer (if they do not have one in stock, they may be able to order one for you from the Colman Company, a distributor)
- Nasco
P.O. Box 901
901 Janesville Ave.
Fort Atkinson, WI 53538
1-800-558-9295
www.nasco.com
- American Livestock Supply
P.O. Box 8441
Madison, WI 53708

These references are provided as a convenience for our readers. They are not an endorsement by the University of Wisconsin.

Tips for choosing and using a strap-on stool.

When choosing strap-on stools for field use, look for a stool that is lightweight, has a base that is wide enough to prevent you from sinking in soil, has adjustable steps from belt to stool, and does not have any parts that would be harmed by weather, dirt, or grit.

Make sure that you adjust the straps so that the stool is tight, not wobbly. This gives yourself a few minutes to get accustomed to having a stool follow you around, and to feel comfortable enough to rely on it to support all your weight. If you position your feet so that your knees form a 90 degree angle, you'll have less knee strain.

You'll find that the stool gives you many posture options. You can sit upright, or let it support you while you sit and lean forward, or sit and lean to the side. If you feel like kneeling or standing for a while, the stool will not be in your way (although it may look a bit strange!).

If you are working in very sandy or in loose, wet soil, you may wish to attach a solid base such as a piece of wood or metal to the spring at the base of the stool.

This material was developed by the Healthy Farmers, Healthy Profits Project, whose goal is to find and share work efficiency tips that maintain farmers' health and safety and also increase profits. For more information, call (608) 265-6621 or visit our website at <http://bae.wisc.edu/hfp/>

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Authors: Astrid Newenhouse, Bob Meyer, Marcia Miquelon and Larry Chapman, Department of Biological Systems Engineering, College of Agricultural and Life Sciences, University of Wisconsin, 460 Henry Mall, Madison, WI 53706.

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Work Efficiency Tip Sheet: A strap-on harvest stool for field work



Berry and vegetable farming or nursery work are always related to stoop labour because variety of plant care and other tasks need to be done by hand. Weeding, pruning, plant shaping, harvesting vegetables, berries, seeds, deadheading spent flowers or taking cuttings are very often done while stooping, kneeling or squatting. The work load is increased due to lifting and moving harvest container every time when worker is moving ahead or a container is filled. Therefore vegetable, berry and nursery workers are in one of the highest risk groups for occupational musculoskeletal problems.

Following suggested solutions can help berry, vegetable or nursery grower management improve working conditions, reduce risk factors for work-related MSDs and simultaneously raise profitability.

Portable field stool (see Figure 1) allows worker sit instead of stooping or squatting while working. The stool is fastened to the worker's body by a nylon belt and straps extending from the belt to the seat are designed to be adjusted to fit worker's body. A single metal leg is adjustable to three different heights depending on the tasks performed. The stool moves with the worker and he/she can easily move from sitting to standing and from standing to sitting, then forward-leaning sitting and then to kneeling. If position is often changed use of the stool reduces muscle stress and prevents pain. Furthermore, worker has both hands free for the task at hand.

Results of assessment of field work at seated heights have shown that using the stool reduces time spent in unacceptable postures (stooping, bending, kneeling etc.) from 82% to 65%.

The price for a strap-on stool ranges from 22-38 USD (c €15-27). It could be equated to the cost of just one day the worker can not work due to pain and thus it will pay for itself very quickly (Meyer et al., 2001).

Specialized harvest cart (see Figure 2 a) is a simple device which allows worker to sit and roll while harvesting salad greens and prevents incorrect posture. The cart is designed to straddle the crop bed or rows and the wheels are on the paths between the beds.

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Figure 2: Suggested practices for MSDs prevention (Sources: Meyer et al., 2000a; Meyer et al., 2000b; Newenhouse et al., 2001a; Newenhouse et al., 2001b; Newenhouse et al., 2001c)



a



d



b



e



c

Seat of the cart is mounted between the rear wheels low to the ground that allows work directly over the bed without stooping. Due to design of the seat worker can harvest all parts of the bed without twisting his/her body. The harvest container is placed on the cart frame within easy reach and rolls along with the worker. The cart can be moved forward in the same manner as wheelchair or stepping along with feet on the ground.

Research data of the same task shows: time spent in unacceptable postures without cart is 46%, with cart – 0%; time spent in marginal postures without cart is 48%, with cart – 93%; time spent in acceptable postures without cart is 6%, with cart – 7%. Work efficiency when harvesting salad greens using the cart is 40% higher. Besides, faster harvesting and quicker time to the cooler maintains higher crop quality.

The parts for the cart cost about 150 USD (c €105). Other costs (labour, custom welding or welding shop rental costs) can vary. If 30 minutes per harvest day are saved the cart will pay for itself in 11-18 weeks (Meyer et al., 2000a).

Prone carts (see Figure 2 b) are platforms mounted on snowmobile treads or wheels driven by a

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motor and designed to carry workers in the prone position over the crop row. One or more workers lying face down on padded supports of the platform have both hands free for picking, weeding or tending plants. Thereby stooping, squatting or crawling is reduced or even eliminated when performing these tasks. The platform and the frame can be adjusted to fit individual workers and position both the worker and the undercarriage in respect of the crop row. Steering of the prone cart is performed by one person using foot controls. A harvest container is placed on the cart.

Use of the prone cart eliminates knee and leg strain, and greatly reduces strain on worker's back and trunk and to work for a longer time as worker doesn't get tired as quickly. The cart can be equipped with a canopy that protects worker from sun and rain. Obviously, faster harvesting and quicker time to the cooler maintains higher crop quality.

Base price of the prone cart about 6,000 USD (c €4200) but it can pay for itself in two to three seasons because of saving labour costs and reduction medical costs or miss less work due to musculoskeletal injuries (Newenhouse et al., 2001a).

Long handled diamond hoe (see Figure 2 c) can replace the hoe commonly used for weeding and thus prevent worker's stooping and reduce fatigue when performing this task. The long handled diamond hoe has a diamond shaped four side sharpened blade fastened to a six foot long handle with a 'T' shaped handle on the end. Design of the hoe allows worker stand upright and perform a push-pull motion gripping the 'T' handle with one hand and guiding the hoe with other hand instead of chopping motion commonly used with other hoes.

The test results show that the worker had 8 degrees of forward lean from vertical when using the long handled diamond hoe comparing with 15 degrees of forward lean when using the stirrup hoe. Neck strain with the diamond hoe is less as worker faces forward instead of sideways. Effort required to perform the task and consequently fatigue is also less because the long handled diamond hoe moves less soil and repetitive lifting the hoe is avoided. Design of the 'T' handle prevents wrist strain as worker's wrist and arm is in a neutral position. Field trials prove faster and more precise weeding with a long handled diamond hoe than with a stirrup one.

Cost the long handled diamond hoe is about 40 USD (c €28) and it can pay for itself by saving time and preventing back, neck and wrist injuries (Meyer et al., 2000b).

Hoophouse (see Figure 2 e) is a fairly simple plastic covered unheated structure that allows control growth environment of plants. Along with extension of harvest season, increase of yield and better crop quality improvement of working environment is achieved. Possibility to use raised beds, bags or bench systems for a more convenient height for the plants reduces workers' stooping when harvesting berries or tending plants. A longer harvest season allows spread out the workload and thus to reduce workers' stress and fatigue. In a hoophouse workers are also protected from rain wind, cold and UV rays (Newenhouse et al., 2001c).

Narrow aisle platform truck (see Figure 2 d) is a low hand truck designed to transport boxes of produce at storage places especially with tight spaces and narrow doorways (e.g. converted older buildings, coolers). The truck is composed of a 16 by 48 or 60 inch¹ platform (10 inches off the floor), four small swivel wheels at the corners and two bigger wheels in the center (this allows worker to tilt and turn the truck on its axis) and 52 inch height boards at the ends (for stabilizing the load and pushing the truck). Using the truck a worker can take many boxes in one trip (e.g. 30 flats of strawberries or 15 crates of cabbage) instead of carrying them by hand. Produce can be left and stored on several narrow aisle platform trucks in the cooler.

Use of the truck allows considerable reduction of worker's time and effort related to gripping, hand lifting and carrying of loads, in other words time spent in unacceptable postures. The trials results showed that time spent under load for taking berries into the cooler was reduced by 84% when using a narrow aisle platform truck compared to hand carrying three berry flats at a time. Total number of trips can be cut by at least 75%. Thus potential stress and strain that can be caused to the worker's body during prolonged time hand carrying of boxes is reduced considerably. Besides, keeping produce on a narrow aisle platform truck in the cooler promotes faster cooling.

¹ 1 in = 2,5 cm

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The suggested hand truck costs about from 160–275 USD (c €112-192) and can pay for itself in two seasons (Newenhouse et al., 2001b).

Promotion of the found and evaluated tools or methods is executed by following means:

- Grower-to-grower exchange. It is implemented engaging farmers who are already using the promoted practices. For example there are ten berry farms in Wisconsin, one in Iowa and one in Minnesota cooperating with the project team in promotion of these practices. Growers and agricultural journalists who are interested in particular tools or methods are encouraged to contact and even visit the pilot farmers. Some pilot farmers were trained to serve as presenters at conferences and workshops for the growers.
- Print mass media. Trade publications such as berry or fruit grower magazines, newsletters and seed catalogues which are most regularly read by growers were chosen to present information on new production methods. Agricultural journalists writing related articles at these publications are provided with relevant material (e.g. story ideas, one-page tip sheets, photos, contact details of potential interviewees etc.). The project team registers track of all articles on promoted practices that appear in grower publications. Column inches of coverage these practices for each article are determined by standard methods.
- Public events. Local and regional grower meetings, conferences and workshops are also used to promote new tools or methods. In this case the project staff is assisted by resource people (e.g. university Extension) and pilot farmers. They can exhibit these tools, deliver presentations on new methods and distribute one-page tip sheets about each practice or summary handouts describing several of the practices.
- Resource people are the university Extension horticulture agents, staff at state and regional grower organisations, other advisors. They are provided with one-page tip sheets about each practice and materials in formats suitable to their needs (e.g. business cards and postcards that illustrated the better practices and lightweight, single-use poster displays for field days) to be distributed during their farm visits and group programs. The project staff consults with the resource people on how to improve the joint efforts in this area.
- Radio is used to air short interviews about the work practices on farm radio shows in Wisconsin and other states.
- Internet is the easiest way to transfer information to farmers from the project website where noncopyrighted materials about each practice are freely available (<http://bse.wisc.edu/hfhp/>). The website is announced by postcards sent to resource people and its address is included on relevant business cards, letterhead, exhibits and all printed materials (Chapman et al., 2008).

Data on promotion of hoopouses (over four years), motorized prone cart, long-handled diamond hoe, field stool and narrow aisle platform truck (over three years) among berry growers can be presented as proof and working example. The promotion leader is hoopouses (25 articles with total 569 column inches). The other four work practices were promoted as follows: the motorized prone cart – 10 articles with 169 total column inches, the long-handled diamond hoe – 5 articles with total 129 column inches, the field stool – 6 articles with 113 total column inches, the narrow aisle platform truck – 3 articles with 96 total column inches. In the first intervention year hoopouses were promoted alone at 28 public events in four states. In the next three years all five methods were promoted accordingly at 31, 39, and 28 public events.

An annual mail survey is conducted to learn grower's perceptions of each method, rate of adoption of the new technologies and reasons of the action failure if it occurred. Results from the surveys help the project team to focus their efforts in improvement and promotion of these technologies.

Sampling of mail survey participants from U.S. is based on available sources such as farmer lists obtained from national and regional fruit and vegetable grower organisations or subscriber lists from a regional publication. New Zealand farmers were chosen as a comparison group of the survey. A mail questionnaire was developed using standardized recommendations with emphasis on how information flow to farmers could increase their awareness and adoption of suggested practices. Persons making decisions on the farm management are requested to fill in the sent questionnaire encouraging them by noting importance of the survey and statement that after return of the completed questionnaire each person would receive 10 first class postage stamps (Chapman et al., 2008).

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The returned questionnaires are evaluated picking out eligible responses then these are analyzed and summarized. Results of few years mail survey allows the project team to define the further steps.

2.4. What was achieved?

A presentable example of the project achievements is study of four year annual mail surveys evaluating awareness and adoption among the berry growers of five promoted above mentioned practices for reduction of musculoskeletal hazards (hoophouses, motorized prone cart, long-handled diamond hoe, field stool and narrow aisle platform truck) and use of the project information sources.

The annual mail surveys were performed using the above described method. A mail questionnaire additionally included questions on the farm manager demographic data. U.S. data from seven states over three years of intervention were compared with New Zealand data from the same period.

Results of the study indicate the gradual increase of U.S. berry growers' awareness of four practices over the investigated period. Percentage of the managers being aware of each practice in the year prior to the intervention and the fourth year of the intervention was: the hoophouses – 42% and 65%, the prone cart – 37% and 56%, the field stool – 21% and 40%, the long handled diamond hoe – 40% and 48%. Unfortunately awareness of the narrow platform truck did not increase and was about 20%. As regards adoption it should be said that there were no any progress in this process. Adoption of the hoophouses increased from 0% to 1% over the investigated period, the field stool – from 0% to 2%, the narrow platform truck – from 0% to 3%. The prone cart was not adopted at all and adoption of the hoe decreased from 17% to 12%. There were no significant differences in awareness or adopting rate of all five practices in U.S. and New Zealand after second year of intervention. Awareness of the hoe only became much higher in U.S. than in New Zealand by the end of fourth year.

U.S. farmers participating in the surveys indicated print media trade publications as the most popular source of information on the suggested technologies. The project team found out that farmers' knowledge on the practices is related to the number of articles and amount of column inches on each practice. Public events are also considered as a good information source. It should be noted that greater awareness of the practices really depends on higher farmers' education and gross sales. Besides, purposive delivery of the project materials to the target group by print media and public events was more effective than information reaching by the comparison group in New Zealand.

With reference to the previous research the project team considers following factors influencing poor adoption of suggested practices: farmers' thinking about the existing risk and feeling of uncertainty, possibly low return on investment, too short time-period of presentation and other reasons interfering with introduction of these practices. Researchers draw a conclusion that wider adoption of new tools or methods by farmers could be achieved only after longer than three or four years information dissemination time-period (Chapman et al., 2008).

2.5. Success factors

It is essential for the successful implementation of the Healthy Farmers, Healthy Profits Project that farmers' practical experience, health, safety and economic knowledge and modern research methods are combined in this undertaking. Such approach first of all allows the project team to find new tools or methods that could improve farm workers' wellbeing and farmers' profits. Secondly the found tools or methods are evaluated by the experts from viewpoint of the farm production quality or efficiency and also quality of work conditions and decision on their promotion is made. Thus only the most effective practices are presented to the target audience.

Information on each suggested method is elaborated in the form (e.g. the project website and one-page 'Wok Efficiency Tip Sheet') what introduces the method itself, presents its benefits supported by the results of safety, ergonomic and economic evaluation, the purchase information or drawings for production. This information is sufficient to allow a farmer to make a decision on adoption of particular practice on his/her farm. The promotion activities include such means as various mass media, extension agents, conferences or grower-to-grower exchanges that are used in various combinations. Success of the action is proved by continually increasing farmers' awareness of promoted practices.



An annual mail survey helps the project team to obtain data on change of farmers' awareness and adoption of each practice, allows to determine effectiveness of information dissemination methods or reasons of the action failure if it occurred and to focus their efforts in proper direction.

2.6. Further information

University of Wisconsin – Madison Biological Systems Engineering Department, Healthy Farmers, Healthy Profits Project, 460 Henry Mall, Madison, WI 53706, USA or <http://bse.wisc.edu/hfhp/>

2.7. Transferability

The idea of the Healthy Farmers, Healthy Profits Project could be successfully transferred to each economic sector as a method of finding solutions for prevention of musculoskeletal disorders and other occupational safety and health problems. The particular described tools could be used for various works related to stoop, kneel or squat labour.

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