

PLOWSHARES #6

Breaking New Ground Technical Report

Farming Following a Spinal Cord Injury

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Introduction

In 1979, a young farmer who had recently experienced a high level spinal cord injury (SCI) contacted the Department of Agricultural Engineering at Purdue University seeking information which would assist him in continuing to participate in his family farm operation. That inquiry eventually led to the establishment of the Breaking New Ground Resource Center which has become widely recognized as the primary source of technical information for farmers and ranchers with serious physical disabilities. Early inquiries to the Center revealed that the number of farmers with permanent SCIs was substantially greater than was originally anticipated. Throughout the existence of the Center, individuals with SCIs have comprised one of the major groups utilizing the services of the Center.

The purpose of this paper will be to summarize the experiences gained through contacts with this small but largely underserved rural population and share suggestions for improving accessibility of the agricultural workplace to those with a SCI. It is also felt that the information presented will have positive spin-off effects for those with less severe disabilities.

Scope of the Problem

No one has a definitive answer as to the number of farmers, ranchers, agricultural workers, and members of their respective families who have experienced SCIs and have chosen to remain in an agricultural setting. In 1981, a study done at Purdue by Tormoehlen¹ of 500 randomly selected farm operators did not discover any evidence of SCI among active farmers. Neither did evidence of paraplegia or quadriplegia show up in the other studies reviewed by Tormoehlen.

In 1986, Wilkinson² completed a mail survey of 500 farm operators with unknown physical disabilities who have utilized the service of the Breaking New Ground Resource Center. The sample was drawn from 36 states and 6 Canadian Provinces. It was comprised of approximately 95 percent males having an average age of 44. Table 1 presents the findings regarding the distribution of disabilities reported by the 186 respondents.

Experience has suggested, and the survey confirmed, that those who contact the Center tend to have more

Table 1. Distribution of Farmers by Type of Disability (Wilkinson, 1987)

Disability	# of Farmers	% of Farmers
Paraplegic	68	36.4
Upper Limb Amputee	29	15.5
Quadriplegic	23	12.3
Lower Limb Amputee	18	9.6
Musculoskeletal	14	7.5
Neurological	14	7.5
Lower Leg Impairment	9	4.8
Respiratory	6	3.2
Vision	5	2.7
Polio	5	2.7
Hearing	4	2.1
Back Problems	4	2.1
Muscular Dystrophy	3	1.6
Cardiovascular	2	1.1
Multiple Disabilities	28	15

severe disabilities. Consequently, this data could not be applied to the general farm and ranch population in order to estimate the incidence of SCIs in the general farm population. It is, however, believed that for every individual who is aggressive in seeking rehabilitation services, there are many others who



Figure 1. An estimated 300 farmers/ranchers experience a spinal cord injury annually in the U.S.

remain unserved, isolated from its potential benefits. Factors such as pride, lack of effective communication skills, low self-esteem, low perception of the need, and ignorance of service availability are major barriers which hinder entering the mainstream of rehabilitation services.

The problem of SCI is dynamic. Each year it is estimated that between 10 and 15 thousand new cases are reported in the United States. Considering that agricultural production has the highest work-related fatality and disabling injury rate of any occupation, it can safely be assumed that a proportional number of SCIs are distributed evenly across this population. Thus approximately two to three percent of the new SCI cases would involve farmers or ranchers, or about 300 cases annually (*Fig. 1*).

In no way can it be concluded that this population is of significant size to demand the reallocation of substantial resources to address their unique vocational problems. Considering, however, the narrow scope of service provided by the Breaking New Ground Resource Center, this group has been identified as a primary target population.

Breaking New Ground Resource Center, Purdue University

Barriers to Farming with a Spinal Cord Injury

Farming has traditionally been a highly labor intensive occupation. It has demanded strong backs, unhindered mobility and considerable physical endurance. An evaluation of the essential work-related tasks completed on typical farm operations would reveal many tasks that would be extremely difficult for someone with a SCI to complete, such as handling livestock, climbing grain bins and silos, operating and servicing equipment and moving bulky supplies and materials. In addition, work activities must be completed under a wide range of environmental conditions including rain, snow, dust, mud and high as well as low temperatures; none of which are readily compatible with someone in a wheelchair.

Over the past 25 years, however, agriculture has become increasingly mechanized with tremendous opportunities for improved accessibility to accommodate the limitations of an individual with a SCI. The use of electronics, centralized controls, hydraulics, monitoring systems, computerization and enterprise specialization have opened the door to many previously impossible or extremely difficult modifications. There is presently no completely sound technological justification to discourage individuals with a SCI from continuing to play an active role in a farm or ranch operation with which he/she is familiar and desires to remain a part of (*Fig. 2*). There



Figure 2. Increased mechanization has made agriculture more accessible to individuals with physical disabilities.

is, however, little evidence to suggest that agricultural production should be considered a viable career choice for an individual with a SCI who was not involved in farming prior to their injury.

Experience has clearly shown that individuals with various levels of SCI have successfully remained active as farmers and ranchers. There have even been those with above a C-5 injury who have made major contributions to the management of farms. Most, however, of those who have remained active in the physical aspects of the farm operation have had a thoracic injury (T-1 to T-12). As the level of SCI increases, the number and complexity of barriers encountered increase substantially with respect to both rural independent living and agricultural worksite activities.

Alternatives to Consider

A farmer or rancher who has recently experienced a SCI has several options to consider in the process of returning to work. These include:

1. *Consideration of alternative, off-farm, employment that would utilize skills and knowledge learned prior to the SCI.* This is an appropriate and crucial career choice to consider with the final decision being influenced by both technical as well as a number of non-technological related factors including complicating health-related problems, advanced age, economics, and level of family support. Experience suggests that a major problem with any of these factors can have a direct impact on whether or not an individual with a SCI is able to successfully and profitably return to farming. Any career change can be stressful but does not necessarily reflect failure. Career changes, if made, should be viewed as new opportunities.
2. *Evaluation of essential tasks associated with the present operation of the farm and where necessary reassignment of job responsibilities.* Jobs that are essential, but present a considerable barrier to an individual with a SCI or are too costly to modify might be best assigned to

someone else. If a substantial number of jobs would require costly modifications, consideration might be given to changing the nature of the operation while still utilizing existing resources. For example, switching from milking cows in an inaccessible stanchion barn to installation of an accessible milking parlor or changing from baled hay to silage in order to reduce the amount of required physical labor. Use of Breaking New Ground's "Agricultural Worksite Assessment Tool and User's Guide for Farmers and Ranchers with Physical Disabilities"³ would be helpful in completing this evaluation.

3. *Modification of tools, processes, and worksites that the individual determines as essential to the operation of the farm.* Often the question is not whether a specific modification can be made but rather is such a modification the best use of available resources; and does the desired task make the best use of the individual's skills, knowledge and interests. In some cases, completion of a task is identified as a personal goal and once accomplished becomes less essential. Careful discernment is needed to ensure that costly modifications are made to those items which have the best potential for frequent and long-term use.

Examples of Worksite Modifications

The following section briefly summarizes a few of the areas in which modifications are often needed for the successful return to work of a farmer with a SCI. Additional and more detailed information is also available from the Breaking New Ground Resource Center.

Accessing Tractors and Combines

Getting back into the seat of a tractor or combine is viewed by many farmers with SCIs as being one of the first major hurdles to again feeling a part of the farm operation (*Fig. 3*). Many spouses have suggested that getting back into the field was a major emotional turning point in the rehabilitation process.

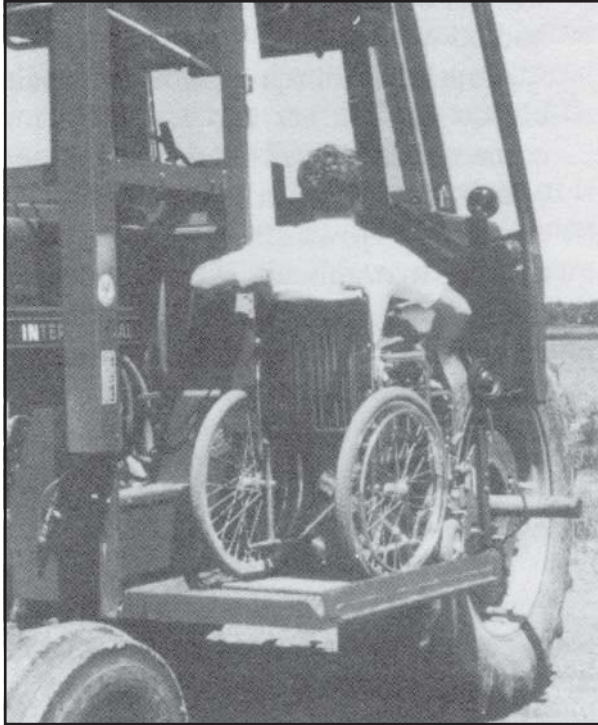


Figure 3. Getting back on the tractor is an important step for farmers with spinal cord injury.

Accessing tractors and combines is being successfully accomplished by hundreds of SCI farmers, including both paraplegics and lower level quadriplegics. Questions concerning tractor accessibility are some of the most frequently received by the Breaking New Ground Resource Center. The rule of thumb presently being used by the Center in responding to these inquires is that, if a person with a SCI has been licensed to drive a motor vehicle, there is no reason that he/she cannot operate a farm tractor.

For many years, the primary means of gaining access to the tractor was sheer strength and determination. Hand holds, padded steps, helpers, and considerable upper body strength were used to get up into the seat. Based on a survey by Wilkinson, the most common used approach presently is the use of man lift attachments that mechanically raise the operator to the operator platform. These man lifts generally fall into one of the following categories:

- Vertical platform lift (Fig. 3).
- Vertical sling lift (Fig. 4).
- Lift seat riding on inclined longitudinal rails.

- Vertical lift seat mounted on an articulating arm (Fig. 5).
- Lift seat mounted on a parallelogram linkage (Fig. 6).

The basic requirements for a lift attachment are generally as follows:

- Provides a seat or platform that securely lifts the operator from the ground to the operator's platform with the needed supports to make a safe transfer to the operator's seat.
- Operated without needing to start the engine of the vehicle.
- Operates at a lift speed of approximately 5 feet per second.
- Designed to provide a lift capacity of greater than 300 pounds.



Figure 4. A widely used approach for gaining access to the tractor has been a sling and manually operated hoist.

- Fail-safe lift operation to avoid free fall, if failure of lift mechanism were to occur.
- Adequate storage position during operation to avoid interference with crops and attachments.

It is suggested that if major modifications are being considered for a tractor or combine that a relatively new model with features such as power assisted steering and brakes and air conditioned cab is considered. Modifications to older equipment is often more difficult and have a potentially shorter life.

For further information on various types of modifications, see “Modified Agricultural Equipment”⁴ published by Breaking New Ground Resource Center.

Hand Controls on Agricultural Equipment

A wide range of hand controls have been developed and are successfully being used on agricul-

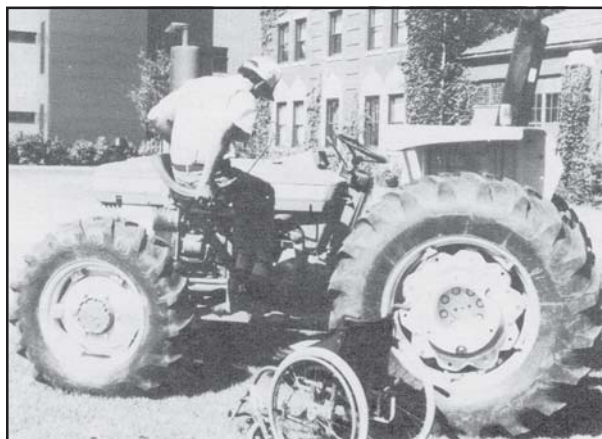


Figure 5. Swing arm lift developed by the Breaking New Ground Resource Center at Purdue.



Figure 6. Vertical chair lift manufactured by Simplicity Lifts of West Lafayette, Indiana.



Figure 7. Hand brakes mounted on a small farm tractor. An over-center mechanism is incorporated to allow the operator to lock the brakes.

tural equipment. These have included mechanical, hydraulic and electromechanical designs. The most common and least expensive is the attachment of hand levers directly to the foot pedals of the tractor or combine (*Fig. 7*).

For additional information on hand control modifications, see “Modified Agricultural Equipment” or “Hand Controls for Agricultural Equipment,”⁵ a special Breaking New Ground Technical Report.

Tractor Accessories

In most cases, it is not necessary to trade tractors after a spinal cord injury. A variety of accessories are available that will make most tractors more accessible and comfortable to operate. If major modifications are planned, however, it might be wise to consider purchasing a newer model that has more years of useful life left.

Seat modifications could be needed depending on the age of the tractor and the farmer’s level of injury. Some of the older tractors have seats which lack proper back support, seat belts or padding needed for someone with a SCI.

Replacement seats are available for many models through local dealers. Most seating on newer farm machines is ergonomically designed and provides good protection and comfort. In some cases, rather than changing the seat, reducing the amount of operating time might be more advantageous in reducing back problems and general fatigue.

Operating a tractor without a cab exposes a SCI farmer to extremely hot and cold working conditions. Naturally the first suggestion would be to install a cab on every tractor. This is possible for most, but not all, newer tractors and can be extremely expensive. If a cab is not available, the next best accessory for summertime working conditions is a sun canopy. It is recommended that every tractor also be equipped with a rollover protective structure (ROPS). One-half of all tractor-related deaths result from tractor overturns. A wind breaker for the tractor with a windshield would reduce exposure to winter working conditions but often increases accessibility problems.

Many of the controls on trailing implements that were formerly manual are now electrically controlled. One example is the spout controls on silage choppers. All of the controls on the new pull-type silage choppers are controlled from inside the tractor cab. Some older units can be converted to this type of control.

Hitching Trailing Equipment

Hitching and unhitching agricultural implements to the tractor is a universal problem for farmers with a SCI. The weight, size and complexity of newer farm implements make this task difficult, in many cases, for even two strong men. In some situations, the only safe alternative is to have an able-bodied worker hitch up the equipment.

A variety of hitching aids are available on the market, and some tractors come with a “quick-hitch” attachment which has made hitching easier for everyone (Fig. 8). However, the problem of making hydraulic, PTO and electrical connections can be



Figure 8. A variety of hitching devices have been introduced which reduce the need to manually hitch trailing implements.

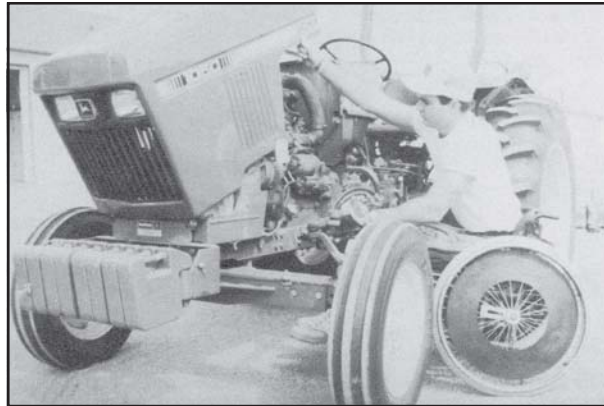


Figure 9. Many service/maintenance tasks can be performed by spinal cord injured farmers.

troublesome for someone with a SCI. These tasks will often have to be left to someone more mobile.

Service and Maintenance of Equipment

The Wilkinson study indicated that service and maintenance of agricultural equipment was a serious barrier for almost half of those responding. There have been numerous approaches to this problem with each being dependent upon the individual's physical abilities, economic resources, type of equipment involved and the nature of the farm operation.

If repairs are done on the farm, a well laid-out farm shop with a smooth working surface is essential. Additional suggestions for improving the accessibility of the shop are provided in a later section.

There is no reason why most farmers with lower level SCIs cannot complete basic maintenance tasks such as changing the oil, servicing filters, lubricating equipment and completing many small repair jobs on tractors and combines (Fig. 9). The wheelchair does not have to totally restrict mobility when doing work in and around equipment. With the use of crutches, braces and mobile standing aids most service points can be reached (Fig. 10). A major exception, is servicing the engine compartment on large tractors, combines and self-propelled harvesters. Engine compartments are typically 6-10 feet off the ground and often demand considerable physical flexibility. It might be best to assign those tasks to others. In some cases, service contracts have been

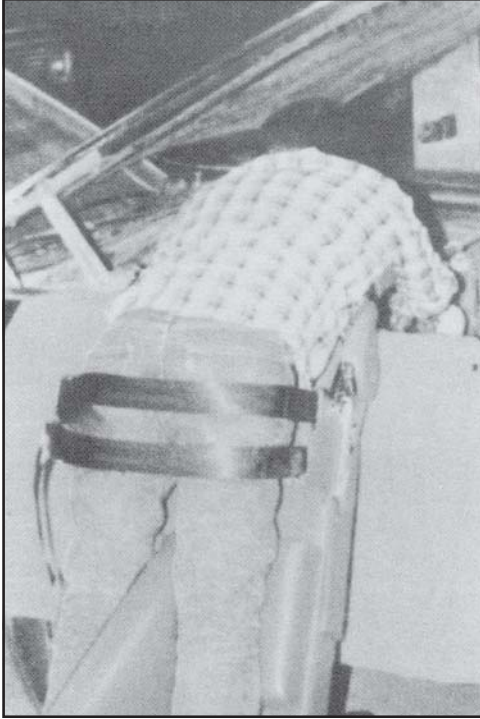


Figure 10. Standing aids can be used to improve access to work areas unreachable from a wheelchair.

arranged with local equipment dealers which include preventative maintenance and regular service of equipment. In the long run this approach may be more economical than making major modifications to the equipment.

Time spent maintaining equipment is a good investment. Well-maintained equipment is more dependable, more productive and worth more at the time of resale. This type of work is familiar to most farmers but is often neglected. Following a SCI, farmers report that completion of basic maintenance tasks is highly rewarding, both physically and mentally.

Communications

Being able to communicate around the farm, where distances can become great at times, improves productivity, efficiency and adds to personal safety. It is believed that a well maintained communications system is essential for a farmer with a SCI.

Both CB and FM two-way radios have been successfully used to provide instant communications.

There are advantages and disadvantages with both types. For example, the FM system is private and more powerful but considerably more expensive.

In addition to installation of radios on all major pieces of equipment used in the field, phones should also be installed in major buildings. Some individuals with SCIs have also gained access to local sheriff or police emergency communications systems in order to obtain help if needed. In some areas portable pagers might prove effective.

Farmstead Mobility

Mobility around the farm or ranch is one of the first barriers a person with a SCI faces when returning home. The diversity of terrain, poor drainage, rough surfaces and the sheer size of some farms can present severe obstacles.

Wheelchairs for farm use should use the largest tires and casters available in order to increase maneuverability over rough ground. Although both pneumatic and polyurethane tires are appropriate for use around typical farmsteads, the pneumatic tires have been preferred for outdoor use because of their shock absorbing capabilities and smoother ride over rough ground. The polyurethane tires, however, have advantages in the farm shop where sharp objects tend to shorten the life of pneumatic tires due to punctures and cuts.

Family harmony is often improved if at least two wheelchairs are available; one for outdoors and one for the house. This is especially true on livestock farms where manure and mud ends up on everything and can be easily tracked inside on tires. (Most farm wives do not like it when their husbands bring their work home.)

Concrete walk and work areas, graded driveways and ramped doorways can make most farmsteads highly accessible for the wheelchair user. Wooden boardwalks and even used conveyor belts may be used to provide a smooth pathway (*Fig. 11*).

To allow the farmer/rancher access to outlying areas of the farm, adapted all-terrain vehicles—ATVs— have become widely accepted by those

with SCIs (*Fig. 12*). The ATV provides tremendous flexibility and now comes with accessories that allow for completion of a wide array of work activities. More information on selection and modification of ATVs for physically impaired farmers is available through Breaking New Ground.⁶

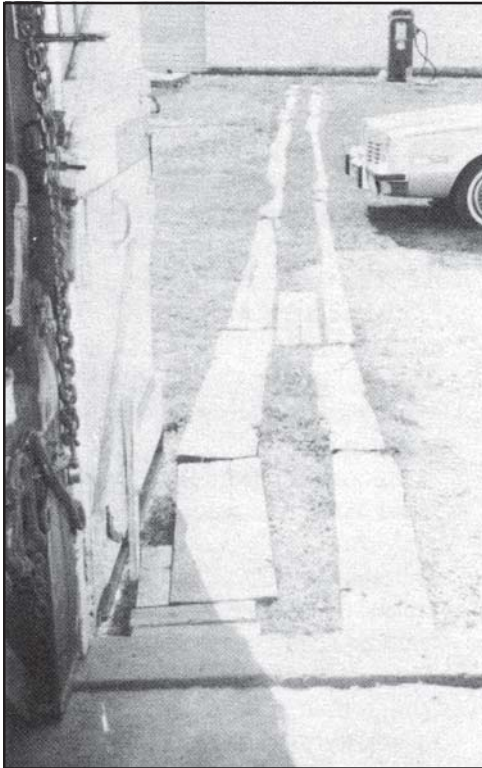


Figure 11. Simply constructed boardwalks allow easy wheelchair use, especially in wet weather.



Figure 12. ATVs have been widely used by farmers and ranchers with spinal cord injuries to improve access to their property.

Accessibility to Farm Buildings

A wide variety of modifications have been documented which have improved the accessibility to existing farm buildings. In addition to ramping, wider doorways and mechanical door openers, farmers with SCIs have installed homemade elevators to reach different levels, modified milking parlors to make them wheelchair accessible and remodeled swine facilities to allow access to most areas of the production process.

Since many farmers are locked into expensive facilities, designed and built prior to their SCI, major structural changes to make them accessible must be planned carefully. Again, as discussed earlier, some SCI farmers have decided to more effectively utilize their management skills than attempt to gain access to every area of the operation and perform tasks that could be more easily handled by others.

One of the buildings most frequently modified is the farm shop. It is where much of the activity of farming takes place. The farm office is often located there and at times the shop provides a safe haven to work and think when things are not going well elsewhere. Improving the accessibility of the shop often has a positive rippling effect on many other aspects of the operation (*Fig. 13*).

Following are ideas to be incorporated into an existing shop to make it more wheelchair accessible:



Figure 13. The farm shop is high on the priority list for making needed modifications such as lowered work benches.

- Entrance barriers such as steps and narrow or heavy doors can be modified by installing ramps and manual or automatic door openers.
- A smooth concrete floor provides a solid work area for large equipment and improves wheelchair mobility. Where concrete is not feasible due to cost, alternative materials such as finely crushed limestone or packed clay could be considered.
- The primary work area should be heated to provide for year-round use. A heated shop could also provide a workplace to pursue other income-generating activities during the off-season. This might include small engine repair, woodworking, small-scale fabrication and welding services.
- If the shop is heavily used, consideration should be given to installing toilet and washing facilities.
- A telephone, if not already present, should be high on the list of needed modifications.
- Good lighting, especially at lower levels and over workbenches, will likely improve both safety and productivity.
- Stationary power tools such as power saws, drill presses and grinders should be located far enough apart to allow easy maneuvering and in some cases will have to be lowered to make them accessible.
- Lowered workbenches, storage shelves and bins and electrical receptacles will improve productivity. Suggested workbench height for someone in a wheelchair is approximately 30 inches. Air hoses and electrical extension cords can be suspended from the ceiling in retractable fixtures to keep them off the floor and within reach.
- One useful addition for some farmers is a portable tool holder or tool boxes mounted on wheels or casters (*Fig. 14*). This will allow the basic tools to be moved to the worksite saving trips back to the workbench.
- Pneumatic- and electric-powered tools have been found to be helpful since those with SCI normally need one hand or arm for balance. The level of energy required to tighten nuts and bolts or perform other repetitive tasks is greatly reduced.

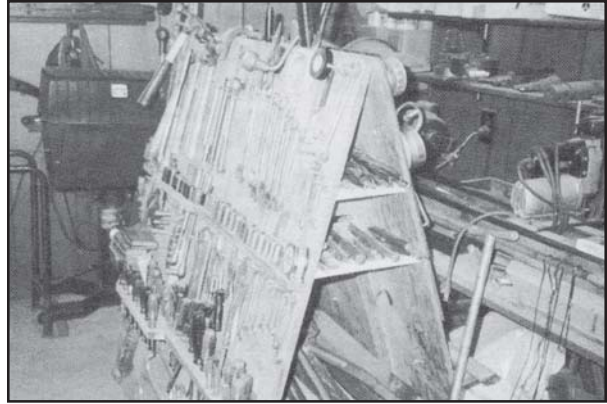


Figure 14. Mobile tool holders and tool boxes help save trips to the worksite.

In the words of one farmer, the farm shop is where he spent most of his time and he wanted it as accessible as his home.

The design of most livestock buildings and crop storage facilities make modification to accommodate a wheelchair extremely difficult. Stanchion barns with their gutters, traditional hay mows filled with baled hay, grain bins and silos, and feed lots with 500 nervous beef cows present both major challenges and opportunities. In many of these situations, acknowledging that some of the jobs performed prior to the SCI would be better assigned to someone more mobile, is a major step forward. In other cases, relatively simple modifications will greatly improve accessibility and will allow active participation in numerous farm operations (*Fig. 15*).

Breaking New Ground has additional information on modifying livestock buildings including a publication entitled, “Providing Wheelchair Access to Livestock Buildings.”⁷ One of the best resources is another farmer who has already made the modifications. A one-day visit to actually see what works and what doesn’t can save a great deal of time, money and frustration.

Work Practices

Spinal cord injured farmers who are returning to farm work should be very cautious when planning their work schedule. The body has been through a tremendous amount of shock, and the stamina that

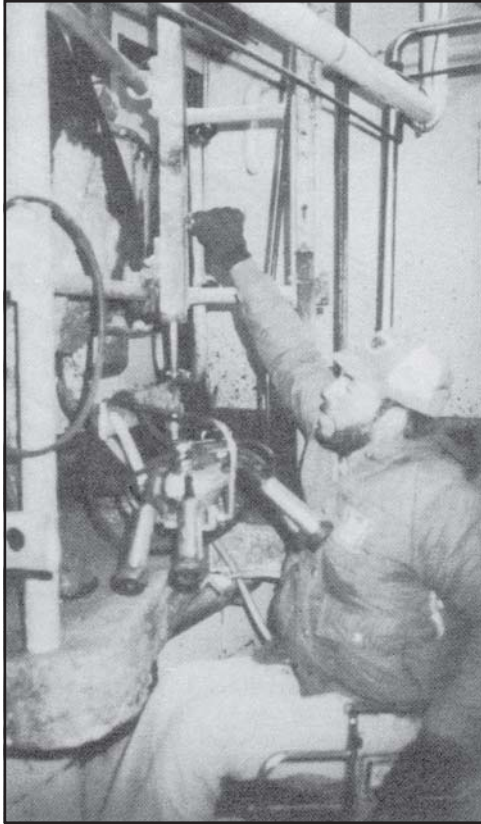


Figure 15. Even livestock facilities such as milking parlors have been modified to accommodate wheelchair users.

once existed will need to be re-established. At no time during a farmer's life will farm work be more strenuous than after a SCI.

All farmers with recent SCIs, especially higher level injuries, need to start off doing farm work at a gradual pace. The bounce and vibration experienced during the operation of a combine or tractor may cause more fatigue now than before a SCI but has been reported by some to have a therapeutic effect. The ability to rest and recover has also been reduced. This readjustment period should not be rushed, it may take one-to-two years to recover completely.

When the work schedule requires driving a tractor or combine several hours during the day, drinking water, a snack and some extra clothing should be taken along. Sometimes a delay in the field cannot be avoided and these items will come in handy. During summer months when temperatures are high, working at night can reduce the potential for heat

stress. Consumption of extra liquid, more frequent rest breaks and shade are important. Tractor cabs with air conditioning should be given serious consideration. During winter months, freezing temperature, poor circulation and lack of feeling in the lower extremities has the potential for causing frostbite. Layered clothing and close monitoring of affected areas are needed.

Safety Considerations

The risks associated with agricultural production are considerable and should be foremost in the mind of the farmer or rancher with a SCI. Tasks that were once performed as "second nature" now must be done methodically and cautiously, otherwise the potential for secondary injuries increases.

There have been numerous reports of helpers and bystanders being injured or involved in "close calls" due to the efforts of the disabled individual to complete a hazardous task. In some cases children and inexperienced family members are called upon to operate equipment or complete other jobs beyond their capability. No job associated with a farm operation is so important that it justifies exposure to unnecessary risks. For more information on safety issues relating to farming with a physical disability see the Breaking New Ground publication, "Potential Health and Safety Risks of Farming with Physical Handicaps."⁸

Summary

Experience gained through the activities of the Breaking New Ground Resource Center clearly suggests that it is possible to successfully modify a farm or ranch operation to accommodate the desire of an individual with a SCI to continue participating in the operation. Successful case histories can be documented involving individuals operating dairy, beef, cash grain, hay, vegetable, poultry and hog farms. This includes both paraplegics and quadriplegics. It is also clear that most of these farmers have yet to realize the tremendous benefits that are possible through the application of recent develop-

ments in rehabilitation technology to their worksite. There is no reason that as more is done to improve the accessibility of agriculture to those with physical disabilities, the need to leave the farm will become influenced more by choice than necessity.

References

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RESOURCES FOR FARMERS WITH SCI

Organizations

The American Paralysis Association
P.O. Box 187
Short Hills, NJ 07078
(800) 225-0292

The American Spinal Injury Foundation
250 E. Superior St. #619
Chicago, IL 60611
(312) 649-3425

The Paralyzed Veterans of America
801 18th St. NW
Washington, D.C. 20006
(202) 872-1300

The Spinal Cord Society
2410 Lakeview Dr.
Fergus Falls, MN 56537
(218) 739-5252

National Spinal Cord Injury Association
600 W. Cummings Park, Suite 2000
Woburn, MA 01801
(800) 962-9629

National Spinal Cord Injury Hotline
(800) 526-3456

Periodicals

Paraplegia News
5201 N. 19th Ave., Suite 111
Phoenix, AZ 85015-9986
(602) 246-9426

Disability Rag
P.O. Box 145
Louisville, KY 40201

Mainstream
2973 Beech St.
San Diego, CA 92102
(619) 234-3138

Challenged American
Box 4310
Sunland, CA 91040
(818) 353-3380

A Positive Approach, CTEC
1600 Malone St.
Municipal Airport
Millville, NJ 08332
(609) 327-4040

Independent Living
Equal Opportunity Publications, Inc.
44 Broadway
Greenlawn, NY 11740

Books

*Spinal Network: The Total Resource
for the Wheelchair Community*
P.O. Box 4162
Boulder, CO 80306
(800) 338-5412

*Spinal Cord Injury, A Guide for
Patient and Family*

Raven Press
1185 Avenue of the Americas
New York, NY 10036

*Options: Spinal Cord Injury
and the Future*

Available from the
National Spinal Cord Injury Association

*Directory of Recreation Resources
for the Handicapped*

11066 Gonsalves Place
Cerritos, CA 90701

*Living with the Disabled: You Can
Help, A Family Guide*

Sterling Publishing Co.
Two Park Ave.
New York, NY 10016

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