

Development of Cultivation Equipment for Diversified Vegetable Production

Final Report for FNC97-169

Project Type: Farmer/Rancher

Funds awarded in 1997: \$3,194.00

Projected End Date: 12/31/1999

Region: North Central

State: Minnesota

Project Coordinator:

[Joe Lancaster](#)

Wilder Forest Farm

Project Information

Summary:

PROJECT BACKGROUND

That farm consists of 100 acres, and is part of a 25 member CSA farmer's guild. The CSA acreage, pasture, hay and small livestock facilities are farmed directly by the producers. About 20 acres is used for community gardens. The majority of the produce grown on the CSA is sent to St. Paul food selves. This is done with the support of a large non profit agency known as the Amherst H. Wilder foundation. The farm is also used extensively by the Wilder Foundation as part of the environmental education and program services to the city of St. Paul. About 9,000 youth come out to the farm every year.

PROJECT DESCRIPTION AND RESULTS

Goals and Objectives:

Development of improved cultivation equipment for diversified vegetable production.

- Increased accuracy and speed
 - o Closer to plant row
 - o In row weeding
 - o Shallow depth cultivation
- Increase versatility
 - o Multiple row spacing
 - o Multiple crop varieties
- Address difficult soil conditions
 - o Improved performance in heavy soils, wet soils, crusting and compaction
 - o Improve conditions for consecutive passes
- Improved destruction of growing weeds

Description of Cultivar Unit

The current design of the cultivar meets many of my objectives, but still has room for further development and improvements. Objectives were met in the following areas:

- Increase accuracy and speed
 - o Closer to plant row
 - o In row weeding
 - o Shallow depth cultivation

Guidance system: A simple guide rod mounted on the belly of the tractor along with two concave disks, (one on each side of the tractor belly), allowed placement of a guide furrow at a specific distance from the plant row on each side of the vegetable bed. This eliminates the need for the pre established guide furrows that the original unit attempted to use, which could not be well maintained for a number of reasons.

The cultivator (a pull behind unit) is mounted on two round pipe skids. These skids ride in the furrows created by the belly mounted discs. Accuracy at speeds up to 5 mph is excellent and is only limited by how well the tractor operator can keep the guide rod following the plant row and how straight the rows have been planted.

Tools: The greatest improvement to how close to the plant row the cultivator could work to came from the design of some six inch cut away discs I had made. I chose cut away disks over other tool types because their action allows for very close work to the plant row without burying the row. Their action also creates a shallow furrow that accommodates the use of side knives and shields, improving their functions (discussed later).

These disks utilized an older belly mount cultivator design with some modifications. Since I had difficulty locating some of the old model discs I had these laser cut from some standard 16" concave disks and ground to a very sharp edge. The angle of cut, both vertical and to the plant row was critical.

I was very pleased with the performance of these disks for the following reasons: 1) they cut very cleanly and would not throw any dirt onto the plant row, 2) they worked well in a number of soil conditions from very crusted to wet, from loose to heavily weeded, 3) they improved the function of other tools, and 4) they worked well in soil with crop residue.

Combined with the guidance system I was able to achieve my goal of being able to work within one inch to the plant row (a total of two inches uncultivated). Being able to work this close to the plant row increased the ability of other tools to destroy weeds in row. It also drastically minimized the amount of hand hoeing that would need to be done. For finer crops like carrots or lettuce a shield to eliminate burying of the row by other tools on the cultivator would allow faster speed when working these crops.

Depth: Depth control is currently achieved by manual control of the three point hitch hydraulics. Because the vegetable beds were not always perfectly flat there was some difficulty maintaining good consistent depth. This was only a serious problem when conditions were poor, such as very wet soil or very tall weeds.

- Increase versatility
 - o Multiple row spacing
 - o Multiple crop varieties

Working a system of row spacing that include; two rows per bed 30" apart, four rows per bed at 10" apart, and single rows (using one of the rows on the 4 row system), allows for a great deal of flexibility and minimal tool changes or adjustments.

Tool selections as mentioned in the previous section show the ability of the unit to work a very large number of vegetable types. I currently use this unit for cultivation of approximately 30 types of vegetables. Tool bars and round shank standards made adjustments quick and easy, although the industry could improve this area dramatically. Additional tools can be added easily to perform such tasks as scurfing

or hilling of beans or corn.

- Address difficult soil conditions

o Improved performance in heavy soils, wet soils, crusting and compaction

o Improve conditions for consecutive passes

A key component of the cultivator is the spring tine weeders. These tines are very effective in destroying germinating weeds seeds in loose soil. They can be used for stale bedding a plot prior to planting, and are very good for pre emergence cultivation. They can also be used to control in row weeds for a number of sturdier crops like corn, beans, or broccoli and they do a fair job of raking out small weeds. They are not, however, very effective in crusted soils.

It was exciting to see the benefit of the gang of small cut away disks with regards to dealing with crusted soil. Properly angled and spaced for the 10 inch row spacing, they were very effective in working the crusted soil. Lightly crusted soil crumbled from the action of two opposing disks pushing the soil towards each other and into itself. While not as pleased with the outcome of the same action in heavily crusted soil the results were still acceptable even for some of the finer crops. This was good as I had already begun work on a tool for busting the crust, which I no longer feel is necessary.

The initial crumbling of the soil by the disk is further complimented by the action of the spring tines. The result of the combined actions is a crumbly yet fairly smooth surface that is less conducive to weed growth and is in good condition for future passes with the cultivator.

The action of the cut away disks and the spring tines combined with side knives or other sweeps is reasonably effective in destroying weeds that have already begun to grow. This is very helpful in wet years where timing is a big problem. Also speaking of wet years, since this cultivator is designed to work at a very shallow depth it allows the farmer to cultivate much sooner after a rain than would be typical. This also increases the window of opportunity to control weeds when it is critical.

Further Development:

Although the grant period is now complete I intend to further develop this implement, because it shows so much potential. Areas that need further development or improvement are:

1) Best tools for working in the wheel track area. Too many or the wrong type may interfere with the guidance system.

2) Trying guide skids in the wheel track to allow cleaner cultivation around outer plant rows.

3) Attach skids shoes to cut away disks for precision depth control to eliminate manual control of depth

4) Mount guide furrow disks and cultivator skid on hydraulic legs to improve functions. The ability to easily raise the skids up to allow use of the spring tine without the other tools would improve its use in stale bedding and pre emergence cultivation

5) Develop shields for protection of finer crops

OUTREACH

I have had some wonderful opportunities to share information learned through the development of this project with a number of people through various workshops and presentations.

- In the winter of 1998 I had the opportunity to share the design concepts with a number of farmers through a presentation I gave at a weed control workshop put on by MISA (Minnesota Institute for Sustainable Agriculture).

- I also presented my experiences and information at the Upper Mid-west Organic Conference in St. Cloud in the spring of 1999.
- I also presented information about the cultivator (and showed the unit) to farm interns who came to the farm to learn about weed control through a local CSA farm intern program
- In spring 1999 I collaborated with Michael Fields Agricultural Institute to bring their Advanced Organic Vegetable Growers workshop to our location. This workshop had been previously funded by a SARE grant. As part of a three day intense educational workshop, growers were introduced to various methods of mechanical weed control that included a half hour presentation of my cultivator. Approximately 40 growers were shown the unit and I discussed the concepts behind the tool system and the tools themselves. I also was able to get feedback from the farmers as well that helped in the further development of it.
- I am currently one of several farmers, University educators and Extension Service agents taking part in a two year SARE funded program through the University of Minnesota Agronomy Department whose focus is studying weed control methods. At monthly meetings we meet to share scientific data and real life experiences in the hope of improving control methods. There is much interest in the development of my cultivator and the shallow cultivation techniques, as a result of this interest we are combining the research efforts of both programs for the mutual benefits derived from such cooperative efforts.

Research

Participation Summary

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture or SARE.



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