

Application of Mulch till Techniques in Small-scale Agricultural Production

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Small Scale Agricultural Production requires constant adaptation of techniques and procedures that are usually developed for large scale agricultural operations. Since 1980 there has been a gradual but consistent shift from agricultural production in small farms to larger farms producing commoditized crops¹. This creates a challenge for small scale producers as tillage tools, are developed to be used in large farms. Governmental agencies tend to focus extension research on developing techniques to utilize these tools at a large scale, leaving the small-scale farmer with few options to gather information on techniques and procedures. In this paper the practice of mulch tilling for soil conservation will be introduced followed by recommendations on tools small scale farmers can use to adapt this practice to their operation

Conservation tillage is broadly defined as “...tillage methods that disturb the soil less than “conventional” and was originally promoted as a soil and water conservation technology”². Although these practices have been around for decades they are still not widely used in small-medium scale agriculture.

Mulch till involves leaving the crop residue on the field to both control erosion of the soil and provide organic matter in the form of decaying plants while limiting the disturbances on the soil year-round.

¹ Hoppe, Robert A., James M. MacDonald, and Penni Korb. Small Farms in the United States: Persistence Under Pressure, EIB-63, U.S. Department of Agriculture, Economic Research Service, February 2010

² Claassen, Roger, Maria Bowman, Jonathan McFadden, David Smith, Steven Wallander. Tillage Intensity and Conservation Cropping in the United States, EIB-197, U.S. Department of Agriculture, Economic Research Service, September 2018.



The main benefit of this practice is closely associated to the research that led to the Revised Universal Soil Loss Equation³ cover management factor variable. Utilizing practices like mulch tilling the producer can reduce soil erosion, enhance the retention of moisture and soil organic matter while fostering the biota on the land⁴.

The most cost-effective way for producers to implement mulch tilling is to use existing equipment.

Producers who own a Category 1 or 2 3-point hitch tractor can utilize implements such as a chisel plow, harrow (disk or rotor) or cultivator to disturb the soil while maintaining more than 30% of residue from the existing crop⁵

Chisel Plow

Chisel plows are usually equipped with double-ended shovels mounted on long beams that are hydraulically controlled to uniformly maintain a specific depth when tilling. Depending on the depth that

³ <https://www.ars.usda.gov/southeast-area/oxford-ms/national-sedimentation-laboratory/watershed-physical-processes-research/docs/revised-universal-soil-loss-equation-rusle-welcome-to-rusle-1-and-rusle-2/>

⁴ Machado, Pedro and Freitas, Pedro. No Till Farming in Brazil and its impact on Food Security and environmental Quality. https://www.researchgate.net/publication/258916779_No-Till_Farming_in_Brazil_and_Its_Impact_on_Food_Security_and_Environmental_Quality

⁵ NRCS Tillage Equipment Pocket Identification Guide. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_007135.pdf

it is applied.



Chisel plows can usually leave anywhere between 50-70 percent residue on the land⁶. In conventional production systems the chisel plow is usually utilized as a primary tillage implement in the fall to prepare the soil for more intrusive and “deep” tillage implements, such as a roto tiller or mold board plow, in the spring. Small scale producers can utilize a chisel plow as the primary system for tilling the land and leave residue as cover. Since the chisel plow is used extensively in commercial agricultural it is easier to find for small scale producers, it is not considered a niche or specialized equipment that demands higher costs and it is easier to both mount and use once purchased. Some of the disadvantages include the probability that less than 70 percent residue will be left on the field if depth is not adjusted properly and the

⁶ University of Nebraska-Lincoln. Chisel. <https://cropwatch.unl.edu/tillage/chisel>

requirement of specialized equipment in the spring, such as a no-till drill, if no other method to reduced residue is utilized. This equipment is recommended for those small-scale producers that have a limited budget and are concerned with ease of use of equipment.

Harrow Disk

A disc harrow is a type of harrow with metal discs lined on two to three different metal beams that can be placed at different angles before working the soil. As all harrows the primary purpose is to disturb the top layer of the soil and incorporate vegetation into the soil⁷. There are a couple of considerations for small producers when selecting a disc harrow. First, only primary disk harrows, those weighing between 250 to 1000 lbs. should be considered as additions to the farm. “Finishing” or lightweight harrows are discouraged because they are not able to achieve the necessary depths to turn the cover crop and incorporate it into the soil. Recommended depth for operation is at least 8 inches, with a consistent speed between 4-6 miles an hour for proper operation. Operating the disc harrow should be a smooth process, with minimal jumping or clogging of the implement. If either clogging or jumping occur there are issues with the angles of the discs or the speed of operation. Ideally the soil must be dried for at least several days before utilizing the harrow and proper use will require at least 30 minutes to an hour to properly harrow a one-acre field.

⁷ Small Farmers Journal. Disc Harrow Requirements. <https://smallfarmersjournal.com/disc-harrow-requirements/>



Small scale producers should consider the disc harrow in addition to the chisel plow as a finishing implement. The disc harrow could be passed after the chisel plow to incorporate the residue left over by the chisel plow into the topsoil. In areas with few concerns for soil erosion the processes can be “Stacked” one after another. If soil erosion is a concern the spacing of the implements can be set to fall for the chisel and early spring for the harrow. Because of its higher costs small producers are advised to invest in the chisel plow first and then the disc harrow. The equipment is readily available and easy to use, producers that already utilize the chisel plow will have few obstacles in operating a disc harrow.

Cultivator

Cultivators main purpose is to control weeds after tillage work has been done with either the chisel plow or disc harrow. Modern cultivators can be attached to the rear of a 3-point hitch Category 0,1,2,3 tractors

are area easy to use. They are also designed to be adjustable, precise and minimize soil disturbance⁸. Small scale producers should only invest in cultivators if the necessary chisel plow and disc harrow are already in use on the farm. When selecting a cultivator, it is essential that high residue, heavy cultivators. These are usually easily recognized by the dual gauge wheels located in front of the undercutting sweep which are not found in the low residue or medium residue cultivators. In no till systems is essential that residue remains in the field, the dual gauge wheels in the high residue cultivator hold down the residue which allows the undercutting sweep to cut. This otherwise minimal addition to a cultivator increases the efficiency of the implement exponentially.



Conclusion

Small scale producers, with a capital investment of between \$3,000 and \$6,000 US Dollars in most regions can buy the necessary equipment to begin utilizing mulch till techniques on their farms. Although yields

⁸ Sustainable Agriculture Network. Steel in the Field. <https://www.sare.org/wp-content/uploads/Steel-in-the-Field.pdf>

initially be reduced during early adoption the long-term benefits to soil health, existing ecosystem and the environment vastly outweigh any initial reductions of output.