Farmer Rancher Grant Program

Final Report Form

I. PROJECT IDENTIFICATION

- Name: Barry J. Shortt
- Address: PO Box 186, 3511 Highway F
- City, State, Zip Code: New Melle, MO 63365
- Phone: 314-452-1016
- Website: www.windridgefarm.net

- Project Title: *Demonstrating The Effectiveness Of Subsurface Drain Tile Installation As An Integrated Planting Practice to Improve Soil Conditions, Tree Establishment, and Productivity of Fruit Trees On Sloping Claypan Soils with Poor Internal Drainage.*

- Project Number: FNC10-841
- Project Duration: One year
- Date of Report: December 3, 2012

II. PROJECT BACKGROUND

Windridge Farm is a family operated fruit farm located just west of the St. Louis and St. Charles metro areas in New Melle, Missouri. We grow small acreages of a variety of fruits and vegetables and market them directly as pick-your-own (PYO) with some sales at our roadside stand. My wife Carole and I purchased the land in 1983, built our house there in 1986, and then began accumulating equipment and advice for starting an orchard. We planted six acres of peach trees in 1988, picked our first crop in 1991, and began diversifying into blueberries and blackberries a few years later. We both have college degrees in crop protection and over 20 years experience in production horticulture. Currently we spend about half our time working the farm and the other half supplementing our income with off-farm employment. During the summer months we employ approximately 6-8 high school, college, and adult employees on a part time basis to help with sales; and retain 2-4 part-time year round to help in production. At our peak in 2009 we harvested 5 acres of peaches, 2 acres of blueberries, and 0.5 acres of blackberries.

Our land is a good location for retail sales on a state highway and we routinely sell all the produce that we grow. The ground is moderately sloped providing good air drainage and what appeared to be good surface water drainage necessary for perennial fruit production. Like much of the upland ridge soils in the Midwest our soil type is much heavier than we would like (Armster and Hatton silty clay loam, 5-9% slope) and the upper soil horizon has been significantly eroded away by many decades of clean till corn farming. As a result much of our land has a water-impermeable clay subsoil 20 to 24 inches deep that acts as a barrier to internal drainage and keeps the topsoil saturated for extended periods of time. In October 2009 the St. Louis area experienced record rainfall and excessively wet soil conditions for several weeks.

This severely damaged peach roots causing complete loss of 3 acres of peaches and scattered losses in the remaining peaches and blackberries. We have also routinely had difficulty establishing new plantings and often suffered 25% peach tree mortality the first year.

III. PROJECT DESCRIPTION

In the midwest heavy clay soils are common in the rolling hills surrounding the major river valleys. Fruit crops require good air drainage so sloping elevated sites are usually chosen. The slope also provides good surface water drainage but has caused serious topsoil erosion in many areas where clean tillage was practiced in corn and soybean production. On our land this has left a fairly thin topsoil with an impermeable clay subsoil 20-24 inches below the surface. In our 20+ years of experience in growing fruit our most serious challenge has been getting peach trees established in the early spring, which is almost always wet, and keeping them vigorous and long-lived through periods of above average rainfall. We, like most other growers, plant peach trees into large augured holes as early as possible in the spring. Because the soil is clayey and is often wet the auger tends to smear the walls make planting "bowls" rather than holes which flood easily and hold water. This causes serious tree losses the first year and reduced vigor for years afterward. Regular applications of metalaxyl to control Phytophthora collar rot provides partial control but is expensive. Trees in the wettest areas die or have poor vigor and by the time a planting is considered mature there are many missing trees. This makes nutrient and weed management much less efficient and makes the whole block less productive. A less common problem is the complete loss of blocks of trees after unusually long periods of saturated soil as in October 2009. It has become clear to us that it is not economical or sustainable to replant these trees without significant improvement to our internal soil drainage.

The installation of subsurface drain tile is a possible solution, but it is not widely practiced in Missouri and experienced installers are not available in our area. Those willing to travel here use very large equipment such as tile plows that don't work well in smaller plantings and they prefer large installations to maintain their profit margin. We intend to demonstrate that a grower with limited experience using University recommendations and locally available supplies and rental equipment can install an effective subsurface drainage system on a smaller scale. In addition, we believe that the trench used for laying the tile can also be used as a planting hole when it is placed directly under the tree rows. The process is simple: a trench is dug and the tile is laid then partially buried to hold it in place. At each tree location a 5 foot long trench is cut across the drainage trench in an X pattern at a shallower depth. This X shaped hole will provide plenty of space for the tree roots and will have back fill soil that is more granular and friable than the mud slabs that usually come off an auger. The soil around the newly planted trees will have excellent drainage and we expect that tree survival will be very good and chemical control of collar rot will not be necessary. The system must also be effective at draining the entire field in a day or two after heavy rains. We consulted with Dr. Kelly Nelson of the University of Missouri Greenley Research Center who examined our soil and gave us advice on placement and sizing of the drain pipes. We will use 3-inch perforated plastic tile placed 2-3 feet deep under each tree row. Those pipes will tie in to a 6 inch main line and outlet into a grassy natural watershed. The system will be laid out using an optical transit level and the trenches will be dug using a rented walk-behind trencher for the rows, and a tractor mounted trencher for the main line. This design will have

more than enough capacity to achieve a drainage coefficient of 1 inch per day. Peach trees will be planted by hand and drip irrigation lines will be installed to ensure strong root growth during the summer. We expect to lose very few if any trees to wet soil and we expect improved vigor throughout their life span. It is unlikely that the peach trees will clog the drain tile due to their high sensitivity to wet conditions.

GOALS

Our objective for this grant project is to evaluate and demonstrate a new practice that will help make peach production economically viable in an area with high demand but difficult production challenges.

1) Devise a method of installing drainage tile that can be combined with planting fruit trees to gain efficiency and improve planting conditions.
2) Demonstrate that this method can be employed by most growers using either existing on-farm equipment or small equipment that can be easily rented.
3) Prove that this method results in improved tree survival and greater tree vigor when compared to trees planted without drainage using a conventional planting hole.

PROCESS

All physical work except for the final data collection has been completed. The fields were plowed, limed, and fertilized in fall 2010 prior to the grant period. In May 2011 the planting area was disked and the planting rows were surveyed for elevation and marked for trenching. A riding trencher was rented to prepare a 2-foot deep trench for the mainline and laterals, and after laying in the perforated drain lines it was also used to push soil back into the trenches. A small walk-behind trencher was used to make short (4-foot long) perpendicular trenches across the lateral lines at 14-foot intervals which served as the planting holes. In early June peach trees were hand planted into these X shaped “holes” so that all trees were planted directly over a drain line 14 feet apart within the rows, with rows (and drains) 19 feet apart.

(continued next page)

Engineering and field map:

Trees were immediately topped and scaffold training began in late-June. It was necessary to pull more soil into the trenches as it continued to settle after a couple of heavy rains. Also in late June drip irrigation lines were laid down each row and a single emitter was installed for each tree (this was expanded to 2 emitters per tree in August). Triple 12 fertilizer was applied to each tree, and due to the lack of rainfall we also applied soluble fertilizer through the drip lines. In July selective post-emergent grass herbicide was used around the base of each tree, and insecticide was applied to the lower trunk to control peach tree borers. Small hotel-size soaps were hung in each tree to deter deer feeding, tree scaffold training continued, and the trees were irrigated frequently due to very hot, dry weather. In August and September the tree-row alley weeds were mowed as needed, and in late September the alleys were disked twice in preparation for seeding bluegrass. In early November the alleys were harrowed and bluegrass was planted using a cultipacker seeder.

PEOPLE (consultants and suppliers)

• Dr. Kelly Nelson	University of Missouri	tile design
• Chris Doll	Doll Horticultural Services	horticulture
• Timewell Inc	Timewell, IL	tile supplier
• Dyer Rents	Wright City, MO	trencher
• Stark Bros.	Louisiana, MO	trees
• Irrigation Mart	Ruston, La	drip line

RESULTS

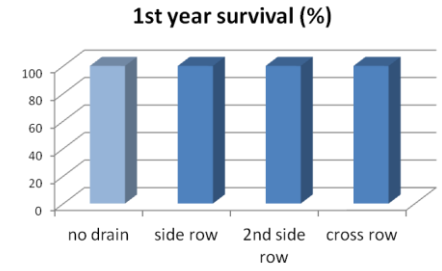
To demonstrate the benefits of this planting system we also planted 5 trees without drain tile using a conventional round hole dug by shovel. These 5 non-drained trees were located adjacent to 2 rows of drained trees and directly across the main line from another row of drained trees, allowing for multiple comparisons.

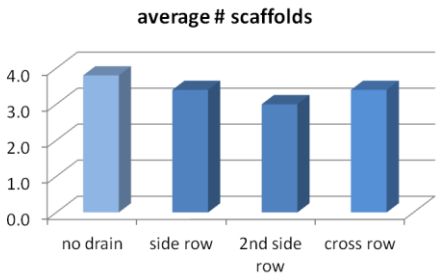
Trees were observed for survival throughout the summer. Planting trees over drain lines has significantly improved tree survival when compared to prior years plantings. In 1993, 1994, and 2001 we typically had about 20-30% tree mortality in the first summer. With the planting system used here we only had about 3% tree mortality, and some of that was due to trunk canker disease rather than root rot or wet soil. The non-drained trees also had good survival (probably due to dry weather after planting) but were clearly less vigorous.

In mid-September data was collected for trunk circumference and scaffold length for four groups of five trees each. This timing and type of data was selected as it best represents tree health and vigor after the first growing season. Trees planted over drain tile had significantly greater trunk diameter and scaffold length when compared to non-drained trees.

PF Lucky 13 Peach - July

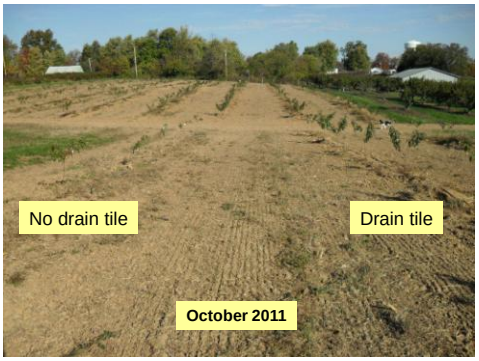
September – 5 trees/sample

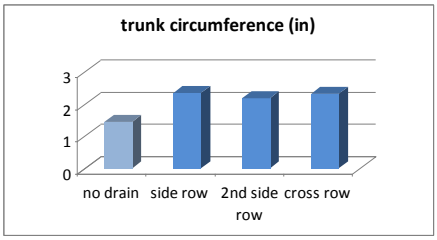


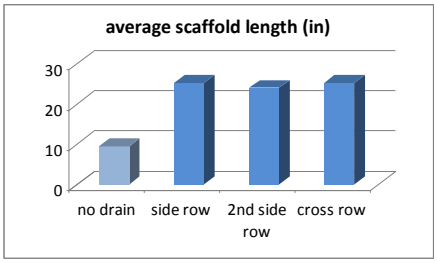


(continued next page)

Trees with drainage had much greater vigor in year 1







DISCUSSION

As shown in the tree growth data and pictures it is very clear that this method really improved the vigor of the peach trees. As of this writing I have observed the trees for two summers and their growth and uniformity is much greater than I have ever seen on this farm, going back to 1988. Survival is much better than in the past as well. Typically I have seen 5% to 10% of the trees die each of the first couple years due to water logging or root restriction, but am now seeing almost complete survival of the trees planted on the drain tile. It appears that the improved drainage and root development also made the trees more resistant to the heat and drought experienced in the summer of 2012. They were drip irrigated, and seemed to thrive in the heat, unlike past plantings where it seemed we could never put on enough water (probably because the roots were impaired).

On heavy soil it can be very difficult to find a period in the spring when the soil is dry enough to dig a planting hole with an auger. Typically I was forced to do this when the ground was still a little too damp and as a result had problems with poor quality, clumped backfill and a poor quality planting hole with smeared (sealed) sides and bottom. With this method a chain trencher is used for tile installation and planting, and the backfill is of much better quality, even in damp soil. Also, since the drain tile is installed first, the entire site drains and dries faster and the planting can be done sooner with better soil conditions.

There are very few drawbacks to this method. Tile installation is added cost and time but I estimated that the added expense is paid off by the first or second picking and then returned many times over by larger subsequent crops. It will limit the acreage that can be planted if all tiling must be done in the spring (my preference), but if time is also available in the fall a larger area can be prepared for planting when the soil is often drier and easier to work with.

I plan to use this method on all new fruit plantings and expect to see the enhanced growth and yield since all of our soils are heavy and most fruit crops are sensitive to wet soil. I also have some established blueberries that should benefit from drainage and I will place the drain tile in between the rows, which is more typical.

IV. PROJECT IMPACTS

This form was completed and submitted.

V. OUTREACH

We did not host field days because the summer sales season is far too busy on a fruit farm, and once the trees are planted the site looks like any other peach planting. The physical process description and the cost/benefit analysis are the most important to convey and this was done by presentation and by sharing with grower consultants. I presented a detailed description of the project at the Farmers Forum at the National Small Farm Trade Show and Conference in November 2011 in Columbia, MO. The audience included Dr. Patrick Byers, the MU Regional Horticultural Specialist, who received a copy of the presentation and has shared the information with growers in Missouri. I also shared the presentation with Dr. Kelly Nelson of the University of Missouri who stated he would use parts of it at crop conferences where he discusses his research on soil drainage and quality. Chris Doll, a retired SW Illinois Horticultural Specialist and now a private consultant, has also received the presentation and consults with growers in Illinois in Missouri.

The past 2 summers I estimate that I showed and discussed the new trees and drainage with about a dozen interested customers who were local farmers and had at least a mild interest in soil drainage.

VI. PROGRAM EVALUATION

This form was completed and submitted.

VII. BUDGET SUMMARY

This form was completed and submitted.