SARE FNE11-706: Feasibility of Shift Trellis Use for Northeastern Blackberry Production 2014 Final Report

SUMMARY

Project purpose:

Test the feasibility of LARS shift-trellis systems for thorned blackberry production against conventional vee-shaped trellises by measuring fruit yield, quality, and harvesting efficiency over the first three years of production of a new blackberry planting.

Methodology:

In 2010, four 175-foot rows of first-year Kiowa blackberry plants were planted. Rows were mulched and aisles were mowed regularly as well as occasionally hand-weeded as needed. Trellis systems, shift and conventional, were built in project year 1 (YR1). Two rows each were pruned and trained annually according to the trellising style.

In January of each year, all four rows were pruned back immediately after applying compost and mulch. Thereafter, shift trellises were shifted back to horizontal winter position. Throughout the spring and early summer, time was spent training new canes to the trellis and heading back canes to encourage branching of blackberries in both trellising systems. Vertical shifting of two shift trellis rows occurred annually in early-July after flowers opened into primary blossoms on all canes.

Throughout the 2011 (YR1), 2012 (YR2) and 2013 (YR3) harvest seasons, records of yields and harvest times were kept for each type of trellis system.

Results:

Harvest time comparison favored the shift system, though the issue of cane breakage during shifting likely caused a flattening out of favorable results in the third year (Harvest Time / Unit: *Y1: 2.41 to 2.27; Y2: 2.07 to 2.95; Y3: 2.31 to 2.58). Quality comparison favored the shift system increasingly each year. (1st Quality: *Y1: 63% to 63%; Y2: 89% to 86%; Y3: 93% to 89%). Yield comparison significantly favored the shift system in year two, but flattened out in year three due to cane breakage during shifting (Half Pints: *Y1: 159 to 159; Y2: 961.5 to 538.5; Y3: 836.5 to 821). *Shift to Conventional

Assessment:

Data demonstrated that the shift trellising of thorned blackberries can contribute to greater harvest efficiency, higher percentage of quality fruit and higher yield. However, there are two significant issues with the system. We recommend further exploration of methods for reducing the initial labor investment of constructing the shift trellises and the very significant issue of cane breakage while shifting.

INTRODUCTION

Village Acres Farm & FoodShed is a 45 acre farm offering Organic produce and pastured poultry in Central Pennsylvania (20 acres rotating through vegetables/berries, grazing and cover crops, the remainder out of production, being used for homesteading, forested buffering or is in woods and stream). Our primary markets are a 250-member CSA in State College, Selinsgrove and Harrisburg, PA and the Baltimore/Washington DC restaurants purchasing through Tuscarora Organic Growers Cooperative in Hustontown, PA.

One of the main selling points of our CSA has been our berry crops, as few of our competitors grow them, and they are also one of our most profitable wholesale crops as well. In 2010, a fairly average year, we harvested 3,902 half-pints of red raspberries from three plantings, for a total value of about $10,000.

In early spring of 2010, we decided to expand our bramble selection by planting 'Kiowa' floricane-bearing blackberries and 'Prime Jan' primocane-bearing blackberries on our farm. Early on, we realized the primocane variety offered very low production rates and so we focused our attention on the floricane variety (the variety we subsequently included in the study). Part of our acreage sits on a hill (15-20% slope), and one of our long-term goals is to improve the profitability of this area without increasing soil erosion by gradually converting it to perennial crops that will not require cultivation. Since we lease this land from a neighbor, we are still wary of very long term investments such as fruit trees. A profitable stand of brambles, then, was viewed to be able to significantly affect both the economic and environmental sustainability of our farm.

In general, we have found bramble plantings to fit in very well with the rest of our farm operation. However, brambles still require a large amount of labor at harvest time, which smaller growers like us often have difficulty hiring, managing, and paying for before the crop is sold. Thorny new primocanes grow towards sunlight on the edges of plants, interfering with harvesting. Bramble fruit are also prone to Botrytis mold when wet, reducing the number of salable fruit. Shift-trellis systems such as those proposed by Stiles (1995, 1999) promise to help overcome these limitations, but they have not been tested extensively on small farms. By shifting the configuration of the supporting trellis during the growing season, after the initial bloom but before fruit have finished developing, shift-trellis systems aim to present a wall of easily accessible fruit projecting onto only one side of a bramble planting. When successful, they should, in theory, substantially speed up harvesting by keeping all the fruit together and away from the thorny new growth in the center of the row. Exposing the fruit in this way should also improve air flow around both the berries and the entire plant, limiting the danger posed by fungal molds such as Botrytis. Although these trellis systems are more costly to construct than the more traditional stationary trellises, increases in harvesting efficiency and the percentage of saleable fruit has been proposed to more than make up for these initial costs.

We have a fairly large, stable work crew during most of the growing season (9-10 full time employees during the summer and early fall), so the labor associated with berry harvest was already here on the farm. Several of our crew members are very experienced berry pickers by now and are able to pick very quickly while still maintaining a high level of quality. However, variability in harvesting experience of other farm workers from year-to-year possibly impacted our results.

Project Lead: Debra Brubaker, lead farmer (replacing Dave Ruggiero, CSA manager, who initially led the project but has left the farm to farm his own land). Debra led data collection, input and analysis responsibilities.

Cooperators: In addition to multiple harvesters over the three year period, much of the maintenance was led by Roy Brubaker, lead farmer, and Steve Freed (lead intern, though no longer with the farm).

Technical Advisor: Kathy Demchak of Penn State Extension

OBJECTIVES/PERFORMANCE TARGET

In this project, we conducted a side by side comparison of blackberry production using a shift-trellising system versus a conventional vee-shaped trellising, for the purpose of determining if shift trellising can provide a producer advantage in regard to fruit yield, fruit quality, and harvesting efficiency of thorned blackberries.

METHODS

In 2010 we planted four 175-foot rows of first-year 'Kiowa' blackberry plants 12 feet apart in roughly E-W rows following the contour of a north-facing slope on our farm. Each individual row contains roughly forty-five plants and covers 175 feet of ground. These plants grew throughout the year and bore occasional fruits although, as first-year plants, we did not expect significant yields from them.

In early spring of 2011 (YR1) we fertilized with 20 lbs of feather meal (13% N) along each 175' row, then applied 1-2" grass and leaf compost in a 2'- wide band over the row. We mulched row edges and mowed the aisles between rows to control weeds. We also did occasional hand-weeding throughout the planting as needed; there did not seem to be any noticeable difference in weed pressure between the two trellis styles, so we didn't keep track of weeding times.

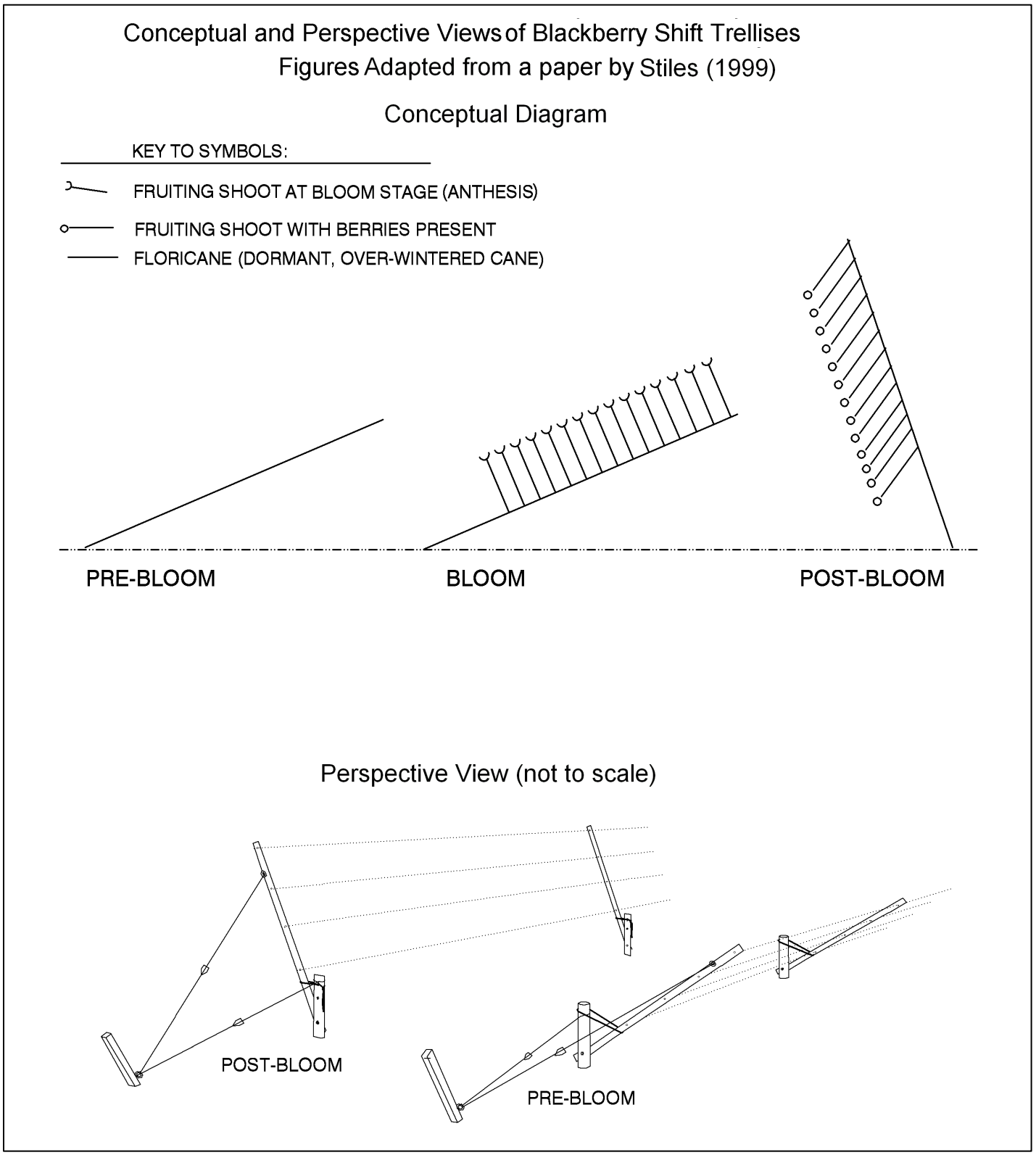
We built our trellis systems in April 2011 (see Figure 1); construction began on the 4th and was finished by April 30. Conventional trellises were built on June 21-22. Our shift trellises were built with posts every 25 feet along our rows, for a total of 2 endposts and 6 mid-row posts in each row. Each post consisted of an eight foot section of untreated locust, driven three to four feet into the ground, attached to a 6-foot length of pipe 10 inches above ground level with an 8" carriage bolt. This pipe (the swinging part of the shift trellis) was attached to the wooden post with a short length of flat steel to serve as a brace. The steel brace has two holes in it, allowing it to be swung into place so that it can brace the swinging arm in both the horizontal (pre-bloom) and near-vertical (post-bloom) positions.

The end posts of each shift-trellis row were further braced by the addition of locust tie-back posts driven into the ground and used to support the end posts with double cross-bracing of high tensile wire. This is the anchor for a 3/16"cable which holds the top of the end pipes in place, preventing them from sagging towards the center of the row. Eye bolts through the end pipes and posts anchor the cables.

Conventional trellises were constructed using two rows of 6' metal posts spaced every 25 feet, positioned to form an open V-shape. Two HT wires were attached on each side of the row, 24'' and 45" from the ground. Wires were secured to locust tie-back posts driven into the ground at each end.

We first shifted the trellises into the vertical position in mid-July after flowers had opened in primary blossoms on all the canes. Pollination occurs on some of them by this point and a few berries are starting to grow. The trellises were shifted back to their horizontal winter position each January.

Figure 1



In 2012 (YR2) and 2013 (YR3), our Blackberry trellising project started by pruning back all four rows of blackberries and shifting the shift trellises back into the horizontal position in January, immediately after applying compost and mulch. Throughout the spring and early summer, time was spent training new canes to the trellis, and heading back canes to encourage branching of blackberries in both trellising systems. In late May of each year, we shifted the shift trellis into the vertical position, after blossom but before the berries were set.

Throughout the harvest season, records of yields and harvest times were kept for each type of trellis system.

Figures 2-10 are photos comparing the systems and demonstrating technique and challenges (i.e., cane breakage).

Figure 2 demonstrates fall composting and mulching

Figure 2

Figure 3 demonstrates winter pre-shifting

Figure 3

Figure 4 demonstrates winter shifting

Figure 4

Figure 5 demonstrates winter full shift position

Figure 5

Figure 6 demonstrates a cane broken during the shift

Figure 6

Figure 7 demonstrates summer vee (left) and shift (right) systems

Figure 7

Figure 8 demonstrates shift timing. Flowers are open in primary blossoms on all the canes (a few berries may be present):

Figure 8

Figure 9 demonstrates summer shift with berries facing one side

Figure 9

Figure 10 demonstrates berries ripening on shift system, most facing one side

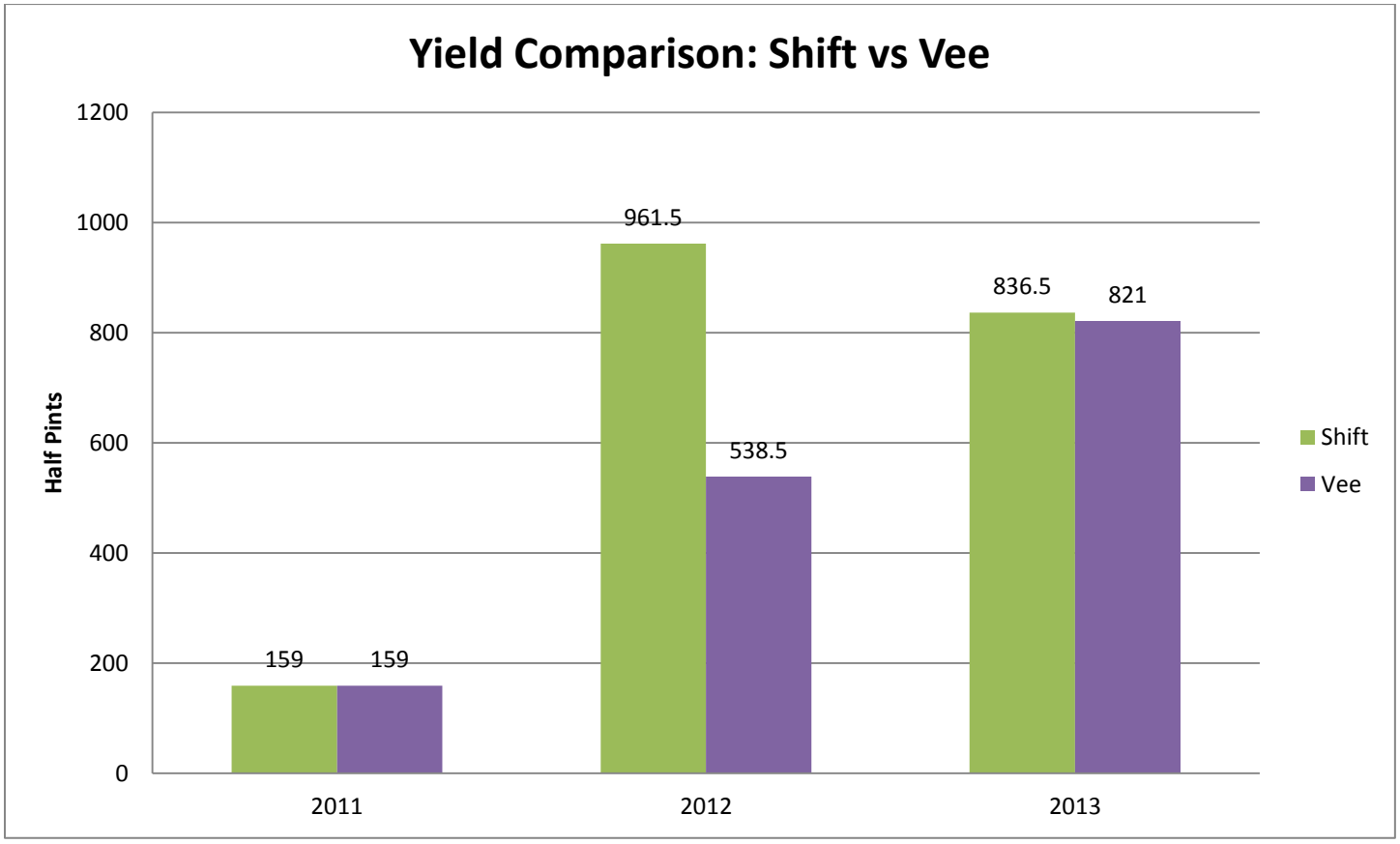
Figure 10

OUTCOMES AND IMPACTS

Data demonstrated that the shift trellising of thorned blackberries can contribute to higher yields , higher quality fruit, and greater harvest efficiency, but this advantage may diminish as the planting matures, without improvement of the system to reduce cane breakage during shifting activities.

Production Rates (see Table 1):

Table 1



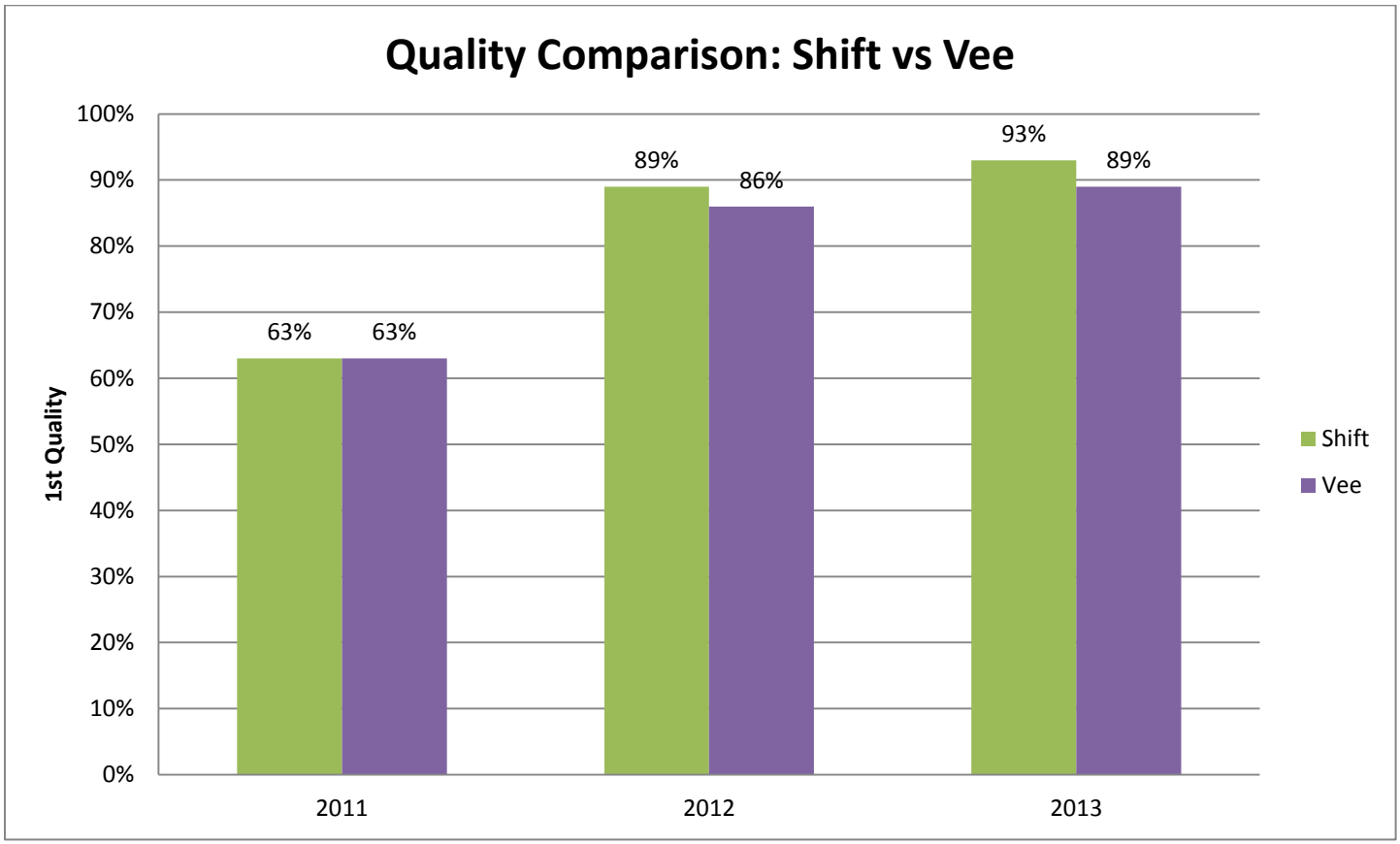
2011 (YR1): Blackberries were planted this season and it was an extremely wet year, so harvest was minimal with both systems.

2012 (YR2): Blackberry harvest showed a marked increase in production from 2011 and a first year to get real data to compare a shift-trellis system to a conventional vee trellis system of blackberry production. Between June 28th and August 10th we harvested 126.8 flats (1714 half pints) of blackberries from our 4 rows of Kiowa Blackberries. Sixty-three percent of these blackberries (1084.5 half pints) were harvested from the 2 rows that are shift trellised compared with the 37% (629.50 half pints) that were harvested from the 2 rows trellised with a standard vee trellis system.

2013 (YR3): Blackberry harvest showed a decrease in shift trellis production and increase in vee trellis production, resulting in little difference in production between the shift and conventional trellising systems. We harvested 836.50 ½ pints with the shift trellis system and 821.00 ½ pints with the conventional system. We attribute the reduction in berry harvesting on the shift trellis to the penchant of the system to cause many of the better established canes to snap off during shifting. Had the breakage not occurred, we assert there likely would have been results more similar to the previous year.

Quality (See Table 2):

Table 2



2011 (YR1): This season was an extremely wet season and resulted in lower than usual quality berry production with both systems.

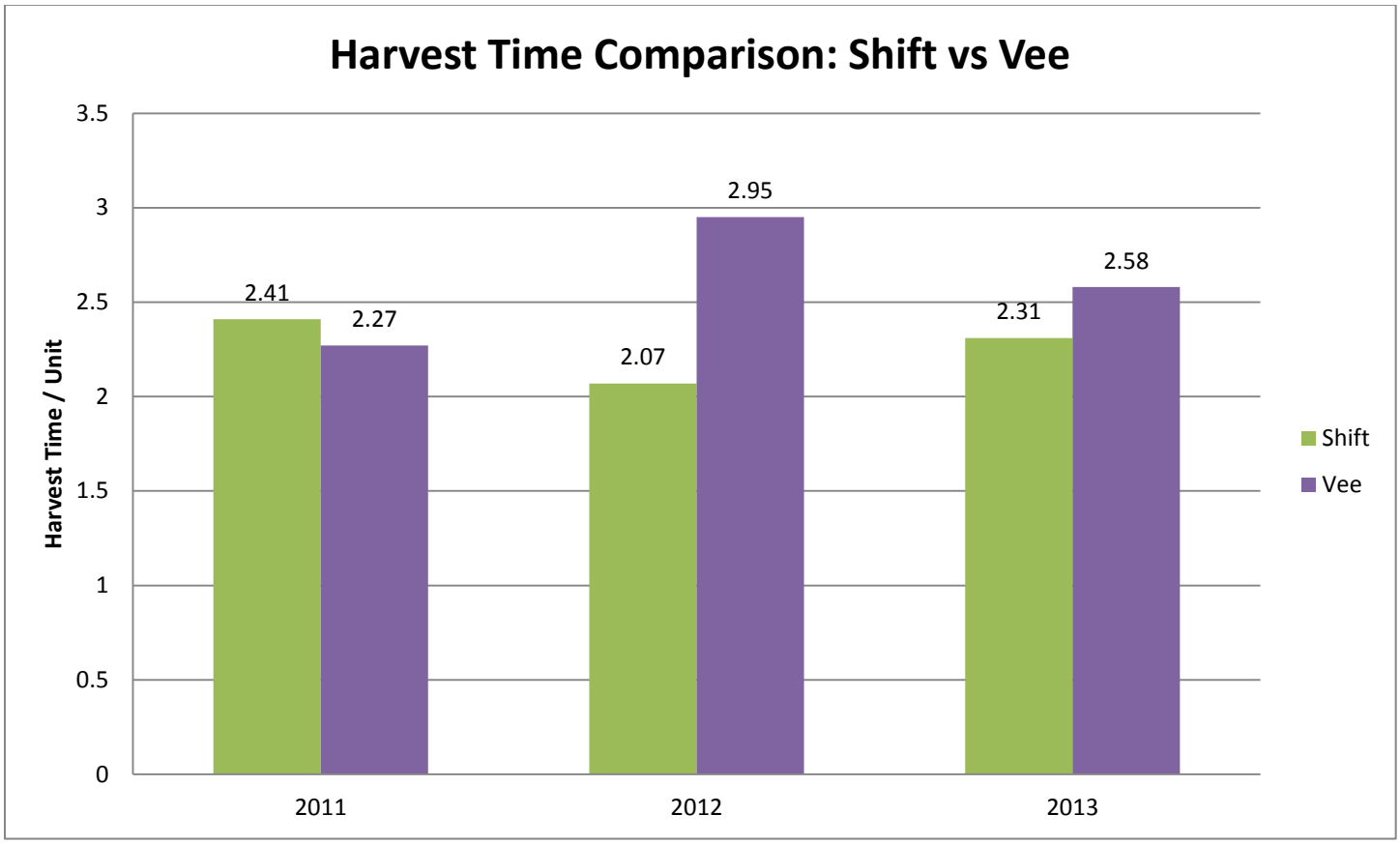
2012 (YR2): Of the berries harvested from the shift trellis 86% were considered 1st quality and from the standard vee trellis, 83% were considered 1st quality. (Chart 3)

2013 (YR3): Of the berries harvested from the shift trellis 93% were considered 1st quality and from the standard vee trellis, 89% were considered 1st quality. (Chart 3)

Harvest Time (See Table 3):

Table 3 shows a graph plotting the Number of Minutes per ½ pint unit throughout the harvest season for both trellis systems.

Table 3



2011 (YR1): Harvest time on the shift system took slightly longer (avg 2.41 minutes) than with the vee (avg 2.27 minutes), but given the small number of berries harvested we believe the difference to be statistically insignificant.

2012 (YR2): The shift trellis shows a harvest time advantage with an average of 2.07 minutes needed to fill a ½ pint container versus the 2.95 minutes required when picking from berries trellised in a standard vee trellis.

2013 (YR3): The shift trellis shows only a slight harvest time advantage with an average of 2.31 minutes needed to fill a ½ pint container versus the 2.58 minutes required when picking from berries trellised in a standard vee trellis.

While the data collected points towards shift trellising as having an advantage over conventional vee trellising for increased yield, and decreased harvest time, we know that more extensive data is needed. Given the varying degree of experience and speed of our pickers, there is a great margin of error surrounding the harvest time and yield (if a picker is not being thorough).

Also one of our concerns regarding shift trellising is the large number of thick (apparently healthy) canes that break in the process of shifting the trellis (see Figure 6). We are curious to find ways to minimize cane loss in this process as it seems yields from the shift trellis could be even higher if we could minimize damage in the shifting process. We also have been recording our time for triming/pruning blackberries in each trellising system.

ACCOMPLISHMENTS

The project was completed successfully as the study question was answered.

POTENTIAL CONTRIBUTIONS

Village Acres Farm regularly fields calls and emails from those who have either visited our farm for a field day or tour or who have visited the SARE website and who have questions regarding the study.

PUBLICATIONS/OUTREACH

Village Acres Farm held informational sessions at the Pennsylvania Association for Sustainable Agriculture (PASA) conference and at the Pennsylvania Vegetable Growers Association (PVGA) conference in the first year. At these sessions, we introduced our study, including objectives and method. Since that time, we have regularly included an information session as part of our farm tours and field days for three years now and provide ongoing support to those who have considered the shift trellis system. We plan to provide a final study overview workshop at both PASA and PVGA conferences in 2015. We routinely receive questions from people visiting the SARE site via email and phone and are happy to provide support.

An overview of the project, along with graphs and photos is available on our website at www.villageacresfarm.com/research/blackberries/trellising

FUTURE RECOMMENDATIONS

This study correlates an improved harvesting, quality and production rates of thorned blackberries with the use of a shift trellising system. However, further research must occur to explore methods of reducing cane breakage. Perhaps research into a more gradual shifting of the trellis or pruning methodologies could prove beneficial. There may also be a benefit to general modifications to the shift trellis system construction that could be beneficial such as for changing height, etc. to facilitate a gentler shifting of the canes.

We recommend replication of our study. We recommend research that would incorporate modification of the system for the purpose of improved results (reduced can breakage).

We will continue with blackberry production on our farm but likely will move to non-thorn varieties, eliminating the need for the shift trellising system, as the cane breakage issue is a significant issue enough issue for us deciding against long-term use of the system.

Attachments

Figures and Tables