



Strawberries: Season Extension

Growing Organic Day-Neutral Strawberries in Caterpillar Tunnels



Aaron Wills inside a caterpillar tunnel with water irrometer at **Little Hill Berry Farm, Northfield, MN**

Little Hill Berry Farm (LHBF) sits on 15 acres in Northfield, MN and is managed by owners Aaron Wills and Molly McGovern Wills. The Wills' purchased their land from a local resident in 2011 and immediately began transitioning what had been conventional corn and soybean acreage to certified organic fruit plots, primarily blueberries. Over the years, they gradually expanded their fruiting plots to include strawberries, raspberries, currants, elderberries and aronia berries providing full-time employment for Aaron. The Wills' began growing day-neutral (DN) strawberries in 2019 - inside two 2,100 square foot caterpillar tunnels (CTs) and uncovered on one half acre of open fields. After success with the CTs, Aaron and Molly abandoned the field plots in 2020 and added three more tunnels for DN strawberries from the CTs annually. The Wills' now harvest approximately 5,300 pounds of fresh organic strawberries annually with gross sales totaling \$47,000 annually in 2021 and 2022.

DAY-NEUTRAL STRAWBERRIES

Day-neutral (DN) strawberries are not sensitive to day length, which means that the plants flower and fruit continuously during moderate temperatures. Consequently, DN varieties produce fruit from July through October or until the first killing frost. They often have a rest period in mid-summer when temperatures are too hot for fruit.

June-bearing strawberries, on the other hand, are sensitive to day length. They produce fruit during a short 2-6 week window in late June to early July.

Day-neutral strawberries have been found to yield best when grown on plastic mulch and under high tunnels (HTs), low tunnels or using table top systems. They can be grown in open fields but are susceptible to disease. In the upper Midwest, DN strawberries are grown as annuals and can be incorporated into any specialty crop rotation.

A number of DN varieties are available for production in Minnesota. Varieties that have performed well in University of Minnesota trials under HTs and open fields include Albion, Cabrillo, Evie-II, Monterey, Portola, San Andreas and Seascape. Generally, DN varieties are just as sweet as June-bearing varieties. Of those field-tested at the University of Minnesota, Albion and San Andreas were found to be the sweetest while Portola had the highest overall yields.

For more information about growing DN strawberries in Minnesota, visit <https://extension.umn.edu/strawberry-farming/day-neutral-strawberries>.



COVERED TUNNEL PRODUCTION

Growing DN strawberries is labor intensive (see table on page 3) and typically done under protected culture like CTs. Aaron installed the CTs in 2019 - some of which were dedicated to strawberries and others to raspberries. The three larger CTs measure 2,100 square feet each; the two smaller ones 1,400 square feet each. All CTs are covered by 6-mil plastic and, unlike high tunnels (HTs), do not have built-in end walls. Aaron removes the CT plastic each fall as the structures are not sturdy enough to handle heavy Minnesota snow loads. The CT frames are supported by rebar, ground posts, tunnel bows and cross braces which are then anchored by nylon rope.

All CT materials were purchased as part of a kit from [Farmers Friend](#). Each CT took three people approximately 1-1/2 days to construct. Although CTs are less durable than HTs, they have the advantage of being more cost-effective and moveable.

Before spring planting in the CTs, Aaron applies compost and lightly works it into the soil before installing the CT plastic, drip tape and the re-useable landscape fabric. These tasks take approximately eight hours per CT. Near the end of April, Aaron and his crew plant 5,200 Albion (*Fragaria x ananassa* "Albion") and Monterey bare-root DN strawberries by hand at a rate of ~ 30 seconds per plant. The plants are placed directly into the soil (silty loam) through holes that have been burned into the landscape fabric. The plants are grouped into two-row beds. Plants are spaced one-foot apart within rows and one-foot apart between rows within each bed. The beds are spaced two-feet apart.

Aaron purchases bareroot DN strawberry plants from [Indiana Berry](#) in January. "The plants are not certified organic but because organic bare root [day neutral strawberry] plants are currently unavailable, we received an exemption from our certifier," says Aaron. "They [Indiana Berry] provided a certificate stating that the plants had not been treated [with synthetic products]." Little Berry Hill Farm is certified organic by [Midwest Organic Services Association](#).

Plants are irrigated and fertilized using a drip tape system. Aaron waters 2-3 times per week in the afternoon - following the morning harvest. He installed a Watermark irrometer to determine plant moisture needs.



Day-neutral strawberries growing in caterpillar tunnels at Little Hill Berry Farm

Aaron checks the irrometer several times per week. Fertigation is supplied to the drip tape using a Venturi system (Nolts Produce Supplies, IA) every 1-2 days depending on plant nutrient needs. The nutrient make-ups of the fertigation applications are determined by a tissue analysis which Aaron performs twice per season with the help of [Advancing Eco Agriculture](#) diagnostic services.

In the fall, Aaron covers the plants with light-weight row covers inside the CTs to extend the season by four weeks. After harvest in mid-November, Aaron terminates the DN strawberries by removing and composting the plants. He then removes and stores the CT plastic and landscape fabric for the winter. The drip tape is disposed of as it "begins to clog by the end of the season," says Aaron. "The clogs occur because we are using the tape to deliver fertilizer."

The CTs have improved the quality of strawberries at LHBF; the plastic protects the fruit from weather and insect damage. Insect pests, particularly Tarnished plant bug (TPB) (*Lygus lineolaris*) and Spotted wing drosophila (SWD) (*Drosophila Suzuki*), are significant issues outside the CTs, requiring frequent spraying. For TPB, the Wills' apply a solution of vinegar and the OMRI-approved broad spectrum insecticide Pyganic at plant flowering (bloom)[1] and another 1-2 times throughout the growing season.

[1] We recommend that growers take care when applying Pyganic insecticides during bloom, spraying only at dawn or dusk when bees are not active.

DN Strawberry Labor Activities by Month	J-M	A	M	J	JL	AU	S	O	N
Planting prep: order plants, cover CT with plastic	■								
Planting: install bare-root plants			■						
Maintenance: remove flowers and runners			■	■	■	■			
Irrigation and fertigation: test for moisture and fertility needs			■	■	■	■	■		
Pest control: treat plants with organic insecticides				■	■	■	■		
Harvesting: harvest, sort, wash, package berries					■	■	■	■	■
Season extension: cover plants with row covers								■	
Termination: remove plants and compost, store fabric and plastic									■

Inside the CTs, however, the pressure from both insect pests is reduced. "We still have to spray for TPB twice a season inside the tunnels," says Aaron. "But we don't do anything for SWD." Aaron suspects that frequent harvests and the warmer inside temperature of the CTs make it difficult for SWD to thrive.

PERFORMANCE & MARKETING



Day-neutral strawberries are harvested by Little Hill Berry Farm staff on a regular Monday, Wednesday, Friday schedule for 16 weeks. Aaron typically begins harvesting DN varieties in late June, with yields tapering off in July and then a big flush in August and September. Experienced pickers typically harvest 10-15 pounds per hour. All berries are sorted and packed in shed/store built by the Wills' in 2021 (washing the berries is unnecessary as the landscape fabric keeps them clean).

Aaron's yields in 2021 and 2022 averaged one pound per plant in the CTs, providing approximately 5,300 pounds of fresh marketable strawberries annually.

By comparison, the DN strawberries grown in open fields at LHBF in 2019 yielded 1/3 pound per plant.

The Wills' market their berries online through their website and through the MN Grown Directory where LHBF invites customers to "connect to the big open sky and beauty of the land..." They also direct market regular seasonal updates via email to previous customers (~5,000 people). All strawberries are sold pre-picked direct from the farm store; staff spend approximately 24 hours per season on sales.

Customers generally place orders in advance of pick-up. The certified organic berries are sold for \$9/lb throughout the 16-week season. Beginning in 2023 the Wills' plan to offer 4-week "strawberry shares" in August and September. Each share is priced at \$76 (\$9.50/lb) and in exchange customers are guaranteed two pounds of fresh strawberries weekly for pick up at the farm store.

Little Hill Berry Farm grossed \$47,000 in 2021 and 2022 from their certified organic DN strawberries. Annual direct expenses (materials and labor) for the DN strawberry enterprise were approximately \$17,793. Subtracting these expenses from gross income, the Wills' net \$29,907 on one-fifth of an acre annually allowing the Wills' to pay back all upfront costs for the five CTs in just over one year.

Little Hill Berry Farm: DN Strawberry Budget for 5 Caterpillar Tunnels

FIVE CATERPILLAR TUNNELS	AVERAGE ANNUAL YIELD 2021-2022 ~1 lb/plant
Area under CT (square feet)	9,100
Number of plants	5,200
Yield, Pre-Pick, lbs	5,300
GROSS INCOME	
Pre-picked, \$9.00/lb	\$47,700
UP FRONT COSTS	
5 CT Kits (20 yr life, excluding plastic)	\$21,500
Plastic for HTs (5 yr life)	\$1,890
Labor for Installation (1.5 days for 3 people per CT, \$22/hr)	\$3,975
Landscape fabric and row covers (10 yr life)	\$750
Venturi fertigation system	\$1,000
Labor for burning holes in landscape fabric (4 hours for 2 people per CT, \$22/hr)	\$880
Interest on fixed costs (5% for two years)	\$2,999
Total Up Front Costs	\$32,995
ANNUAL MATERIAL COSTS	
Plants (5,200 plants, \$0.25/plant)	\$1,300
Drip line	\$500
Fertilizer, water	\$925
Packaging (\$0.08/1 lb container w/label, pre-pick only)	\$416
Total Annual Costs	\$3,141
ANNUAL LABOR COSTS	
Add and remove CT plastic (4 hours for 3 people per CT, \$22/hr)	\$1,320
Add compost, install drip tape and lay fabric (4 hours for 2 people per CT, \$22/hr)	\$880
Install plants (4 hours for 3 people per CT, \$22/hr)	\$1,320
Manage irrigation and fertigation (1.5 hours per week for 22 weeks, \$22/hr)	\$1,320
Harvest, grade, wash and pack (11 lbs/hr, \$22/hr)	\$10,604
Marketing and sales (2 hrs/wk, 12 wks, \$22/hr)	\$528
Total Annual Labor Costs	\$14,652
NET INCOME AFTER ANNUAL COSTS	\$29,907
MONTHS TO PAY BACK UP FRONT COSTS	13.24

Resources

- Yield and Quality Characteristics of Day-Neutral Strawberry in the United States Upper Midwest Using Organic Practices. Andy Petran, Emily Hoover, Laura Hayes and Steve Poppe. 2017. Biological Agriculture & Horticulture, 33(2).

