

Wenatchee

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Site description

The [Tree Fruit LTARE1 experiment](#) is located at a 2.5 acre orchard block at Washington State University Sunrise Research Orchard at Rock Island, WA (47.31988, -120.0663747) initiated spring 2023. The soil type is a Pogue fine sandy loam (Aridic Haploxerolls).

Experimental Design

The LTARE1 experiment is designed in a randomized complete block with six replicated blocks containing five treatment plots each: mulch, integrated organic, high carbon, standard, and standard plus. Experimental plots are 2820 ft² (three 94 ft tree rows; 108 trees per plot). Ten-foot-wide planted buffers divide each replicate.

Site Establishment

We installed irrigation submains designed to accommodate micro-sprinklers, drip, and overhead cooling to be automated separately for each of five treatments in the 2.5 acre planting.

Tree Establishment and Maintenance

At LTARE1 soil preparation for planting included two passes ripping soil to a depth of 24 in E-W and N-S before fumigation. Soil was fumigated with 1-3 dichloropropene and chloropicrin the fall before planting. Spring soil preparation included two passes of discing to a

depth of 6 in, one pass with a rototiller in tree rows followed by one pass with a cultipacker (Table 1). All plots received an application of gypsum at 2000 lb acre-1. Apple cv. Honeycrisp Firestorm grafted on G.214 rootstock trees were hand-planted on April 25 to 26, 2023 at 2.5 ft between trees and 10 ft between rows. Best management practices for tree

In the high carbon and integrated organic treatments, compost was applied pre-plant





maintenance were employed using standard methods (Tables 1).

Description of Treatments

In the mulch treatment, we applied a 2 to 3 in deep layer of apple wood chips (aged at 131° F for 15 days, turning 3 times) at approximately 200 yd⁻³ acre⁻¹ three weeks after planting. In high carbon and integrated organic treatments, we applied compost (19.0% C, 1.7% N, 0.81% P, 2.02% K) applied using a Whatcom mulch spreader at 10 ton acre⁻¹.



Press release

Read two press releases about the LTARE site planting.
[The Wenatchee World](#)
[Good Fruit Grower](#)

Measurements

Bulk soil. We conducted baseline soil sampling May 9 to 12, 2023. Soil was sampled 1 ft from trees (edge of root zone) using a 2 in diameter core. Sampling included 12 subsamples per plot for depths 0-15 cm and 15-30 cm and 6 subsamples per plot for depths 30-60 cm and 60-90 cm.

Soil was sent out for analysis of total organic carbon, pH, texture, mineralizable carbon, POXC Carbon, ACE protein, EC, CEC, macro and micro-nutrients, available water capacity (0-15 cm, 15-30 cm), and nematodes (0-15 cm) (Soiltest Farm Consultants, Inc., Moses Lake, WA) PLFA (University of Missouri), and nematodes (AgriFood Canada). Additional soil was stored for archive, metals, and bioassay measurements.

Tree growth

For each treatment plot, ten trees were designated as measurement trees. We marked trees at 20 cm above the graft union and measured initial trunk diameter using a tree caliper (two perpendicular measurements) on May 23, 2023. Rhizosphere soil. We designated one of the ten measured trees per plot for root and rhizosphere soil sampling. For each tree, two to four sections of fine roots containing root-adhering rhizosphere soil (approximately 1 to 3 g) were sampled at a depth of 5 to 20 cm and a distance of 20 to 40 cm from the tree base using sanitized tools on June 6th, 2023. Samples were immediately placed on ice and later stored at -80°C.



Reserachers, including co-PI Somera were excited to see the trees planted.

Operation	Implement/Equipment	Details	Date
<i>Fumigation</i>			
Fumigation		63% 1,3-Dichloropropene and 35% Chloropicrin (Telone C35, Trident Ag Products, Woodland, WA) at 35 gal acre ⁻¹ . Soil 60 °F, soil moisture 60% field capacity.	Oct 27, 2022
<i>Soil preparation</i>			
Soil tillage - Rip	24 in shank Massey Ferguson 165, Buffalo, NY	24 in depth E to W and N to S	Oct 20, 2022
Soil tillage - Disc	Frontier DH1508, Deere & Co. Moline, IL John Deere 520, Moline, IL	Disced to 6 in depth 2 passes E-W with 19 in disc.	Apr 7, 2023
Soil tillage - Rototill	Maschio 180c, Padova, Italy John Deere 520, Moline, IL	To 8 in depth with 7 in gap tine-shaft.	Apr 12, 2023
Soil tillage - Cultipack	Woods C84, Oregon, IL John Deere 520, Moline, IL	1 pass.	Apr 12, 2023
<i>Fertility</i>			
Gypsum	Stoltfus spreader, Morgantown PA John Deere 520. Moline, IL	Ca 22.5%, S 18%; 2000 lb acre ⁻¹ . Disced to incorporate.	Apr 7, 2023
Fertigation	Venturi	8 lb N per acre as Calcium Ammonium Nitrate (17-0-0).	May 26, Jun 2, 2023
<i>Tree planting</i>			
Planting	Hand dug approximately 12 in by 12 in holes.	Apple cv. Honeycrisp Firestorm grafted on G.214 rootstock trees 2.5 by 10 ft spacing. Trees immediately clipped to trellis and irrigated within 30 min.	April 25-26
Herbicide and cold injury protection		From soil line to 24 in trees painted with white latex paint to protect from herbicide and cold damage.	May 11-12, 2023
<i>Pruning</i>			
Pruning		All branches were cut back to 5-in stubs.	May 11, 2023
<i>Drive Rows</i>			
Soil tillage - Rototill	Maschio 180c. Padova, Italy John Deere 520, Moline, IL	Drive row only to level for grass seeding. 1 pass to 2 in depth.	May 15, 2023
Soil tillage - Cultipack	Woods C84. Oregon, IL Front-Mount JD 5400n, Moline, IL	Drive row only. Leveling for grass seeding.	May 17, 2023
Tillage-rototill	Maschio 180c. Padova, Italy John Deere 520, Moline, IL	Weed control before seeding grass.	June 1, 2023
Seeding Grass	Seeder Tar River Implements DRL-72, Rocky Mount, NC Kubota M8540, Osaka, Japan	Companion Covercrop mix, ProTime Lawn Seed, Portland, OR at 100 lb acre ⁻¹ to 1 in depth.	June 5, 2023
<i>Weed Management</i>			
Herbicide	Rears Pak-Tank, Eugene, OR John Deere 520, Moline, IL	Tank spray rate 33 gal acre ⁻¹ . Pendimethalin (Satellite) 1 gal acre ⁻¹ . Pyraflufen-ethyl (Venue) 4 oz acre ⁻¹ .	May 17, 2023
<i>Pest Management</i>			
Fungicide	Rears Pul-Blast. Eugene, OR Kubota M8540, Osaka, Japan	Fluopyram/Trifloxystrobin (Luna sensation) at 5.8 oz acre ⁻¹	June 2, 2023
Insecticide	Rears Pul-Blast. Eugene, OR Kubota M8540, Osaka, Japan	Imidacloprid (Alias 4F) at 3.2 oz acre ⁻¹	June 2, 2023
<i>Irrigation</i>			
Drip	24 in emitter spacing, 0.53 GPH	Drip irrigation applied at 1.1 acre-inch week ⁻¹ in five daily 2 h sets.	April 25 to present

Table 2. Treatment details

Operation	Implement/Equipment	Details	Date
<i>Mulch</i>			
Mulch application	Whatcom Manufacturing Mulch Spreader. Lynden, WA Kubota M8540	Chipped apple wood. Chip size 0.25-0.5 by 2.5-6 in. Aged at 131 F 15 days turning 3 times 2 to 3 in depth (93 yd ³ acre ⁻¹)	May 23, 2023
<i>High Carbon</i>			
Compost application	Whatcom spreader, Mifflintown PA	Tractor in low gear 2 at 1700 RPM, belt setting 3 19,776 lbs acre ⁻¹ . Compost composition 19.5% C, 1.7% N, 0.81% P, 2.02% K.	April 11-12, 2023
<i>Integrated Organic</i>			
Compost application	Whatcom spreader, Mifflintown PA	Tractor in low gear 2 at 1700 RPM, belt setting 3 19,776 lbs acre ⁻¹ . Compost 19% C, 1.7% N, 0.81% P, 2.02% K.	April 11-12, 2023
<i>Standard</i>			
See above			