

EFAO 2021: Research Protocol

Effect of spacing on basket willow (*Salix spp.*) crop production

Farmer-researcher(s): Andrea Matrosovs, Wild Willow Farm & Studio - West

Project type: Research trial

Research priorities: Weed control

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Objective

How closely can willow be planted to achieve an optimal perennial basket willow crop? Optimal basket willow has rods that are numerous per stool, unbranched, straight vs bowing at the butt end, and good height (between 3-8 feet). Willow for larger baskets or woven structures requires good thickness, too.

Background

There is variation in spacing in modern European and North American basket willow culture. Compared today, historic practices experimented with more intensive in-row spacing. Benefits of closer spacing are weed control, forcing the willow stools to grow straight vs branching out by making them compete for light, and economy of space.

Between-row spacing varies according to environmental and mechanical considerations to balance the space required to provide adequate air flow but also space for horses (historically) or machinery (today).

Experimental Design

Field layout

From previous years' experience, Andrea now uses weed barrier fabric. She's found that the 4' weed barrier is the maximum that allows for ergonomic reach to the centre for harvesting each year.

To test different in-row and between-row spacing, Andrea will employ a replicated trial along a gradient, vs randomizing her treatments, using a trial design.

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Andrea will harvest willow from 4 areas in neighbouring crown land, and use one source for each replicate. In a replicated pattern with 4 replicates, Andrea will test 6" and 12" spacing **in-rows** and 6", 12", 18" and 24" spacing **between rows**, with control spacing of 12" in-row and 24" between-row, for a total of **20 plots** as follows:

Layout for each of 4 replicates. Each replicate section will have 5 plots with different in-row and between-row spacing, for a total of 20 plots.

For cuttings that do not take, Andrea will replace in spring 2021 with extras that she is storing in a water bucket. UPDATE: Cuttings were not sustainable after too long in buckets.

Andrea will replace cuttings that did not take in late fall 2021 or early spring 2022.

New replicate charts:



Spacing	Between Rows			
	6"	12"	18"	24"
6" In-Row	Plot C = 84	Plot D = 48	Plot E = 36	
12" In-Row		Plot B = 24		Plot A = 12

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Measurements for each variety

Pre-Harvest

Before harvesting, Andrea will record branching as described below. She will also use the measuring stake for 3' to 8' to take photos of each plot.

In the fall of 2021 Andrea recorded branching, # of stems per stool (cutting) and tallest stem height per cutting instead. She will still complete the Harvest data as listed below.

Branching per willow

- **For each willow**, Andrea will record whether it is branched (yes) or unbranched (no). Unbranched is a desired attribute of basket willow.

Harvest

- Andrea will harvest **all rods** from each plot separately, cutting as far down as possible to the stool.

Rod count per plot

Count of # of rods harvested per plot.

Height distribution per plot

Andrea will sort the willow cuttings and classify by the foot. Example 3-4' is called a "4-foot" and basket willow is from 3' up to 8' depending on the purpose.

For each plot, she will draught (sort) the willow using a technique in a barrel or large pail to separate the tallest down to the smallest, and count the number of rods in each category: 3',4',5',6',7'.

Dry weight per plot

After Andrea has taken rod count and height measurements, she will bundle all rods per plot, label with an tag ID, and dry in the barn shed. Once dry, Andrea will take a total weight of all rods from each plot. Using the rod count, she will calculate an average weight per rod per plot. Andrea might also take fresh weight measurements.

Photos

Andrea will take photos of each variety throughout the season.

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Research Plan

Time	Task	Methods & Measurements or Action Item
Late March/early April 2021	Source willow	Cut 1 and 2 year old branches from nearby heritage willow on Crown Land.
Late March/early April 2021	Prepare cuttings	Cut segments into 10" lengths & store cold until planting.
April 2021	Layout weed barrier	Layout 2 x 31' strips in the north field and 2 x 31' strips in the south field.
April 2021	Plant cuttings	Plant the 4 strips of 5 sets each according to plan. Reverse order of 2 strips (1 north field & 1 south field).
April to October 2021	Take photos	Monthly from planting to end of growing season.
Monthly	Check-in	Check-in with Sarah March to November of each year.
October 2021	Collect & submit data	Submit Year 1 crop gradient observations.
November 2021	Write report	Write a report with the Research team.
December 31 2021 DEADLINE	Invoice	Send Sarah invoice for farmer-fee.
March 2022	Harvest Year 1 crop	Cut rods and collect/label by set.
March 2022	Sort rods and collect data	Collect Year 1 crop data per set: # of rods total, # of rods per stool, un/branched, height per category (3' to 8'), total fresh weight.
April 2022	Sweep weed barrier	Sweep leaf debris to discourage weeds.
April to October 2022	Dry willow	Store sorted/labeled bundles in airy dry barn shed.
October 2022	Collect & submit data	Collect Year 1 crop dry weight data. Submit all Year 1 crop data & Year 2 crop gradient observations.

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November 2022	Write report	Write a report with the Research team.
December 31 2022 DEADLINE	Invoice	Send Sarah invoice for farmer-fee
March 2023	Harvest Year 2 crop	Cut rods and collect/label each set.
March 2023	Sort rods and collect data	Collect Year 2 crop data per set: # of rods total, # of rods per stool, un/branched, height per category (3' to 8'), total fresh weight.
April 2023	Sweep weed barrier	Sweep leaf debris to discourage weeds.
April to October 2023	Dry willow	Store sorted/labeled bundles in airy dry barn shed.
October 2023	Collect data	Collect Year 2 crop dry weight data. Submit all Year 2 crop data & Year 3 gradient observations.
November 2023	Write report	Write a report with the Research team.
December 31 2023 DEADLINE	Invoice	Send Sarah invoice for farmer-fee
March 2024	Harvest Year 3 crop	Cut rods and collect/ label each set.
March 2024	Sort rods and collect data	Collect Year 3 crop data per set: # of rods total, # of rods per stool, un/branched, height per category (3' to 8'), total fresh weight.
April 2024	Sweep weed barrier	Sweep leaf debris to discourage weeds.
April to October 2024	Dry willow	Store bundles in airy dry barn shed.
October 2024	Collect data	Collect Year 3 crop dry weight data. Submit all Year 3 crop data.
November 2024	Write report	Write a report with the Research team.

*Please note that if data is submitted after the submission deadline, EFAO staff cannot guarantee that your data will be analyzed and written up before the Research Symposium and/or the next growing season.

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Staff check-ins

Monthly

Materials

Please list all materials, supplies and equipment that will be reimbursed for this project. If possible, please also indicate a short-list of any in-kind materials, supplies and equipment that you will use.

Material	Unit	Quantity Required	Total Cost*	Note
Pro garden weed barrier	2 rolls of 4' 5 oz	2	\$204.24	
Fabric pins			\$19	
Digital scale			\$65	To measure rod weight
Fishing waders		1	\$112.99	To source native willow cuttings
Total			~0	

Farmer-fee

\$500 in 2021, \$250 in 2022 and \$250 in 2023, invoiced to EFAO in the fall of 2021 and 2022 and after the farmer-researcher submits data in 2023.

Invoices for Farmer-Fees & Reimbursements

Research expenses

- Email an invoice along with copies of receipts for all qualified expenses to **research@efao.ca**.
- Expenses can be claimed anytime throughout the year.
- Deadline: December 31, 2021

Farmer-fee

- Email an invoice for your farmer-fee to **research@efao.ca**.
- Farmer-fees can be claimed after your data is submitted
- Deadline: December 31, 2021
- If you collect HST for your farm business, you can choose to add HST to your fee.

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Memorandum of Understanding

You agree to keep an active membership with EFAO throughout the duration of your trial.

<https://form.jotform.com/210625202854246>

To check the status of your membership, log in here:

<https://efao.z2systems.com/np/clients/efao/login.jsp> or contact Martina, martina@efao.ca.

References

Most scientific papers about Salix focus on the crop as biofuel, so spacing is much greater and machinery is heavily used.

- M. Armitage, M. A. Dirr; Influence of Spacing on Yield of Buddleia and Salix Grown as Cut Flowers and Stems. Journal of Environmental Horticulture 1 December 1995; 13 (4): 176–177. doi: <https://doi.org/10.24266/0738-2898-13.4.176>

Historic Basket Willow culture was low-tech and focused on the economy of space to produce the highest quality and quantity of yield.

- Traité pratique de la culture de l'osier et de son usage dans l'industrie de la vannerie fine et commune. Motrier, A. (1855). France
- Osier culture. Simpson, John M. (1898) DFB19. United States
- The basket willow. Hersey, Edmund. (1899). BI38. United States
- Basket willow culture. Mell, C.D. (1908). United States.
- Practical Results in Basket Willow Culture. Mell, C.D. (1908). FSC148. United States
- The basket willow. Hubbard, William-F. (1909). FB341. United States.
- Basket willow culture. Lamb, George-N. (1914. Rev. 1923). FB622. United States.
- Basket Willow Culture in Maryland. Pfeiffer, Carl E. (1919). United States
- The cultivation of osiers and willows. Paulgrave Ellmore, William. (1919). England

In addition to advice from Ontario cutting suppliers (the first two in the list below), Andrea has also gathered modern practices from several countries online, including:

- Lakeshore Willows, Lene Rasmussen, Ontario
- Branch Ranch, Jackie and Jill, Ontario
- Bluestem Nursery, Jim and Muriel, British Columbia
- Dunbar Gardens, Katherine Lewis, Washington
- Vermont Willow Nursery, Michael Dodge, Vermont
- Brenden Farren, Ireland
- Hanna Van Aelst, Ireland
- Cross-referenced with several commercial growers, England