Beginning Sugarmaking: Trees, Taps, Tubing & Tanks

George Cook
UVM Extension
Maple Specialist
Identifying the Maples

- **Sugar Maple**
  - Brown twig
  - Sharp bud
  - Smooth leaf

- **Red Maple**
  - Red twig
  - Round bud
  - Rough leaf
Selecting Trees to Tap

- 10” – 12” DBH
- Healthy
- Accessible
Characteristics of Tapable Trees

- Tapholes in healthy trees usually close in 2-3 years.
- Rate of taphole closure is a good indicator of tree health.
Timing

- February – April
- Be alert for highs mid-30s to 40s and lows in the 20s.
- Earlier – southern areas & southern exposure, lower elevations
- New to the area? Check with local sugarmakers
- 5 – 8 week “normal” season
- +/- 12 - 15 “runs” during the season
TRUNK IN A VACUUM

SUCTION

WATER ABSORPTION

Freeze

0°C 32°F
-5°C 23°F

If the tree or ground were deeply frozen in a hard winter, sap will not flow, water will not absorb.

Thaw

+5°C 41°F
0°C 32°F

Thawing starts in the small branches.

SAP FLOW
Tapping Equipment

- Basic equipment required for tapping maple trees:
  - Tapping drill bit
  - Cordless drill
  - Spouts
  - Small mallet
  - Clean container to carry spouts to be installed.
Tappers and Drill Bits

- **New, Sharp bit:**
  - easier to use
  - cut clean, round holes which close more quickly.

- **Old, rusty, dull bits lead to:**
  - Oval holes & sap leakage
  - contamination
Tapping with Buckets

- 7/16” historical
- 5/16” today’s standard
- 1 ½” – 2” deep into clean, white sapwood
- Brace & bit or cordless drill
- Keep 6” to the side of any open taphole
- Use entire circumference
- Tap spout, do NOT pound!
Tapping with Tubing

- 5/16” most common spouts
- Retire your 7/16” spouts
- 1 ½” – 2” deep
- Tap spouts with light mallet
- 24” – 36” drop-lines
- DTS = Downhill, Tight & Straight
- Polyethylene tubing
- Vacuum for greatest efficiency
Tubing layout

- Cull trees 1st before laying out and hanging lines!
- Serpentine laterals
  - Line that goes tree to tree
  - Limit Ys in line
- Gravity vs vacuum
- Empty into mainlines or tanks
Mainlines

- ¾” or larger
- Most fittings start with ¾”
- Polyetheline
- Layout and install wire to attach mainline to
- Attach each end, then tighten and use pull-backs as needed
- Maintain 2 – 3% slope
- When in doubt, use a hand-held site level <$20
- 2 – 3 FT drop in every 100 FT of run
3/16” vs 5/16”

- More taps per laterals with 3/16”
  - Strive for 5 with 5/16”
  - 15 – 25 seems to work with 3/16”

- 3/16” best for good vertical drop
  - Most fittings now available

- Both - steep like a Mtn stream; 5% or more

- Mainlines – flatter like a river; 2-3% minimum
3/16” Gravity Tubing

- Relatively New
- Innovative
- Exciting Results
- Up to 28” vacuum!

- Mine: 2015
- 21” on mainline,
- 21” on 5/16”…
- 25” – 27.5” top of 3/16”
- 19.5”…limited drop, gravity
2016 Season

- Converted all to 3/16”
- Gravity: up to 24” Hg, limited vertical drop
- With 21” Hg vacuum on mainline: 24” – 28” Hg
- Excellent flow and volume
- Very happy with results
Vacuum for Small-scale/Beginners

- Diaphragm Pumps
  - +/- $1,000
- Several manufacturers
- 5” inch diaphragms
- Single & Double set-ups
- Change diaphragm annually
  - Kit runs +/- $40
- Duckbill vs umbrella valves
- Effective for small operations – up to 500 taps
• Squirrels – a royal pain with tubing systems
• Clear Out Softwoods – squirrel habitat
• **NO Bleach** (NaClO)
  • High Sodium – squirrels like salt, too!
Tapping Guidelines

- No tree tapped under 10” DBH
- 10” – 17” tree = 1 tap
- 18” + tree = 2 taps
- NO MORE THAN 2 taps
- Don’t cluster tap
- Vacuum tubing:
  - Strive for 5
- Gravity: 10 to 12
- Serpentine, not Ys.
Quaint, but…
Very “Old School”
Not Recommended!
Sap Collection

- All Food Grade – intended for food use!
- Tanks to use: Stainless, polyethylene
- Shaded & cool = under 40°F
- New lines keep sap cooler, black plastic water pipe gets hot
Sap Collection

- Old Buckets = lead solder
- Plastic tubing systems ~ growing steadily
- Sap Bags ~ Few, mostly mid-west
Sap Collection & Storage

- All gathering & storage tanks – lead free (e.g. stainless steel, fiberglass, polyethylene, etc.)
- Gather daily, boil at once
- Keep sap cool
- Strain, Filter
Sap Storage

- How much storage do you need?
- 2 gallon per tap per day - tubing
- Plan for two days storage
Galvanized

Re-Grind

Food Grade Polyethylene

Good
Sugaring Basics: Buildings, Boiling, Bottling & Bragging!

George Cook
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Vermont Maple Conferences - 2016
Jones Rule of 86

- How many gallons sap to make a gallon of syrup:
- Measure sap sweetness
- Divide “86” by % sugar in the sap.
- Example ~ 2.4% sap; divide 86 by 2.4 = 36 gallons sap for a gallon of syrup...good
- 86 / 1.5% sap = 57...Ouch!
Sugarhouses
The early days...

FUN but, There’s gotta be a better way!
The building...

- Foundation
- Drainage
- Concrete
- Electricity ?
- Water ?
- Accessibility
- Convenience

- Look around
- Ask questions
- Take measurements
- Photos
Evaporating/Boiling Equipment
Buying an Evaporator

- Equipment not included with evaporator:
  - High temp bricks & mortar
  - Candy or kitchen thermometer
  - Hydrometer & cup
  - Pails
  - Scoop, skimmer
  - Grading kit
Evaporators (2017)

- A peek at prices
- Small unit, flat pans: $1,500 - $2,500
- 2’ x 4’: $3,000 & up; 2 x 6: $4,000 – 6,000+
- Brick & Cement: $250 - $300

Also need:

- Stovepipe, fittings, piping, skimmer, dipper, hydrometer, thermometer, strainer, grading kit, containers, firing gloves, pails.
- All sap/syrup handling/storage containers to be intended for food.
- Garbage cans - NEVER intended for FOOD.
What Size?

- Never big enough – plan for expansion
- Room around evaporator
- Cupola – at least as many square feet as pans’ surface
  - So…2 x 6 rig needs 12 square feet at cupola, minimum
FAQs

- How many taps?
- How many gallons of sap?
- How much time to spend boiling?
- How many gallons can you evaporate per hour?

- Figure 1 + gallons sap per tap per day
- Start time…Quitting time???
Basic Evaporators

- Evaporation Rates Vary
  - 5 to 8 gallons sap / hour; single pan
  - 15 to 20 gallons/hr.  2’ x 4’ rig
  - 25 to 30 gallons/hr.  2’ x 6’ rig
- Figure 100 taps = 100 gallons per day; 100 gall @ 20 gall/hr = 5 hours to boil.
Evaporator Performance

- Basic rigs...
- ½ pint syrup per hour for small, flat pan rig
- 2 – 3 pints per hour for 2’ x 4’
- 4 – 5 pints for 2’ x 6’
- Maintain steady, hot fire to increase production rate
Matching

- Sizing the Evaporator
  - 10 – 50 taps
    - Single pan, ½ pint, etc.
  - 50 – 300
    - 2’ x 4’, 2’ x 6’
  - 300 +
    - 2’ x 6’ or larger
- Contact manufacturers for recommendations
The Arch

- Height? Think of your back.
- Line with Firebrick
- 6” or larger stovepipe
- Double walled for pipe passing through walls or ceiling
- Stack – 3 x pan length
  - 2’ above roof line
more Arch

- Level the arch
  - Initially
  - Recheck often

- Grates
  - Position with open end of Vs facing up.
Fuels

Firewood

- Mixed hard & soft wood
- 16” – 20” length for small evaporator
- Know your firebox
- 2” – 3” diameter
- Combination split & round wood
- Cut a year ahead
People with TOO much time on their hands
Other Fuels

- Wood Chips
- Propane
- Fuel Oil
- Wood Pellets
Boiling
Finishing
Packing
Marketing
Getting Ready

- AGAIN... Level the Evaporator
  - L to R & F to B
- Flood with sap
  - Ensure ample supply
  - All valves “ON”?
- Newspaper & kindling wood
- Do NOT use gasoline or other accelerants
Firing Up

Firing

- Firing/welding gloves
- Leave 3” – 4” space end of wood to door
- Too long can damage pans
- Criss-cross pattern
- Leave plenty airspace
- Open/Shut doors quickly
Running the Evaporator

- Set draft door & damper
- Monitor & maintain sap level during boiling
- Fire every 7 – 8 minutes
- Egg timer handy
Running the Evaporator

- **Recommendations**
  - Flooding depth: 1 ½”
  - Boiling depth: ¾” – 1”
  - De-foamer: 1 drop/pinch every 10 minutes or each firing
  - Switch sides daily
  - Shutting down: I switch to soft-wood last few firings, fewer hot coals remaining
  - Leave 2” or so in pans, get to know your rig, how much is enough?
Improving Efficiency

Small fan at draft/ash door will improve boiling rate...
Steady, hot fire

“Best $16 ever spent!”
Defoamers

- FRESHNESS COUNTS
- Vegetable oils
- Commercial defoamer – both liquid and solid
- Dairy products ???
  - milk, cream, butter allergies
- Do NOT over do it.
- Never use spray bottle.
Periodic maintenance

- Maintenance
  - Clean out ashes regularly
  - Clean pans as needed
  - Switch sides often
- Repairs
Is it Syrup yet?

- **Temperature:** 7 ½ °F above boiling point of water – check thermometer daily.
- **Hydrometer:**
  - 32° Baume or 59.9° Brix
- **Measure hot:** right off evaporator
Filtering/Straining

- Filter / strain **HOT** ... immediately off evaporator
- Pre-filters very beneficial
- Check filters for thin areas
- Boil new filters 2X before use
- Clean daily, **do not** wring
- Sniff test – store dry, paper bag in drawer
  - Never in damp, musty area
  - Never near moth-balls
- Use new, accurate kit – old kits lighten
- Have old kit checked
- “Equal to or lighter than” minimum color
- Sky or fluorescent light

Grading Syrup
Syrup Standards

- Density
- Color
- Clarity
- Flavor
Bottling, Canning Syrup

- Hot pack: 180 - 190°F
- Cap it
- Lay container on side - 10 minutes, then stand, let cool
- New, clean containers
- Keep coded sample bottle of each batch
- Code each container
Syrup Storage

- Cool before storing
- Store in cool area
- Freeze, if room available
- Low density syrup will spoil, ferment
- Heavy density syrup will crystallize
Vermont Maple Syrup Grades

- **1900s thru 1982**
  - Fancy - A - B - C - Substandard

- **1982 thru 1993**
  - Fancy - Grade A Medium Amber - Grade A Dark Amber - Commercial - Substandard

- **1993 thru 2014**
  - Fancy - Grade A Medium Amber - Grade A Dark Amber - VT Grade B - Commercial - Substandard

- **2014-2016 (transition) on…**
  - No. Am. Maple Syrup Grades
  - Grade A Golden/Delicate (VT Fancy) - Grade A Amber/Rich - Grade A Dark/Robust - Grade A Very Dark/Strong - Substandard
Selling / Marketing

- Vermont Labeling Requires:
  - Product & Amount
  - Your Name
  - Address

- Grade A…
  - Golden/Delicate “VT Fancy”
  - Amber/Rich
  - Dark/Robust
  - Very Dark/Strong

- Code each container

- Charge a realistic price … cover your costs … make a profit …
Displays – Exhibits

- Put Your Best Foot Forward
- Attractive Display, Clean, Neat
- Samples? Taste them daily
Entering Syrup to Win

- Entering a contest?
- Do everything a judge would do:
  - Open it
  - Check the Density
  - Check the Clarity
  - Check the Color
  - TASTE it!
- Now…Would you want someone else tasting this syrup?

- Sugarmakers with the best intentions have RUINED their syrup.
- Never place it in used containers:
  - No Pickle Jars
  - No Peanut Butter Jars
  - No Mayonnaise Jars
- Best in new, rinsed canning jars
- This means new lids, too!
End of Season Clean Up

- **HOT WATER** – the magic ingredient, soft water best
- Pan cleansers – neutralize & triple rinse when used
- Stiff bristle brush, avoid scratching equipment
- No soap, detergent, any scented material
  - Syrup is very sensitive and will pick up other flavors
Cleaning your Evaporator

- Fill pans with water; distilled if available, it’s mineral-free.
- Add cleaner – Carefully!
- Boil 1 hour or until scale is loose, flakes off
- Stiff bristled nylon brush
- Avoid harsh abrasive pads or steel wool
After Sugaring

- Clean pans, equipment
- Pull spouts, clean lines
- Cover pans with plywood, tarp or plastic to keep out squirrels, mice, bats & debris
Bells & Whistles ~ wish-list

- Many efficiency enhancing products available:
  - Steam hoods
  - RO
  - Forced Draft
  - Vacuum
  - High efficiency oil burners
  - New tubing systems
  - Quick-connect couplings for tubing
  - Canning units
  - ...
Looking for Info…

- George.cook@uvm.edu
- Toll-free 866-260-5603
  or
- Mark.isselhardt@uvm.edu
- 802-899-4923
  or
- www.uvm.edu/~uvmaple

- VMSMA at
  - www.vtmaple.org
- UVM PMREC at
  - www.uvm.edu/~pmrc
- Maple Manual
- Sugarmakers
Questions?
All too common Off Flavors

- Buddy
- Metabolism
- Ferment
- Metallic
- Defoamer
- Musty/Moldy
- Chlorine
- Detergent/Soapy
- Burnt Niter
- Scorch
- Filters/ New Filters
- Chemical