

Research Project Title: Reducing Harvest Shrink

Funder: Maine Technology Institute

UMaine Project Investigators: Cooperative Extension (Dr. Lily Calderwood), Mechanical Engineering (Dr. Bashir Koda), Advanced Manufacturing Center (John Belding), Wild Blueberry Commission of Maine (Eric Venturini)

Objectives:

1. Assess current harvesting technology and practices with a focus group of industry experts
2. Innovate data-driven improvements to harvesting technology and develop “best harvesting practices” to improve efficiencies of existing technology
3. Drive adoption by carrying out a robust outreach program to deliver data-driven best harvesting practices and demo harvesting innovations
4. Evaluate this project as a model to catalyze and deliver innovation to the Maine wild blueberry industry

The Diameter of teeth is calculated by following assumption:

1. Average force to pick up one berry (For ripe berry 0.45N and for unripe 0.83N); Numerical ratio for ripe and unripe berries is 80% and 20% respectively.
2. The maximum yield of wild blueberry plantation per square meter 6.3 kg m⁻²;
3. Maximum mass of wild blueberry is 0.88g maximum.
4. There for seven thousand berries can be grow over one square meter;
5. In in this design space between teeth are taken as 15mm, 20mm and length is 25cm. minimum working length of the teeth is 20cm.

For Blueberry hill farm maximum number of berries on one stem is 27. Moreover, the length of this blueberry cluster is 5cm. for maximum condition around 27 blueberries will be on each tooth for 5cm length. There for maximum force applied on teeth is 14.202N.

The gravitational force due to tooth and berries may be negligible. Selecting material for teeth as a stainless steel (corrosion resistance). Which is having high mechanical strength and flexibility. Mostly used as a teeth material. Diameter of the teeth is taken as 4mm and 6mm.

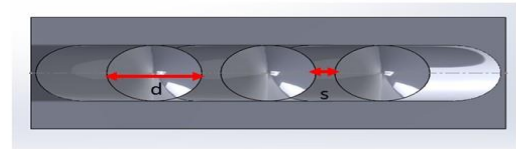
- Considering one tooth as cantilever beam.
- Calculating diameter for limiting bending stress.
- $\sigma = 205 \text{ MPa}$ (Stainless steel)
- $L = 150\text{mm}$ (Length of teeth)
- Load of berries due to weight and connection to stem = 14.202N (Maximum 27 berries)

$$d = \sqrt[3]{\frac{32WL}{\pi\sigma}}$$

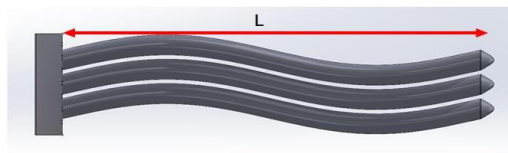
Length of teeth(L), mm	Limiting Stress, MPa	Load on teeth(W), N	Diameter(d), mm	Space between each teeth (s)
150	205	14.202	5mm	3.5mm
200	205	14.202	5.5mm	4mm
250	205	14.202	6mm	4.5mm



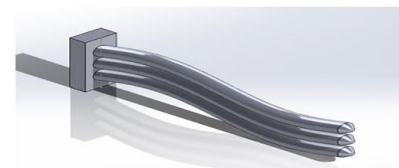
Side View



Front View



Top View



Isometric View



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