STRAWBERRIES

Fragaria x ananassa Duch.

An aggregate fruit of achenes borne on an enlarged receptacle
Strawberries
Strawberries, Straibere, Strabery

- Worldwide - *Fragaria vesca*
- Canadian - *Fragaria virginiana*
- American - *Fragaria virginiana, Indian*  
  “oda-e-min” = “heart berry”
- Chilean, Hawaiian, California, South America - *Fragaria chiloensis*
- Utah - *Fragaria virginiana - Mountain strawberry*  
  - source of the day neutral gene
- Cultivated strawberry - *Fragaria x ananassa*
- All: n = 7, 14, 21, and (28 = Octoploids)
Modern Strawberry

Duchesne, Antoine Nicolas 1766. “Histoire Naturelle des Fraisiers” (18 to 19 years old)

“…Ananas strawberry….is…intermediate between … Scarlet…[F. virginiana] … and…Frutiller [F. chiloensis]…. I conclude the Ananas to be a cross…..

F. x ananas = Pine (as in pineapple)

Strawberry first discovered in Europe

F. sp. = Numerous subsequent crosses
Strawberry - The Name?

- English name ‘Strebere” from “running stems strawed over the ground…”
- Children threaded berries on grass straws to sell
- Straw mulch
- Old English noun = stre “straw” and verb = “to straw” = strew, scatter, spread, disperse
Strawberry Fruit Uses

- Fresh
- Preserves
- Jams
- Jellies
- Frozen
- Juices
- Extracts
- Flavorings
Leading Strawberry Countries

- United States  462T MT
- Poland        212
- Japan         202
- Italy         161
- USSR          120
- France        92
- Spain         85
California Strawberries

- $60M annually
- 75% of USA total
- 16% of USA acreage
- 40 to 50 tons/acre
- Day neutral: ‘Selva’
California Strawberries

- 60% of US crop
- 10,000 acres (US total 25,000 acres)
- New Cultivars (Breeding programs)
- Pallated air shipping
- In transit Controlled Atmosphere
- Annual planting
- Soil Fumigation
California Strawberries

- Clear plastic mulch
  - Soil heating (winter crop)
  - Clean (no dirty berries)
  - Larger fruit
  - Longer season
- White plastic mulch
  - Cools soil
  - Summer crop
The Plant

- The strawberry is an herbaceous perennial.
- Perennial portion of the plant is the crown, which is the stem.
- The crown produces roots, leaves, branch crowns and flowers.
- Strawberries plants are shallow rooted with 50% to 90% of the root in the top 6” of the soil.
History

- In Greek and Roman times, the strawberry was considered a wild plant.
- In 1780, the first strawberry hybrid was developed in the United States.
- Legend has it that if you break a double strawberry in half and share it with a member of the opposite sex, you will fall in love with each other.
History continue

The strawberry was a symbol for Venus, the goddess of love, because of its heart shapes and red color.
Different Types Of Strawberries

- June bearing, everbearing, and day neutral are different types of strawberries grown.
- June bearing strawberries produce a crop during a two-to-three week period in the spring.
- Everbearing strawberries produce three periods of flowers and fruit during the spring, summer, and fall.
More About The Different Types Of Strawberries

- Day neutral strawberries will produce fruit throughout the growing season.
- Everbearing strawberries are great for gardeners who have limited space.
Picking Your own Strawberries

- When picking your own strawberries be careful not to over pick strawberries because they quickly mold when left at room temperature.
- Select plump, firm, fully red strawberries.
- The smaller strawberries are most often the most flavorful.
Picking Tips

- Grasp the stem just above the berry between the forefinger and the thumbnail and pull with a slight twist motion.
- With the stem broken about one-half inch from the berry, allow it to roll into the palm of your hand.
More Picking Tips

- Carefully place ~ don’t throw ~ the fruit into your container.
- Don’t overfill your containers of try to pack the strawberries down.
Facts About Strawberries

- Eight strawberries will provide 140 percent of the recommended daily intake of Vitamin C for kids.
- Strawberries are the first fruit to ripen in the spring.
- One cup of strawberries are only 55 calories.
- On average, there are 200 seeds in a strawberry.
Facts Continue

- 94% per cent of united states households consume strawberries
- The strawberry is the only fruit with the seeds on the outsides of the fruit
- Strawberries are a member of the rose family
Space

Strawberries can be grown in small spaces
Site considerations

- Available water
- Available sunlight
- Soils
- Slope
Obtaining Plants

- Purchase plants from a reputable nursery
  - True to name
  - Disease free
  - Virus indexed
- Don’t save, don’t share
- Arrange for spring delivery
Strawberry Plant

- Crown
- Leaves
- Stolons (runners)
- Roots
- Trusses (flowers and fruit)
- Plantings last 3-5 years
Daughter Plant

Stolon

Stolons or Runners
## Fruiting Habits

<table>
<thead>
<tr>
<th>June bearers</th>
<th>Short Day</th>
</tr>
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<tbody>
<tr>
<td>Everbearers</td>
<td>Long Day</td>
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<tr>
<td>Day Neutral</td>
<td>Insensitive</td>
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</tbody>
</table>
Day Neutral Strawberries

- Based on a collection of F. virginiana made in Utah’s Wasatch mountains by Royce Bringhurst, Breeder at UC-Davis.
- Incorporated into breeding program.
- Is now the basis for the strawberry industries in California, Florida and other warm climates.
Protecting plants

- Don’t allow plants to dry out before planting
- Open bags and inspect for disease
- Keep cool and damp (not wet)
Planting

- Spring after danger of frost past
- Don’t allow plants to dry out before planting
- Remove old or dry leaves
- Proper depth
- Spread roots
- Firm soil around crown
How You Should Plant Them In The Ground

The center plant is set correctly, with the soil just covering the tops of the roots. The plant on the left is set too shallow, the plant on the right too deep.
PLANTING DEPTH

Shallow  Correct  Deep
Planting

- Spring after danger of frost past
- Proper depth
- Spread roots
- Firm soil around crown
Ways To Plant Strawberries

matted row

spaced row: two runners

spaced row: four runners
Mulching

Strawberries are very sensitive to the frost in the spring. Mulches that have covered the plants during the winter months should be removed in the early spring.
Strawberry planting systems

- **Matted Row**
  - 12 to 18” between plants
  - 36 to 40” row spacing
  - Beds 12-18” wide
  - Runners encouraged

- **Spaced Plant**
  - 6” between plants
  - 36 to 40 row spacing
  - Single plant row
  - Runners removed
Spaced Plant System
Spaced Plant System
Remove blossoms the first year

Promotes vegetative growth
Irrigation

- Strawberry is shallow rooted
- The soil must not dry out
- Require 1 to 2 inches per week
- 2 inches each of the three weeks before harvest
- 1 inch is .6 gallons per sq. ft.
Dead 😞    Alive 😊
Renovation

- Begin *immediately* after harvest
- Control weeds
- Mow leaves if leaf diseases serious
- Narrow rows
- Place soil around crowns
- Incorporate mulch
- Fertilize
Fertility

- Amend soil before planting
- Do Not add fertilizer before harvest
  - Get leaves, not fruit
Weed management

- Herbicides are not recommended for garden plantings
- Weed control is best done with a hoe or by hand weeding
- Grasses are the most competitive weeds
Major Insect Pests

- Tarnished plant bug
- Spittlebugs
- Strawberry weevil (clipper)
Tarnished Plant Bug

- Causes “cat-faced” berries
- Suck plant sap and inject a toxin which breaks down tissue
- Injury occurs shortly after bloom
Tarnished plant bugs

Management

• Monitor for presence by holding white paper under flower clusters and tapping then gently
• If present, apply an insecticide
• See “Strawberry pest management for home gardeners” (A2127) for current recommendations.
Spittlebugs

- Immature spittlebugs produce a frothy mass on strawberries in May & June
- Feeding stunts growth
- If buds or flowers attacked no fruit are produced

Control:
- Appropriate insecticides
- Keeping host weeds out of surrounding areas
F. vesca
Virus indicator plant
Strawberries in the home

- Rototilling
- Soil conditioning
- Full Sun Area
- Raised Bed
- Soaker hose
- Mulch
- Liquid fertilizer
- Net for fruit protection
“The strawberry plant is now called Fragaria, …*Fraga* by the poet Virgil. How this beautiful and lovely plant was known to the old Greeks, I cannot say,…” - Fuchs

“…the running stems of which are strewed (anciently strawed) over the ground…

*Terrestribus fragis*” = ground fragrance
Strawberry habitat

- Strawberries are found in every country from the tropics to the arctic
- More widely distributed than the grape
- Musky species live in forests and tall grasses - shaded - shares the aromatic and vinelike flavor of Muscat grapes - lives in eastern Europe, Russia, and Siberia
Morphology of the Strawberry

- Crown
- Leaf bases
- Stolons
- Trifoliate leaves
- Aggregate flower
- Cap = calyx
- Fruit = vascular bundles around pith inside the receptacle cortex, achenes on surface
Strawberry crown

- Rosette crown (1") covered by overlapping leaf bases (stipules)
- Anastomosing
- Vascular cylinder of bundles and leaf traces
- Buds occur in leaf axils
Strawberry crown

- Rosетted crown (1”) covered by overlapping leaf bases (stipules)
- Anastomosing
- Vascular cylinder of bundles and leaf traces
- Buds occur in leaf axils
Stolons

- Prostrate
- Two nodes
- Originate in leaf axils
- Second node forms daughter plant

The principal asexual propagation method

High # potential plants
Leaves - evergreen till frozen

- Compound pinnate
- Trifoliate - 3 leaflets
- Leaflet on petiolule
- Petiolules on petiole
- Stipule around base
- Prominent veins under
- 2/5 spiral arrangement
- Plastrochron 8-12 days
Roots

- Adventitious from bases of new leaves in the crown
- Primary roots are soil penetrating
- Secondary roots - feeders
- Stele = vascular cylinder = diagnostic
**Root characteristics**

- 50 to 90% in the upper 6” of soil
- Depth of rooting can be 40”
- Penetration greater in sands and less in clays
- Shallow roots = special cultural practices - mulching
Inflorescence

- = scapes
- peduncle
- branches
- fruit stem a pedicel
- a dichasial cyme
- from 1 to 39 flowers
- 1 p, 2 s, 4 t, 8 quaternary, 16 quinary
Fruit

- Cap = calyx
- Achenes - straw?
- Ripened receptacle = fleshy pith
- Vascular bundles
- Cortex
- Epidermis
- Bearing achenes
Shapes of strawberries.

USDA Charts
The Strawberry Cultivars to Marketing

‘Raritan’

‘Midway’

‘Mesabi’

‘Nourse’
**Propagation**

- Seeds for *F. vesca*
- Runner plants from 1st and 2nd daughter plants
- Grown in sanitized fields
- Fruit is removed to promote vegetative growth

Lareault Nursery
Lavaitre, Quebec
Plant Growth - Leaves

- Leaf growth optimum = 23°C
- Crown branching at photoperiods < 10 hrs
- Stolons grow at photoperiods > 10 hrs
- Leaf area follows daylength, LD = LVS
Plant Growth - Roots

- Root growth best at 13°C (55 °F)
- Crown growth best at 18 °C (65 °F)
- Feeder roots - no cambia
- Spring growth limited (depends on root starch)
Plant Growth - Dormancy

- Induction by short days
- Conditioned by low temperatures
- Induction → crown, root, & petiole starch
- Effective chilling curve same as tree fruits
- Southern S grow under SD & low T and require little chilling
- Northern S grow under LD and require chill
Runner growth

- Long days
- High temperatures > 21 °C (70 °F)
- Junebearers runner under SD with T > 24 °C
- Everbearers and Day Neutrals runner under SD&T of 16 to 28 °C
Junebearing Strawberries

- “Single croppers”
- “Long day”
- Facultative short-day plants
- Require night lengths shorter than 10 hours or temperatures less than 15 °C for flower induction - FBI - flower bud differentiation
- FBD - flower bud development - clustering
**Everbearing Strawberries**

- Perpetuals, four-seasons, re-bloomers, day-neutrals
- Everbearing controlled by 1 recessive gene
- Runnerless controlled by 1 recessive gene
- Alpine “Brighton” characteristic breeds true
- Octoploid everbearers display variation
- Flowering - Single crop (short day only), everbearing (LD & SD) and day neutral (continuous)
Limits to productivity

- Spring freezes
- Wind
  Shelters increased yield 56%
  Shelters decreased wind speed 31%
- Biological competition
  Weeds - especially grasses and vines
  Animals - birds, slugs, ants, rodents
  Parasites - nematodes, viruses, blights
Weed Control

Dacthal
Incorporated
Strawberry culture

- Raised beds
- Spaced matted rows
- Matted rows
- Single Hill
- Double Hill
- Multiple Hill
- Spacing from 5” to 5’
### STRAWBERRY TRAINING SYSTEMS

<table>
<thead>
<tr>
<th>Matted Row</th>
<th>Hedge Row</th>
<th>Double Hedge Row</th>
<th>Hills Single Row</th>
<th>Hills Double Row</th>
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O = mother plant  
o = daughter plant
New Zealand
Strawing Strawberries

- Pine Straw
- Wheat or Barley Straw
- Sawdust
- Black plastic
- Clear plastic
- Containerizing barrels
- Hanging baskets
Harvesting
Harvesting, Mechanical
Renovation