

Cultivar selection

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<http://http://ujkert.szie.hu/oktatas/letoltheto-oktatasi-segedanyagok/fruit-and-viticulture-production>

Main elements of fruit production

- | | | |
|------------------------------------|---|-----------------------|
| • Site selection | } | Orchard establishment |
| • Cultivar selection | | |
| • Site preparation | | |
| • (Producing propagation material) | | |
| • Tree planting | } | Production technology |
| • Vegetation management (tillage) | | |
| • Fertilisation | | |
| • Irrigation | | |
| • Pruning and training | | |
| • Plant protection | | |
| • Harvest | | |
| • Storage | } | Post-harvest |
| • Fruit handling | | |

Basic terms

- **Pomology or Fruticulture**: the science that deals with fruits and fruit growing
- **Systematic pomology**: the study of the kinds of fruits
- „A **cultivar** is an assemblage of plants that
 - a) has been selected for a particular character or combination of characters,
 - b) is distinct, uniform and stable in those characters, **DUS**
 - c) when propagated by appropriate means, retains those characters.”/Cultivated Plant Code Art 2.3/
- Classified by a public authority (UPOV, NÉBIH)

Some classification possibilities of fruit cultivars

- **Breeding methods**
- **Geographical origin** ► ecological requirements
- **Usage** – dessert (fresh consumption), processing
- **Pollination features** – self-pollinating (self-fruitful), self-incompatible (self-ubfruitful)
- **Harvesting season** – early, mid, late season
- **Features, appearance of the fruits**

Breeding methods of fruit cultivars

- **Selection of seedlings** of known or unknown origin (random or chance seedlings); folk selection, regional selection
- **Cross-breeding** (hybridization); → need for new characteristics; resistant cultivars
- **Selection of natural** (spontaneous) **mutations** – e.g. colouration, growth habit
- **Clonal selection**
- **Induced mutation** – X rays, chemicals, colchicin
- **Biotechnological methods** – micropropagation, markering, plant transformation

Geographical origin of fruit cultivars in the temperate zone

- **Local, indigenous cultivars** – perform and suits best to the place of origin
- **Acclimatized, well adapted cultivars** – e.g. Idared (USA, apple), Williams (GB, pear), Germersdorfer (D, cherry), Stanley (USA, plum) in Hungary
- **From Atlantic climate** – prefer humid and balanced weather; e.g. Elstar (NL, apple), Gala (NZ, apple)
- **From Mediterranean climate** – need longer growing season; e.g. Granny Smith (AUS, apple), Bergeron (F, apricot), Babygold (USA, peach)
- **From Continental climate** – tolerate temperature and humidity fluctuations

Possible cultivation centres of the three cultivated avocado races



Different cultivar groups of plums



Aspects of cultivar selection I.

characteristics determining value on the market

- Suitability for specific purposes (dessert: eaten fresh, different kind of processing, dual purpose variety)
- Appearance: fruit size, shape, colour, surface
- Flesh colour
- Flesh texture
- Culinary attributes, taste, nutritional value
- Harvesting season (early, middle, late season)
- Period/season of availability
- Shelf-life, keeping qualities

Aspects of cultivar selection III.

characteristics determining value of rootstocks

- Compatibility and affinity with the scion
- Depth and strength of rooting
- Effects on growth and fruit bearing habits of the scion
- Sucker formation habits (sucker: shoots originating from underground plant parts)
- Requirements to soil physical characteristics
- Salt and pH tolerance
- Water requirement, draught tolerance
- Cold tolerance, winter hardiness
- Resistance/tolerance to soil-born diseases and insects (nematods)

Aspects of cultivar selection II.

characteristics determining value in the orchard

- Ecological requirements; chilling-, precipitation-, ((soil-)) requirements; winter hardiness,
- Stress (draught, heat, frost) tolerance; disease resistance → regular yielding
- Rootstock compatibility/incompatibility
- Growth habit, tree habit
- Yield potential, years to come into bearing, length of bearing
- Flowering period; self-fertility, self-incompatibility
- Rate of fruit setting
- Parthenocarpy (fruit formation without fertilisation of ovules)
- Harvesting season, ripening habits
- Agro- and phytotechnological requirements
- Suitability for mechanisation

Cultivar use for apple

- About 7.500 cultivars worldwide
- Globalised apple trade → only five cultivars ('Fuji', 'Red Delicious', 'Golden Delicious', 'Granny Smith', 'Gala') amount 60% of the world's yield
- 'Jonagold' and 'Idared' are also significant in Europe
- Club cultivars – e.g. 'Ariane', 'Jazz', 'Kanzi', 'Modi', 'Pink Lady'; presently 34 club cultivars in Europe
- Increasing importance of disease resistance (powdery mildew, scab, fire blight)



Cultivar use for pear

- Asian (*Pyrus pyrifolia*) and European (*P. communis*) pear
- Over 3.000 cultivars worldwide
- Pear cultivar use is conservative, only 8-10 ones are grown in market plantations around the world
- In Europe 'Conference', 'Williams', 'Abate Fetel' and 'Doyenné du Comice' accounts for 60% of the yield; red-coloured variants were added to the assortment recently
- **Breeding objectives:** disease and pest resistance, increasing climatic adaptability, decreasing growth habit, improving fruit quality, improving suitability for machine harvest



Cultivar use for peach and nectarine

- Peach, nectarine: over 2.000 cultivars worldwide
- Well distinguished cultivar groups based on
 - fruit surface – velvety or smooth (nectarine)
 - flesh colour – white or yellow, white is beginning to become popular again
 - usage – dessert or processing
 - stones – clingstones or freestones
- Many cultivars are of Californian origin → frost susceptible
- Globalisation → decreasing difference in the appearance of fruits
- Present trends: extending the harvesting period, breeding special cultivars (flat, red-fleshed)

Cultivar use for banana (and plantain)

- Very narrow genetic background due to the constant vegetative propagation
- Altogether just 200-300 clones are grown worldwide
- Di-, tri- (50% \leq) and tetraploid cultivars
- *Musa acuminata* (A) and/or *Musa balbisiana* (B) genomes are mainly involved
- Dessert bananas: AA or AAA, plantains: AAB or ABB or BBB
- Gros Michel (AAA) was the main cultivar for export, now Cavendish (AAA) dominates (90%)

Cultivar use for mango

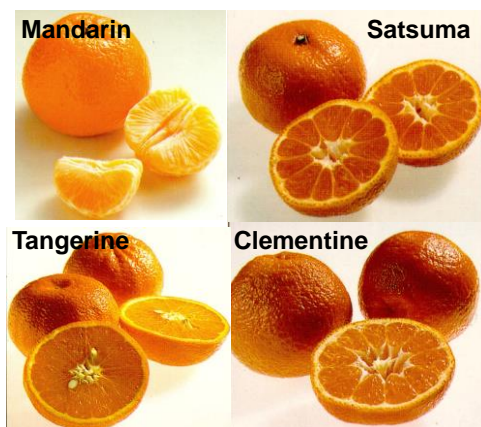
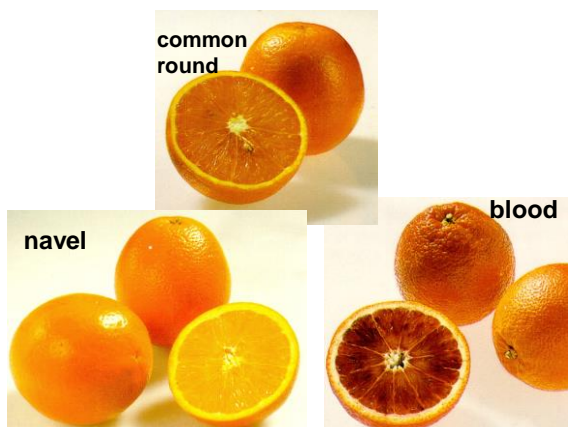
- Over 1.000 cultivars; the most important gene pool is in India
- Every region has its own local cultivars
- Presently the most important international cultivars are chance seedlings
- Floridian cultivars are very successful internationally
- India, USA (Florida), Israel and Australia have the most active breeding programmes
- Regular bearing, dwarf tree size, extended cropping season, less fibre in the fruit, disease resistance are the main breeding goals

Cultivar use for pineapple

- There are five four (five) big cultivar groups: Cayenne, Queen, Spanish, Abacaxi (or Pernambuco), (Maipure)
- Great emphasize paid on disease and insect resistance, and on suitability for fresh-fruit export

Cultivar use for citrus fruits

- Several important species
- Plenty of cultivars
- Easy peelers for fresh fruit production
- Interspecific and even intergeneric hybrids are increasingly popular



Literature

- Barry (2014): Citrus cultivars – their lineage and nomenclature.
https://www.unece.org/fileadmin/DAM/trade/agr/meetings/wp.07/2014/Post-session/CULTIVAR_Nomenclature.pdf
- Békefi, Bujdosó, Kovács, Szalay, Tóth (2011): Evaluation of fruit cultivars.
http://www.tankonyvtar.hu/hu/tartalom/tamop412A/2011-0028_evaluation_of_fruit_cultivars/adatok.html
- Brickell (Ed.) (2009): International code of nomenclature for cultivated plants. 8th edition. Scripta Horticulturae No. 10
- Nakasone & Paull (1998): Tropical fruits. CAB International