

On-farm Orchards of Fruit Trees

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Abstract: Four on-farm plantations (KRNP Vrchlabí, the Orchard of Reconciliation in Neratov, Podyjí National Park, and Šumava National Park) were successfully established in a traditional form, with large orchard trees on seedling rootstocks. Certain accessions (cultivars) for on-farm conservation in the given locality were selected, according to the incidence and presentation of genotypes in these particular areas. This information was obtained by localization of fruit trees *in situ* and the determination of certain cultivars. Nursery stock production for on-farm plantations is described. Because of the longevity of the plantation, seedling rootstocks were used for the production of planting materials for the on-farm plantations. Techniques of on-farm plantation establishment and orchard management are stated within the paper. Four established on-farm plantations have ensured the long-term preservation of landraces in their original areas.

Keywords: apples; pears; plums; sour cherries; sweet cherries

On-farm conservation is the long-term preservation of landraces, by growing them in areas in which they were originally cultivated. This means of conservation is based on traditional growing technologies, which have been practised by farmers for millennia. Thus, the landraces are highly adapted to the local environment, and is likely to contain locally adapted alleles of gene complexes (MAXTED *et al.* 2008). Large orchard trees are grown on vigorous seedling rootstocks, planted widely spaced, in on-farm plantations (PAPRŠTEIN *et al.* 2007). On-farm conservation may also be defined as the sustainable management of the genetic diversity of locally developed landraces (MAXTED *et al.* 1997).

On-farm conservation is of cultural, social, landscape, and environmental importance (PAPRŠTEIN *et al.* 2003; PAPRŠTEIN & KLOUTVOR 2003, 2007a, b). It should give the public information about the old original fruit cultivars. Fruits from these extensive plantations can be used for further processing (dried fruits, juices, fruit wines, fruit spirits, etc.).

The younger generation can get acquainted with the older traditional technologies (i.e. manual fruit presses) employed for this kind of small-scale production. Bicycle paths and nature trails can be led-around on-farm plantations.

MATERIALS AND METHODS

Based on the cultivars' determination and description in the different regions of the Czech Republic, certain cultivars were selected for the establishment of on-farm conservation.

Several basic principles for the planting of an on-farm plantation were observed. Because of the longevity of such a plantation, seedling rootstocks were used for the production of the planting materials for these on-farm plantations. Seedlings were planted in the first year. For the production of straight tree trunks, the cultivar Croncelské for apple, Hardyho máslovka for pear, and Stanley for plum were used as interstems. The interstems were

inoculated onto seedling rootstocks in August in the first year. In April of the second or third year, when the budding trees had reached the height of 2 to 2.1 m, grafting of the landrace was done in the tree crown, approximately at the height of 1.8 m. The canopy was trained in the nursery during one or two growing seasons. In this manner, the prepared nursery trees were transplanted to permanent locations, and the on-farm plantations were established. The area of a plantation was 10 × 10 m. The establishment of the on-farm plantations was based upon planning. Trees were planted according to the harvest time, in order to improve the economy of the plantation. Proper documentation of the trees and the tree's characteristics was conducted. At least three trees per cultivar were planted.

RESULTS AND DISCUSSION

Survey of areas

Since 1994, the survey has been carried out in cooperation with the administrators of national parks and protected landscape areas, who provided maps showing the occurrence of fruit species. Determination was carried out at the time of fruit ripening, together with a description of the health status and a short characterization. Important accessions were localized by Global Positioning System (GPS) and registered *in situ*. Certain accessions (cultivars) for on-farm conservation in a given locality were selected according to the incidence and representation of genotypes in particular areas. Grafts were taken from important genotypes, and these materials were transferred to the nursery in the Research and Breeding Institute of Pomology (RBIP) Holovousy, Ltd.

Preparation of site for plantation establishment

The preparation of the soil on the planting site for on-farm conservation started two years before the plantation was created. It was based on complex agricultural soil analyses. The aim was to supply organic matter and mineral nutrients to the whole soil profile, aerate the soil, and improve the soil structure. Potassium and phosphorous were applied to the soil before planting, because they

slowly move down the soil profile. Cereals were used as a preceding crop, because of the possibility to apply herbicides for perennial weed control. The surface of the soil was levelled by harrows. In the lowlands, north-south row orientation provided better light penetration. In broken terrain, it was necessary to orient tree rows along contour lines, irrespective of the compass direction, in order to avoid soil erosion.

Planting and orchard management

After planting, the tree trunks were protected from animal damage. Grass mixtures were sown between the rows to enable the use of agricultural mechanization during rainy weather. Formative pruning and training of the young trees was carried out to develop a strong tree framework, with proper shape and form, that would support fruit production. Annual winter pruning was done to open up the tree canopy. This provided better aeration of the canopy and light penetration. Pruning stimulated the formation of flowers and fruit buds. In succeeding years, as the tree matured, it was necessary to remove unwanted growth; such as upright growing shoots, and laterals with sharp branch angles, to allow light penetration. Dead or diseased wood was also eliminated.

Additional fertilization was done according to soil and leaf analyses. Nitrogen fertilization was applied annually. The first dose of nitrogen was applied in autumn, the second after flowering, and eventually the third at the beginning of July. Micronutrients were applied mainly by foliar fertilizing.

The first on-farm plantation of fruit in the Czech Republic was established in the Krkonoše National

Table 1. Krkonoše NP (KRNP) in Vrchlabí – number of fruit cultivars 2002

Fruit species	No. of cultivars
Apple	25
Pear	4
Sweet cherry	10
Sour cherry	4
Plum	4
Total	47

Table 2. Neratov – number of fruit cultivars 2004

Fruit species	No. of cultivars
Apple	29
Pear	21
Plum	2
Total	52

Table 3. NP Podyjí-Znojmo – number of fruit cultivars 2005

Fruit species	No. of cultivars
Apple	5
Pear	8
Total	13

Table 4. NP Šumava – number of fruit cultivars 2008

Fruit species	No. of cultivars
Apple	14
Pear	3
Total	17

Park (KRNAP) in Vrchlabí in 2002 (Table 1). There are 47 accessions of fruit resources conserved by this method. The apple collection is the largest with 25 accessions, sweet cherry with 10 accessions follows.

The second on-farm plantation (Table 2) was established in the Orlické hory Mts, in the village of Neratov, near the Polish border. The original population of the village was displaced shortly after the Second World War. Therefore, a plantation established in 2004 was named the Orchard of Reconciliation. In the following years, the plantation was supplemented by other fruit trees. At present, there are 52 accessions of fruit genotypes in this plantation. These are 29 apple landraces, 21 pear landraces, and 2 plum landraces.

The on-farm plantation in the Podyjí National Park, Znojmo was established in 2005 as the third (Table 3). It is the smallest plantation, consisting of only 13 accessions of apple and pear.

The last on-farm plantation was established in the Šumava National Park (Table 4). Seventeen acces-

sions (14 apple and 3 pear cultivars) were planted in autumn 2008. The collection will be continuously supplemented in the years to come.

Established on-farm plantations secured the long term preservation of landraces in their original areas. Examples of important landraces suitable for on-farm plantations are listed below:

Sweet cherries

Ladeho pozdní cv.

A very old Czech cultivar (red bigarreau), of unknown origin; ripening 9 weeks after cultivar Van. It is the latest ripening cherry cultivar kept in the germplasm collection. Fruits are medium large to small, with an average taste.

Dönissenova cv.

Yellow bigarreau, probably originated from Guben (Germany). Fruits ripen 8 days after cultivar Van, and are susceptible to cracking. The flesh has a sweet taste. It is an undemanding cultivar.

Buketova cv.

This is a very old Czech landrace of sweet cherry, which usually bears 2 or 3 fruits per stem. Fruits ripen 5 days before cultivar Van. The fruits are small (about 3 g). The taste is average, acidic-sweet. The juice stains easily.

Sour cherries

Vackova cv.

This cultivar originated as an occasional seedling of Ostheimská in Eastern Bohemia in 1893. The fruits ripen several days before cultivar Napoleonova. Fruits are medium to large (5–6 g). The colour is dark red. The flesh is soft with a very good acidic, spicy taste. Trees are moderately vigorous to vigorous. Crowns are rounded and very dense. Trees are productive and precocious. It is a self-sterile cultivar.

Apples

Hetlina cv.

Hetlina is an old apple landrace originating from the Domažlice region. The first description origi-

nates from the 18th century. The size is medium large (150 g). The fruit is resistant to bruising. The flesh is white or cream, medium firm, juicy. The disadvantage is that the fruits are of only average taste.

The cultivar is moderately susceptible to scab, tolerant to mildew, resistant to frost. Fruits are storable until June. MCGHIE *et al.* (2004) found the highest content of polyphenolic compounds (out of 59 surveyed apple cultivars) was found in the flesh of Hetlina (4154.0 µg/g). Apple fruits with higher amounts of phenolic compounds, and thus with a higher potential for antioxidant activity, could be an important tool for improving human health.

Chodské cv.

This is a Czech cultivar from Southern Bohemia, which has been grown since the 18th century. Fruits are medium, rounded, and irregular in shape. The flesh is whitish yellow, firm, juicy, with a good sweet acidic taste. Harvest is in mid-October. Fruits store well until March. Trees are semi-vigorous, productive, precocious, and resistant to frost. This cultivar is not susceptible to either scab or powdery mildew.

Smiřické vzácné cv.

A Czech landrace from the end of the 19th century, spread mainly in North-Eastern Bohemia. The fruits are bigger (140–180 g), with a regular, flat-rounded shape. The flesh is white and juicy. The taste is acidic sweet. Eating maturity is from December to March. Trees are flat-rounded and vigorous.

Míšeňské cv.

This is a very old cultivar, of unknown origin. The cultivar has been grown in Bohemia since the beginning of the 15th century. The flesh is whitish, firm, with a good acidic sweet taste. The eating maturity is from November to April. The rounded crowns are dense. The trees are vigorous and resistant to frost.

Malinové holovouské cv.

This is a local landrace, which was found by Lord František Josef from Leveneu and Grünwall, in Holovousy in the late eighteenth century. This cultivar gained first prize at the Imperial Exhibition in Vienna in 1888. Historical records state that even Emperor Francis Joseph II honoured

the excellent taste of this cultivar. Thanks to that, the cultivar gained a favourable reputation and expanded throughout the former Austria-Hungarian Monarchy. The rounded fruits are medium to larger (140–170 g). The flesh is acidic sweet, with a raspberry flavour and excellent taste. The eating maturity is from October to November. The cultivar is suitable for high-stem trees.

Pears

Krvavka moravská cv.

This is a very old landrace. The fruits are smaller (56 g), with good sweet taste. The flesh is crispy and juicy, and has a deep pink colour. Harvest time is in mid-August. Trees are very vigorous with spreading crowns.

Špinka cv.

This is a very old landrace that has been grown in Bohemia for more than 400 years. The fruits are smaller, short conical, with an excellent taste. Fruits are characterized by a big open calyx. The fruits ripen successively from mid-August until the beginning of September. Trees are very vigorous, with bulky widely pyramidal crowns. The trees are long-lived (150-plus years).

Plums

Bílá trnečka cv.

This plum cultivar is resistant to PPV (*Plum pox virus*). Fruits ripen 37 days after the fruits of Ruth Gerstetter. Average weight of the fruit is 7.2 g. The main disadvantage is an unacceptable bitter taste.

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