The fertilization problems of cultivated red- and black currant varieties in Hungary

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Summary: Small fruits have a modest share in the fruit production of Hungarys. Red currant was grown traditionally in home gardens 60–70 years ago. Commercial production was established only in the surroundings of some town. The black currant was unknown until after Wold War II. An important change occured in small fruit production in the 1950s. Socialist countries, which had cheaper labour power, made efforts to meet these demands. In this time we produced 25.000 t.
Presently the country produces 13–15.000 tons currant fruit yearly 60% from this is black currant, which has a better market. It is our own interest to make our currant production more profitable. The currant is the second most widely cultivated soft fruit. Our product is disposed mostly on EU markets.
There was no breeding activity in this field in Hungary earlier. Cultivars used were mostly of foreign origin (W. European; *Boskoop Giant, Silvergieter, Wellington XXX, Russian; Altaiskaya Desertnaya, Neosupaiuschaiasya,* N. European; *Brödtorp, Öjebyn).* Besides well-known advantageous this cultivars have also some defects mainly unfavourable–adaptation to climatic conditions, which caused fertilisation problems, reduced the fruit set and uneven growth with decreased yields *(Dénes & Porpáczy,* 1999). About 140 black currant cultivars were investigated during the last four decades in our variety trials and only four of them were introduced with satisfying yielding capacity (3.5–5.5 t/ha).

Key words: red- and black currants, fertility, fruit set, cultivar combination, realised productivity

Introduction

Hungary is located in southern part of black currant ecological optimum zone (47,5° latitude), demands special cultivars *(Fertőd 1, Aranka* /F.11/, *Dyana* /F.41/ Hungarian, and *Eva, Otelo, Titania* foreign). The climate is characterised by great fluctuations in temperature at the end of winter and in the spring, as well. The frequent springfrost, relatively short summer day lengths, summer drought and warm summer nights are usual. In particular the black currant is more sensitive to shorter daylenght then red currant. Plant size, flower numbers per raceme and self-fertility decreased in southern direction *(Nars & Wareing,* 1961; *Zeller,* 1968). There is the characteristic example of *Brödtorp* black currant cultivar, which yielded 12.2 kg/bush in Norway *(Øydwin,* 1971), but only 1.46 kg/bush in Hungary in the same year. The value of variety detectable decreased at distances greater than 600 km (N-S) direction. This effect was notable at red currant.

Hungary has an active black currant breeding program in the Institute of Fruit Breeding, at Fertőd, since 1965 sponsored by the Ministry of Agriculture and Regional Development. Good adjustment to climatic condition is very important and ensure regular cropping of black currants. To reduce the risk of frost damages, the breeding program is oriented to improve the tolerance of flowers to low temperature and even escape spring frost, which ensures the reliability of cropping. The cultivars belonging to the same bloom-time group have a good chance to cross pollinate each other.

The blooming time depends on the length of the flower cluster *(Fig. 1).* The time interval between the bloom of the terminal and basal flowers of the long-clustered cultivars may be as long as 20 days. The fairly long bloom period of currant requires an extraordinary pollen supply *(Porpáczy* in *Nyéki,* 1996). Cross-pollination of cultivar combinations also depends largely on their blooming simultaneously.

For good pollination, the pollinizer cultivars must provide pollen for a long time. Good pollinizer cultivars assure not only good fruit set, but also affect the weight of the berries *(Papp & Porpáczy,* 1999). In black currant cross-fertilisation is also held to be advantageous.

Fruit-setting characteristics of the cultivated varieties are different. Productivity of many black currant cultivars is increased in Hungary by interplanting with recommended pollinizer cultivars. The currants are insect pollinated.

Practically there is no breeding program for red currant in Hungary, but variety testing. The white- and red currant varieties (Jonkheer van Tets, Fertődi hosszúfürtű, Detvan, Rondom, Rotet, Blanka, Primus, Zitavia) are self-fertile, the degree of self-fertility depends on the year and location. For this reason we can not recommend the varieties for polliniser cultivars.

Material and method

The research was conducted in the period of 1996–1999 in the field experiments of Fruit Breeding Institute at Fertőd. In our investigations we determined the following properties of currant cultivars:

Simultaneous blooming period of black currant cultivars and candidates group. Phenophases of bloom end the observed: the beginning of bloom, full bloom, and were, intensity of blooming. We achieved the bloom phenograms of black currant cultivars, assigned then to blooming groups.

Determination the rate of self fertility. The applied methods were hand-self-pollination made with paintbrush on radical emasculated flowers under isolator, 10 replications. As isolator, parchment bags were used. Radical emasculation: anthers as well, as corollas, petals as sepals, were removed. The pollen originated of other bushes of the same cultivar (clonal geitonogamy). One replication consisted of 10 neighbouring inflorescence placed at the top of one year old shoots *(Zurawicz* et. al., 1993).

We measured the following characters:
- number of flower set
- number of mature fruits
- mean weight of 100 fruits/g
- number of mature fruits was expressed in the percent of flowers also by open pollination.

Realised productivity in orchard (of black currant cultivar combinations) was detected.

In these experiments 2 characters were evaluated:
- total fruit yield in kg/bush, t/ha
- mean weight of 100 fruits/g.

The results data were processed statistically.

Results

It has become widespread practice to group black currant cultivars according to blooming time to establish cultivar groups blooming synchronously.

There are three groups of blooming time cultivars investigated. In *Figure 1* we can distinguish three groups: the first is *early* blooming which located in the upper rectangle *(Diana* /F.41/, *Fertődi 1., Viola, Hidasi bőtermő, Silvergieter F.59., Wellington XXX, Brödtorp)* cultivars the second is intermediate blooming, which can be found in the cover of the two rectangles *(Viola, Hidasi bőtermő, Silvergieter F.59, Wellington XXX, Otelo, Brödtorp)* cultivars and the third is *late* blooming which can be found in the cover of the under rectangle *(Viola, Hidasi bőtermő, Silvergieter F.59, Otelo, Brödtorp, Titánia, Aranka* /F.11/) cultivars. In those years when after cool spring suddenly warm weather occurs, the early and late blooming cultivars may coincide.

Recommanded cultivar placement in black curant orchard is max. 4-rows wide of main variety, between 1–2 pollinizer rows.

Results concerning fruit yield expressed in percent of mature fruit related to self pollination, open pollination by interplanting with recommended polliniser cultivars and productivity in the variety trial *(Table 1).*

The exceptional cultivar in Hungary is *Titánia* from Sweden, which became the main variety in the eighties. (*Fertőd 1.* cultivar.) The results of variety evaluation show

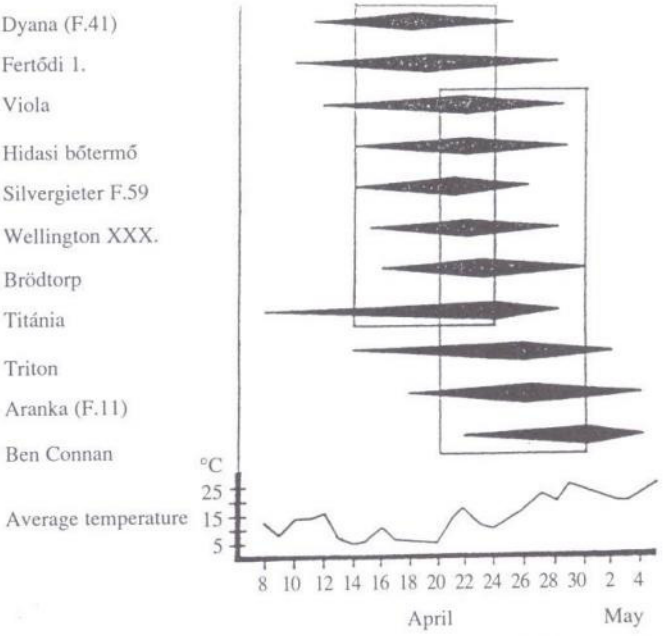

Figure 1 The blooming period of black current varietis grown in Hungary

that varieties originating from sites with similar conditions (Bojnice, Slovakia) are better suited to black currant cultivation then the others. *Otelo* is the most valuable. *Fertőd 1.* has been particularly successful and now accounts for 40% of the plantations. The promising new cultivar candidates *Aranka* (F. 11) and *Dyana* (F. 41) were introduced by this breeding program. Those cultivars belonging to an early blooming group *(Dyana* /F. 41/, *Fertődi 1., Otelo)* and a medium late group *(Titania, Aranka* /F. 11/, *Otelo)* which have a good chance to cross pollinate each other.

Realised yield of black- and red currant cultivars was detected on a farmer plot in a good year (1996) and in a year withspring frost (1998) at Fertőd.

The aim of Hungarian black currant growers is to cultivate varieties with high yield combined with resistance to diseases and tolerance to environmental stress. The good yield of black currant depends on accurate flower fertilisation. The adequate fertilisation could be achieved only with accurate selfor free pollination. In our experiment

Table 1 Fertilisation of black currant cultivars

N. Varieties	% of Fertilisation		Varieties for Pollination
	Self fertilisation	Association of Varieties	
1. Aranka (F 11)	54.4	76.4	2. 5. 6. 7. 8. 9. 10.
2. Ben Sarek	43.2	71.6	1. 5. 6. 7. 8. 9. 10.
3. Dyana (F 41)	57.4	79.9	1. 2. 4. 5. 8. 9. 10.
4. Eva	44.2	71.4	1. 2. 3. 5. 8. 9.
5. Fertődi 1.	49.7	76.1	1. 2. 6. 7. 8. 9. 10.
6. Hidasi bőtermő	34.4	70.1	1. 2. 5. 7. 8. 9. 10.
7. Silvergieter F.59	37.8	59.2	1. 2. 5. 6. 8. 9. 10.
8. Otelo	46.2	70.4	1. 2. 5. 6. 7. 9. 10. 11.
9. Titania	36.5	69.2	1. 2. 5. 6. 7. 8. 10. 11.
10. Triton	38.7	71.4	1. 2. 5. 6. 7. 8. 9. 11.
11. Wellington xxx	30,4	68.2	1. 2. 3. 4. 5. 8. 9. 10.

better fruit set was obtained by free pollination in mixed plantation than after hand self-pollination. The fruit set difference between self-pollinated and interplanted with recommended polliniser cultivars was considerable: the yield of cultivars *Fertődi 1:* 26.4%, *Titania* 32.7%, *Wellington XXX* 41.8% was higher. For that very reason were projecting cultivars in Hungary *Aranka* (F. 11), *Dyana* (F. 41), *Fertődi 1., Otelo* and *Titania.* High self-fertility does not guarantee high yield, becanse the cultivars to be planted in Hungary are depend on the very accurate pollination.

Pollinating insects, mainly honey-bees, play an important role in this process. Pollination is facilitated by bees and two hive/ha is recommended to assure good pollination.

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