

Apple and Pear Cultivars for Organic Production in a Cool Climate

Apfel- und Birnesorten für den organischen Anbau in klimatisch kühleren Gebieten

Dag Røen, Gunnhild Jaastad and Stein Harald Hjeltnes

The Norwegian Crop Research Institute

Abstract

Only early ripening cultivars of apples and pears may be grown successfully in the short and rather cool growth season of the fruit producing areas of Norway. Due to a combination of high yield, good fruit quality and scab resistance, the Swedish cultivar 'Aroma' is recommended as major cultivar for organic apple production today. 'Philip' is recommended as cultivar for organic pear production. During 5 years 21 apple cultivars and 15 pear cultivars have been tested in organic orchards in comparison with 'Aroma' and 'Philip'. Several cultivars in the trial are promising for use in organic production.

Keywords: apple, pear, cultivars, organic production

Introduction:

Only early ripening cultivars of apples and pears may be grown successfully in the short and rather cool growth season of the fruit producing areas of Norway. We may grow 'Elstar' and 'Conference', but only at the warmest locations, while later ripening cultivars will normally not develop sufficiently in our climate. Winter frost may be a problem in some locations some years, but not to a large extent. Frost during flowering is normally not a problem in pome fruit production. Due to combination of high yield, good fruit quality and scab resistance, the Swedish cultivar 'Aroma' is recommended as major cultivar for organic apple production today. 'Philip' is one recommended cultivar for organic pear production. For most characters, the demands for pome fruit cultivars are similar for organic and integrated production. The main difference is a higher demand for resistance to major diseases in organic pome fruit production. In Norway the main problem is apple scab. The objective of this study was to find a wider range of cultivars of apples and pears for organic production in Norway.

Material and Methods:

In 1999 we planted a trial with whips of 22 apple cultivars on M9 rootstock and 15 pear cultivars on Brokmal rootstock. Of each cultivar 4 trees were planted in a randomized block design, with 2 replicates and 2 trees per replicate. Planting distance was 1,67 x 4 m. The orchard was maintained following the national guidelines for organic production (Debio, 2001), and was approved an organic certificate in 2001. The orchard was on productive soil, and trees were fertilised with dried chicken manure by planting (0,5 kg per tree) and in 2002 (0,25 kg per tree). Weeds in tree row were controlled by repeated tilling May-August with additional hand hoeing around tree stem. In main season for scab ascospore release we sprayed with sulphur. In 2001 and until June 2002 lime sulphur was allowed in organic fruit production in Norway, and we applied a few sprays with lime sulphur before flowering. In 2000 all fruitlets were removed, and we harvested the first yield in 2001.

The apple cultivars in the trial were 3 cultivars and 3 selections from USA ('Dayton', 'William's Pride', 'Redfree', NY 55140-9, NY 66305-139 and NY 66305-289), one selection from Canada (BC 11W-12-11), one cultivar from Chzech Republic ('Rubin'), one cultivar from Poland ('Witos'), 3 Norwegian cultivars from a private breeder ('Ingelin', 'Katinka' and 'Katrina'), 4 cultivars and 4 selections from

our own breeding programme ('Eir', 'Idunn', 'Nanna', 'Siv', NA 14-70, NA 32-87, NA 43-96 and NA 48-20) and a red fruited sport of the old Danish cultivar 'Ingrid Marie' ('Karin Schneider'). Control cultivar was a red sport of 'Aroma' ('Aroma Ylvisåker'). The pear trial included one cultivar from Sweden/Norway ('Ingeborg'), one cultivar from a private breeder in Norway ('Anna'), 11 selections from our own breeding programme (NP 309, NP 852, NP 2870, NP 2879, NP 3043, NP 3048, NP 3577, NP 4189, NP 4279, NP 4310 and NP 4366) and 'Conference'. Control cultivar was 'Philip'.

Harvest time, harvested yield, number of fruits harvested and number of fruits on ground were recorded every year. Total yield was calculated as the sum of harvested yield and fruits on the ground. In 2001 and 2002 we recorded apple scab, pear scab and powdery mildew on trees. In 2001-2003 we noted reasons for outgrading on each fruit on a sample of 50 fruits from each replicate. All harvested fruits were examined if less than 50 fruits were harvested per. Proc GLM procedure of SAS programme (SAS, 2001) was used for analysis of variance. When analysing data for apple and pear scab, no scab was observed in some cultivars (zero variance). Those cultivars were omitted before analysis of variance on scab incidence on the remaining cultivars.

Results and discussion:

In Tables 1 and 2 the cultivars are sorted in order of harvest time. Harvest date is shown as number of days before 'Aroma' (apple cultivars) and 'Philip' (pear cultivars). The included cultivars covers the entire season for apple and pear production in Norway.

Table 1. Harvest date, accumulated yield and percentage of fruits outgraded due to damages (total) and due to apple scab and feeding by butterfly larvae (Lepidoptera). Mean of years 2001-2003.

Apple cultivar	Harvest date*	Total yield** tons/haa	***	Outgraded due to damages			Apple scab %
				Total %	Larvae feeding %	***	
Nanna	-41	13	efg	41,7	19,4	abcd	2,9
Siv	-35	13	efg	45,5	10,8	bcd	6,8
Eir	-34	25	abcd	28,6	11,9	bcd	10,2
NY 66305-139	-30	16	cdefg	21,9	11,8	bcd	0,0
Idunn	-28	14	efg	43,8	12,8	bcd	0,4
Ingelin	-27	14	efg	28,6	15,7	abcd	0,0
Katinka	-26	12	efg	40,3	27,0	a	0,0
Will. Pride	-25	29	ab	48,7	9,3	bcd	0,0
NA 14-70	-13	26	abcd	33,9	8,4	cd	0,0
Redfree	-12	18	cdef	18,3	6,3	d	0,0
Witos	-9	26	abcd	33,5	11,2	bcd	0,0
Aroma Y.	0	27	abc	21,1	8,5	cd	4,7
Rubin	0	7	g	13,2	7,4	cd	1,1
Dayton	1	35	a	19,3	10,7	bcd	0,0
K. Schneider	7	16	defg	67,7	12,9	bcd	1,2
Pr > F	< 0,0001			< 0,0001	0,0052		n.s.

* Mean harvest date 2002-2003, in days before / after cultivar 'Aroma Ylvisåker'.

** Accumulated total yield for 2001-2003 in metric tons per haa.

*** Different letters indicate significant differences calculated with Duncan test.

Accumulated total yield for 2001-2003 is shown for apple cultivars in Table 1 and for pear cultivars in Table 2. The most productive apple cultivar in this trial was 'Dayton'. Among the earliest ripening apple cultivars 'Eir' and 'William's Pride' had the highest total yield. As these results are from the first years after planting, cultivars that enter late into bearing are disfavoured. This is especially the case for pears, which generally come later into bearing than apples. NP 852 was very productive during these first years after planting, and NP 4310 also started fruiting early. The first fruits on NP 2870 was picked in 2003 (4 year old trees), but then it started yielding with a quite good crop. Most of the apple cultivars had sufficient fruit size, but BC 11W-12-11 had too small fruits (92 g). Apple cultivars 'William's Pride', 'Katinka' and NY 66305-139 as well as the early ripening pear selection NP 4310 had fruits in the lower range of acceptable fruit size (120-135 g). Fruits of pear selection NP 2870 were too big (291 g).

Table 2. Harvest date, accumulated yield and percentage of fruits outgraded due to damages (total) and due to pear scab, stone cells (bugs) and feeding by butterfly larvae (Lepidoptera). Mean of years 2001-2003.

Pear Cultivar	Harvest date*	Total yield** tons/haa	***	Outgraded due to damages			
				Total %	Pear Scab %	Stone cells %	Larvae feeding %
NP 4310	-29	9	abc	30,9	9,2	1,2	13,7
NP 3048	-8	9	abc	4,9	0,0	0,3	2,3
Ingeborg	-1	3	cd	52,8	0,0	11,0	40,3
Philip	0	8	abcd	38,5	2,6	15,1	13,8
NP 2870	2	6	bcd	24,5	0,0	5,7	13,2
NP 3043	3	1	d	40,0	0,0	16,7	40,0
Conference	14	8	abc	26,2	0,0	4,9	21,2
Anna	14	4	bcd	47,8	5,6	5,7	33,8
NP 852	14	13	a	35,7	0,0	1,0	28,8
Pr > F			0,0084	n.s.	n.s.	n.s.	n.s.

* Mean harvest date 2002-2003, in days before / after cultivar 'Philip'.

** Accumulated total yield for 2001-2003 in metric tons per haa.

*** Different letters indicate significant differences calculated with Duncan test.

Percentages of apples and pears outgraded due to some diseases and pests are shown in Table 1 and 2 respectively. When choosing cultivars for the trial, one major concern was resistance to apple and pear scab. Half of the apple cultivars possess Vf-resistance to apple scab, and so far no scab has been observed on those. So far, we do not know of any reports of apple scab on Vf cultivars in Norway. In the apple trial most scab was found on NA 48-20 (17 % of the fruits). This selection is from a cross of 'Summerred' x 'Florina', but Vf gene from 'Florina' is not transferred to NA 48-20. We had a non-tolerance approach to apple scab on fruits, degrading every fruit with scab lesions. 'Aroma' is considered sufficiently resistant to apple scab to be grown organic successfully. In our trial 5 % of 'Aroma' fruits were with scab lesions. In pear only NP 2879 had a lot of scab (37 % of fruits). Some scab was also found on fruits of NP 4310, 'Anna' and 'Philip', but not to a large extent. In some other areas of Norway scab resistance of 'Philip' is broken, and in those areas we do not recommend organic production of this cultivar.

'Ingelin' turned out to be very susceptible to powdery mildew, but quite a lot of mildew was also found on 'Karin Schneider', 'William's Pride' and NY 66305-139. Only on 'Dayton' and 'Rubin' no powdery mildew was observed. We consider 'Ingelin' to be too susceptible to powdery mildew for organic growing on the locations in Norway that have favourable conditions for mildew. On the other

cultivars in this trial mildew should be sufficiently controlled by removing primary sources of inoculum in spring combined with sulphur sprays against scab during scab ascospore release.

In Table 1 and 2 results are also presented on percentage of fruits outgraded due to feeding by lepidopterous larvae and bugs (Heteroptera). The within cultivar variation was large for these characters, and except for larvae feeding on apples, means were not significantly different. Other causes of degradation in apples not presented in Table 1 include feeding by bugs, cork cells on skin due to unknown causes, cracking, damage by birds and bitter pit. In pears, fruit cracking and bird damage were the most important causes of degrading not included in the results. The highest percentage of outgraded fruits on apple was found in 'Karin Schneider' and 'Katrina'. Degradation was then mainly due to cork cells of unknown cause on skin. The lowest percentage of fruits outgraded was found in 'Rubin'. Thus, the yield of first class fruits for this cultivar ranks it better than if only the total harvested yield is considered. The most productive apple cultivar 'Dayton' as well as control cultivar 'Aroma' did, however, also have a low percentages of fruits outgraded. Apple cultivar 'Katinka' was very susceptible to feeding by lepidopterous larvae, while less than 10 % of 'Redfree', 'Rubin', NA 14-70, 'Aroma' and 'William's Pride' were outgraded due to this pest. In pears percentage of outgraded fruits was lowest in NP 3048 with no scab, very few stone cells and little larvae feeding on skin. 'Ingeborg' and 'Anna' seem to be very susceptible to feeding of lepidopterous larvae, and also had quite a few fruits with stone cells due to bugs.

If we compare results from this trial with former results on percentage outgraded fruits from organic production of 'Aroma' and 'Philip' (Røen & Jaastad, 2002), we now found less damage due to lepidopterous larvae and. 5 % of fruits with scab seem to be a typical level in organic production of 'Aroma', however, pear scab on 'Philip' has not been observed before at this location.

Of the very early ripening apple cultivars in this trial, 'Eir' had highest yield. It did however get some apple scab in this trial, maybe too much for organic production. In 'Discovery' season, 'William's Pride' was the most productive cultivar. But it is not recommended for planting due to taste, appearance, fruit size and problem with cork cells. NA 14-70 has potential for organic production, covering the season between 'Discovery' and 'Aroma'. It is from a 'Aroma' x 'Discovery' cross, with aromatic taste and attractive appearance. It is however as susceptible to Gloeosporium rot as 'Aroma'. 'Aroma' still defend its position as major cultivar for organic apple production in Norway. 'Dayton' is a cultivar in the same season that should be tried in organic production, with very good yield and few problems. Fruit quality is not at the level of 'Aroma', but fully acceptable. 'Rubin' is a cultivar with very good fruit quality, and low percentage outgraded in this trial. When quality is concernde it is beter than 'Karin Schneider', the problem with 'rubin' is the low yield.

NP 4310 is a very early ripening pear selection, that now probably will be released as cultivar. In this trial it did get some scab, but it is still better than alternative cultivars for this season. NP 3048 may be a good alternative to 'Philip' for organic production, with similar yield but much less percentage of outgraded fruits. NP 2870 is also a promising selection, but fruit size was too big is this trial. This may however improve when trees get older. NP 852 is a promising alternative to 'Conference' in our climate.

Literature Cited

Debio 2001. Regler for økologisk landbruksproduksjon, 57 pp.

Røen, D. & G. Jaastad 2002. Damage on organic fruits caused by diseases and pests. Poster, NJF-seminar NO346, Organic production of fruit and berries, Årslev, Denmark 22. Oct. 2002.

SAS 2001. The SAS system for Windows, Release 8.02.

