PROTECTION OF GENETIC RESOURCES OF POMOLOGICAL PLANTS AND SELECTION OF GENITORS WITH TRAITS VALUABLE FOR SUSTAINABLE FRUIT PRODUCTION

Journal of Fruit and Ornamental Plant Research vol. 12, 2004 Special ed.

EVALUATION OF APPLE CULTIVARS FOR SUSTAINABLE FRUIT PRODUCTION

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(Received October 22, 2004/Accepted December 16, 2004)

A B S T R A C T

In the spring of 2002, two-year-old scab-resistant or partially scab-resistant apple cultivars grafted on M.9 rootstock were planted in the Experimental Orchard at Dąbrowice, near Skierniewice in central Poland. The cultivars evaluated were 'Bohemia', 'Rubinola', 'Topaz', 'Goldstar', 'Pinova', 'Redkroft', 'Free Redstar', 'Melfree' and 'Early Freegold'. While in the orchard, the trees were evaluated in terms of their suitability for sustainable fruit production. The experimental plot was divided into two halves. In one half, no chemicals were applied to either the trees or the soil. In the other half, only those chemicals which are allowed for use in sustainable fruit production were applied in limited amounts in order to control pests and diseases. After planting, tree rows were mulched with agricultural spun-web, linen residue felt, or sawdust in a 1.2 meter wide strip. Grass was allowed to grow between the rows and was regularly mown.

While in the orchard, the trees were evaluated in terms of their suitability for sustainable fruit production. Trees mulched with spun-web and linen residue felt grew better and bore earlier than trees mulched with sawdust. In both years of the trial, 'Bohemia', 'Rubinola' and 'Topaz' had the largest trunk cross-sectional area, but produced long, bare shoots, which made training difficult. 'Rubinola', 'Topaz', 'Bohemia' and 'Early Freegold' bore fruits of acceptable eating quality. The other cultivars bore poor quality fruits.

Based on the two-year trial, 'Rubinola', 'Topaz' and 'Early Freegold' are the scab resistant apple cultivars most suitable for sustainable fruit production in modern orchards.

In the first two years of the trial, apple scab was not observed, probably because of the dry growing seasons. Damage by spider mites and codling moths was not economically significant. A homemade extract of nettles was not effective in controlling aphids.

Key words: apple, scab resistant cultivars, tree vigor, fruit quality

INTRODUCTION

When a new orchard is being planted, growers often select cultivars which are resistant to apple scab (Czynczyk, 1996; Kruczyńska et al., 1999; 2000). Growing scab resistant apple cultivars reduces the need for chemicals, which helps protect the environment (Niemczyk, 2000abc). Scab resistant apple cultivars are becoming more and more popular in the European Union. The new scab resistant cultivars taste good (Jönsson and Tahir, 2004; Kruczyńska, 1999). 'Topaz', 'Rajka' and 'Rubinola' are valuable scab resistant cultivars from the Czech Republic (Kruczyńska et al., 2000; Kruczyńska, 2002). Other interesting scab-resistant cultivars include 'Enterprise' from the United States, 'Ecolette' and 'Santana' from the Netherlands, 'Pinova', 'Rebella' and 'Rewena' from Germany, and 'Redkroft', 'Free Redstar', 'Melfree' and 'Early Freegold' from Poland (Kruczyńska, 2002). The aim of this trial was to select the scab resistant cultivars which are most suitable for sustainable fruit production in modern orchards.

MATERIAL AND METHODS

In the spring of 2002, two-year-old scab-resistant or partially scab-resistant apple cultivars grafted on M.9 rootstock were planted in a podsolic soil overlaying heavy clay in the Experimental Orchard at Dąbrowice, near Skierniewice in central Poland. The cultivars evaluated were 'Bohemia', 'Rubinola', 'Topaz', 'Goldstar', 'Pinova', 'Redkroft', 'Free Redstar', 'Melfree' and 'Early Freegold'. The trees were planted 3.40 x 1.35 meters apart and trained as slender spindles.

The trial was set up in a randomized block pattern with four replications of three trees each. The experimental plot was divided into two halves. In one half, no chemicals were applied to either the trees or the soil. In the other half, only those chemicals which are allowed for use in sustainable fruit production were applied in limited amounts in order to control pests and diseases. After planting, tree rows were mulched with agricultural spun-web, linen residue felt, or sawdust in a 1.2 meter wide strip. Grass was allowed to grow between the rows and was regularly mown. No mineral fertilization was ever applied to any part of the orchard.

While in the orchard, the trees were evaluated in terms of their suitability for sustainable fruit production. Tree trunk diameter was measured 30 cm above ground level and converted to trunk cross-sectional area. The yield of fruit per tree and the mean fruit weight were also recorded for each year.

Results were statistically elaborated by analysis of variance, followed by Duncan's multiple range t-test at $P = 0.05$.

RESULTS AND DISCUSSION

Table 1. Trunk cross-sectional area, yield and mean fruit weight in scab resistant apple cultivars

Cultivar	Spraying	Mulching material	Trunk cross-sectional area [cm^2] 2003	Yield [kg/tree] 2002-2003	Mean fruit weight [g]
'Bohemia'	none	spun-web	5.80 b*	0.11 a	220
		linen felt	4.04 a	0.42 b	250
		sawdust	4.41 a	0.47 b	280
	limited	spun-web	5.93 a	0.29 a	230
		linen felt	4.88 a	0.25 a	300
		sawdust	4.99 a	0.02 a	300
'Rubinola'	none	spun-web	5.48 b	1.70 b	190
		linen felt	4.19 a	1.13 ab	150
		sawdust	4.94 a	0.81 a	160
	limited	spun-web	7.36 b	0.96 a	210
		linen felt	5.12 a	0.85 a	160
		sawdust	6.03 ab	0.63 a	200
'Topaz'	none	spun-web	4.69 a	0.22 a	120
		linen felt	4.91 a	2.70 b	140
		sawdust	5.01 a	1.71 b	130
	limited	spun-web	5.12 a	2.82 a	150
		linen felt	5.04 a	2.05 a	140
		sawdust	5.56 a	2.62 a	150
'Goldstar'	none	spun-web	3.61 b	1.10 a	190
		linen felt	2.84 a	0.72 a	140
		sawdust	2.92 a	1.19 a	160
	limited	spun-web	3.61 a	0.99 a	190
		linen felt	3.41 a	0.99 a	130
		sawdust	3.84 a	1.25 a	220
'Pinova'	none	spun-web	5.18 a	4.46 b	130
		linen felt	4.58 a	3.08 ab	120
		sawdust	4.61 a	1.59 a	120
	limited	spun-web	5.73 a	4.90 a	150
		linen felt	5.32 a	5.43 a	120
		sawdust	5.94 a	3.45 a	130
'Redkroft'	none	spun-web	3.93 a	3.57 a	130
		linen felt	3.76 a	3.59 a	150
		sawdust	4.49 a	2.62 a	150
	limited	spun-web	4.89 a	3.26 a	150
		linen felt	4.38 a	3.55 a	150
		sawdust	4.47 a	3.35 a	170

*Means followed by the same letter do not differ significantly according to Duncan's multiple range t-test at P=0.05

Trees mulched with spun-web and linen residue felt grew slightly better and bore earlier than trees mulched with sawdust. In both years of the trial, 'Bohemia', 'Rubinola' and 'Topaz' had the largest trunk cross-sectional area, but produced long, bare shoots, which made training difficult (Tab. 1 and 2).

'Early Freegold' was also very vigorous. 'Goldstar', 'Melfree' and 'Redkroft' were the least vigorous. This agrees well with earlier reports of tree vigor on M.9 rootstock (Kruczyńska, 2002; Kruczyńska et al., 2000).

Table 2. Trunk cross-sectional area, yield and mean fruit weight in scab resistant apple cultivars from Poland

Cultivar	Spraying	Mulching material	Trunk cross-sectional area [cm^2] 2003	Yield [kg/tree] 2002-2003	Mean fruit weight [g]
'Free Redstar'	none	spun-web	4.62 a	1.62 a	180
	limited	spun-web	4.38 a	2.08 a	200
'Melfree'	none	spun-web	3.85 a	3.66 a	160
	limited	spun-web	4.44 a	4.87 b	180
'Early Freegold'	none	spun-web	7.45 a	2.33 b	190
	limited	spun-web	7.00 a	1.24 a	220

*For explanation, see Table 1

'Pinova', 'Redkroft', 'Melfree' and 'Topaz' had the highest yield, and 'Bohemia', 'Goldstar' and 'Rubinola' had the lowest yields. 'Rubinola', 'Topaz', 'Bohemia' and 'Early Freegold' bore fruits of acceptable eating quality with a low susceptibility to decay. The other cultivars bore poor quality fruits. This agrees with earlier reports stating that organically grown fruit is usually inferior in eating quality to commercially grown fruit (Kühn et al., 2003).

'Pinova', 'Topaz', 'Goldstar' and 'Redkroft' bore apples that are much too small to meet the demands of modern consumers.

Based on the two-year trial, 'Rubinola' ,'Topaz' and 'Early Freegold' are the scab resistant apple cultivars most suitable for sustainable fruit production in modern orchards.

Apple scab was not observed in either year of the trial, probably because of the very dry growing seasons. Powdery mildew was easily controlled by pruning infected shoots. Damage due to spider mites was not economically significant. Spraying with carpovirusine ensured that the percentage of apples damaged by codling moths was insignificant. A homemade extract of nettles was not effective in controlling aphids.

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OCENA ODMIAN JABŁONI DO EKOLOGICZNEJ UPRAWY

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S T R E S Z C Z E N I E

Odmiany jabłoni odporne lub częściowo odporne na parcha jabłoni 'Bohemia', 'Topaz', 'Rubinola', 'Goldstar', 'Pinova', 'Redkroft', 'Free Redstar', 'Melfree' i 'Early Freegold" szczepione na M.9 posadzono wiosną 2002 roku w doświadczalnym sadzie ekologicznym w SD w Dąbowicach. Kwaterę ekologiczną podzielono na dwie części. W jednej części uprawiano jabłonie bez stosowania chemicznej ochrony i herbicydów. W drugiej części stosowano ograniczone zwalczanie szkodników i chorób środkami dopuszczonymi do ekologicznej produkcji owoców. Po posadzeniu glebę wzdłuż rzędów drzewek o szerokości 1,2 m wyściółkowano: agrowłókniną, kołnierzami wojłokowymi i trocinami. Glebę w międzyrzędach drzew utrzymywano w murawie często koszonej. W ciągu dwóch lat (2002-2003) odmiany 'Bohemia', 'Rubinola' i 'Topaz' były bardzo trudne w prowadzeniu, gdyż tworzyły długie nagie pędy bez pąków bocznych. Drzewa te miały również największą powierzchnię poprzecznego przekroju pnia. Nieco silniejszy wzrost drzew i wcześniejsze owocowanie zaobserwowano u drzew rosnących w glebie przykrytej agrowłókniną i kołnierzami wojłokowymi niż trocinami. W pierwszych dwóch latach nie obserwowano porażenia owoców przez parcha jabłoni, ponieważ były bardzo suche sezony. Występowanie populacji przędziorków i owocówki jabłkóweczki było poniżej progów ekonomicznego zagrożenia. Zwalczanie mszyc za pomocą extraktu z pokrzywy przygotowanej sposobem domowym było mało skuteczne. Owoce odmian 'Rubinola', 'Topaz', 'Bohemia' i 'Early Freegold' uzyskiwały najwyższą ocenę smakową. Smak owoców pozostałych odmian był miernej jakości. Na podstawie dwuletnich wyników parchoodporne odmiany: 'Rubinola', 'Topaz' i 'Early Freegold' są najbardziej przydatne do uprawy ekologicznej.

Słowa kluczowe: jabłka, odmiany parchoodporne, wzrost drzew, jakość owoców