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The hunt for new future apple varieties

Info

Original article

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In the course of last year, various announcements appeared in the media that symbolised the revival of variety innovation seen recently in the apple sector. Because the apple sector is currently in a crisis, innovations, which are exclusive to a greater or lesser degree, are being incorporated in strategies to distinguish individual players from the competition (Sansavini and Guerra, 2015).

Three of the announcements mentioned above were:

The Breeding Group Midwest Apple Improvement Association (MAIA) has signed an agreement with the International Pome Fruit Alliance (IPA) for the market introduction of the first hybrids of MAIA under the brand name EverCrisp® (www.freshplaza.com, 8/2/16).

„We have acquired the exclusive rights to three new varieties: Kizuri, Gradisca and Lumaga Galant®. The latter is resistant to scab“, announced the chair of the Melinda consortium (Italiafruit News, 6/9/16).

“We are currently working on new varieties that will bring about a revolution in the apple sector“, explained the General Director of Apofruit Bastoni. “We will present these during the Fruit Attraction in Madrid“. (Fruitbook Magazine, 18/9/16).

Improved strains or entirely new varieties?

The developments in fruit cultivation show that a large proportion of new plantings in Europe consist of standard varieties and their strains. The strains mainly differ externally from the original varieties, predominantly due to the colour of the apple.

However, true innovation happens when entirely new apple varieties are introduced, meaning the introduction of new hybrids, that originate from

the more than 80 apple breeding programmes in the world.

Financing of variety breeding

Many public institutes are spending less time and money on the independent testing of new varieties. Moreover, numerous breeding programmes are no longer government financed, but operate as semi-public organisations or are even privatised. These programmes are under enormous pressure to become profitable in the short term. Contracts for the propagation, cultivation and/or market introduction are increasingly being entered into before a variety has been thoroughly independently assessed.

For a government institution like the Laimburg Research Centre, which operates primarily for the benefit of local growers and businesses, independent variety research remains one of the important activities. This was confirmed by the Scientific Advisory Board, which in August 2016 came together to discuss the research station's research programme.

This article is intended to provide information about promising varieties, drawing on the data and experience gained mainly in South Tyrol.

Scab-resistant varieties

The first cross of *Malus floribunda*, which carries the scab resistant gene Vf, and Rome Beauty was carried out as early as 1914 by the University of Illinois. After 100 years of breeding, there is now a generation of varieties featuring a monogenic resistance to scab with striking characteristics, which can compete with those of the traditional varieties. However, it is now time to make decisions concerning the planting of scab-resistant varieties, something that is demanded and supported by the public. That this is necessary is shown by the ongoing discussions concerning drift and residues. Of course, in addition to scab, there are other pathogens and pests, and in various European regions, the monogenic resistance to scab has already been breached.

In spite of this, the planting of these varieties is a first step in the right direction. The breeders are already working on the development of multi-resistant varieties. According to our data, the following, in alphabetical order, appear to be the most interesting: Bonita, CIV323 Isaaq®, Fujion, Inored Story®, Ladina, Lb17906, Lumaga Galant®, PremA34, SQ159 Natyra®, UEB32642 Opal®, Dalinette Chouquette® and Xeleven Swing®. A detailed description of these varieties was published by Guerra (2014).

Snack apples / Children's apples

At the end of the 1980s, HortResearch in New Zealand (now PFR) selected an apple with good organoleptic properties that could be stored well, however, it had a small fruit size. And that was when the idea of the genetically small snack apple arose. This apple is so small that it required the introduction of a new product class, the mini-apple. The classification commonly used until then specified a minimum fruit size below which it was not allowed to sell the traditional varieties. The group of snack apples currently includes the New Zealand variety PremA96 Rockit®, and the Italian variety CIV323 Isaaq®. This latter variety has already been mentioned in this article as one of the resistant varieties. Attractive packaging and commercially positioning the apples as a snack and not as an apple allowed these varieties to occupy an important and sustainable niche in the market. While in the past breeders and variety researchers rejected varieties that were smaller than Gala, the criteria changed with the introduction of the snack apple.

Varieties with red flesh

Other varieties that are potentially interesting for the consumer are those with red flesh (Guerra,



Apple varieties with red flesh can count on a lot of interest.

EFM

2012). Market research carried out in Italy indicated that 85% of consumers did not know of the existence of apples with red flesh. The same percentage indicated that they were interested in trying these apples. These two elements, new and interesting, are important preconditions for innovation. Many hybrids with red flesh are still protected by test contracts that include a confidentiality clause. Therefore, it is currently not possible to publish the test results. However, commercial orchards exist of the Swiss variety Luresweet Redlove® and the French varieties RS-1 and RM-1 Red Moon®/Surprise Inside®.

Extremely well-colouring varieties

As a result of climate change and the growing use of anti-hail nets, bicolour varieties have increasing difficulty colouring, especially in hot regions. Moreover, the majority of breeding programmes are found in regions where the apples colour well. This means that there is an increasing demand for varieties that colour well. In addition to Inored Story® and CIV323 Isaaq®, which were already mentioned as being resistant varieties, based on the results from the Laimburg Research Centre, MC38 Crimson Snow® and Fengapi are interesting varieties that colour easily.

Varieties with special internal properties

In recent decades, breeders have mainly made their selections based on criteria such as productivity, fruit size, firmness and storability. Only recently have textural properties such as juiciness and crispness become more important alongside flavour and aroma. This is why there is an increas-

Prediction of the product range (in % of total production) of apples worldwide, excluding China.

Position	Variety	2015	Forecast for 2025	
1	Golden Delicious	15.92	14.61	-9%
2	Red Delicious	15.22	14.55	-5%
3	Gala	12.78	13.30	4%
4	Fuji	7.17	6.88	-4%
5	Idared	4.80	3.80	-26%
6	Jonagold	2.63	2.70	3%
7	Granny Smith	2.99	2.46	-22%
8	Cripps Pink	2.23	2.15	-4%
9	Jonagored	1.53	1.75	13%
10	Braeburn	1.72	1.63	-6%
11	Honeycrisp	0.88	1.37	36%
12	Jonathan	1.21	1.27	5%
13	Elstar	1.14	1.03	-11%
14	McIntosh	0.98	0.80	-23%
15	Gloster	0.57	0.59	3%
16	Rome Beauty	0.70	0.57	-23%
17	Red Jonaprince	0.26	0.44	41%
18	Tsugaru	0.46	0.41	-12%
19	Scifresh Jazz®	0.33	0.41	20%
20	Ohrin	0.41	0.40	-2%
21	Pinova	0.27	0.36	25%
22	Empire	0.35	0.34	-3%
23	Melrose	0.36	0.31	-16%
24	Spartan	0.34	0.28	-21%
25	Reinette	0.39	0.27	-44%
26	Cortland	0.24	0.26	8%
27	Sciros Pacific Rose®	0.25	0.26	4%
28	Boskop	0.29	0.22	-32%
29	York	0.25	0.20	-25%
30	Bramley	0.16	0.19	16%
31	Cox's Orange	0.17	0.16	-6%
32	Ambrosia	0.09	0.14	36%
33	Northern Spy	0.09	0.13	31%
34	Lobo	0.10	0.11	9%
35	Cripps Red Joya®	0.13	0.11	-18%
36	Caudle	0.11	0.09	-22%
37	Mutsu	0.10	0.08	-25%
38	Hokuto	0.08	0.08	0%
39	Senshu	0.10	0.08	-25%
40	Nicoter Kanzi®	0.03	0.07	57%
41	Stayman	0.10	0.06	-67%
42	R.I Greening	0.03	0.03	0%
43	Ingrid Marie	0.04	0.03	-33%
44	Newton	0.01	0.02	50%
45	Winesap	0.01	0.01	0%
	Andere	17.85	21.76	18%

(Belrose, 2016)

ing interest in the United States for Honeycrisp crosses. Minneiska Sweetango® , which is such a cross, has been tested in Europe for ten years and is planted in Styria, Trentino and Switzerland. There is hardly any or no experience in Europe with other American Honeycrisp offspring such as WA38 Cosmic Crisp®, MN55 Rave®, NY1 Snapdragon®, NY2 RubyFrost® and Maia1 EverCrisp®.

Varieties with yellow skin

While there are many traditional and new bi-colour or red varieties, Golden Delicious has a monopoly position in the segment for varieties with a yellow skin. (Guerra, 2013). In the last edition of Interpoma in November 2016, two very promising varieties with yellow skin were presented; the Czech variety UEB32642 Opal® (already mentioned as being a resistant variety) and Shinano Gold with the brand name Yello®.


Other types of variety


To conclude, a glimpse of the future for varieties that are not yet available. In this respect, it is worthwhile mentioning super sweet varieties, which have a refractometer value around 20°Brix, that could be of interest for the Asian market. It is probable that apple varieties with a low allergenic value will also play a role. Breeders are also working on new developments for the far future.





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Variety/brand name	Bonita
Type	Resistant
Cross	Topaz x Cripps Pink
Variety owner	Institute for Experimental Botany Prague (CZ)
	The fruits are extremely uniform in shape, size and colour. The pink-red colour is very attractive, the flavour intensity average, slightly acidic with fragrant nuances. The storability is still to be studied, however, until now the results of storage in normal cold stores have been mediocre.


Variety/brand name	CIV323 Isaaq®
Type	Resistant/snack/ colours easily
Cross	Unknown
Variety owner	CIV (IT)
	Flowers very early, ripens between Gala and Golden Delicious, should have a wide picking window, is not susceptible to premature fruit drop, but has a slight tendency to become greasy. The production is good and regular, more than 70% of the skin of the apples is a dark red colour. Up to now, no russetting has been seen, the mildew susceptibility is acceptable. The flavour is balanced, with a pleasant and refreshing degree of acidity. Good storability and an especially good shelf life.


Variety/brand name	Fujion
Type	Resistant
Cross	Fuji x Florina
Variety owner	CIV (IT)
	The name Fujion already indicates the similarities with Fuji. Fujion is scab resistant and has, in contrast to Fuji, no problems with biennial bearing. Fujion ripens at the same time as Fuji, is somewhat smaller and has a slightly less spherical shape. A light haze and stripes are visible on the red skin. At harvest time, the flavour and flesh are comparable to Fuji. However, after medium to long storage, Fujion loses some juiciness and aroma.


Variety/brand name	Inored Story®
Type	Resistant/ colours easily
Cross	Pinova x X6398
Variety owner	Novadi (FR)
	This variety is suitable for hot fruit-growing regions, where good colour development is possible. The trees grow weakly and must therefore be handled carefully. The fruits are uniformly cone shaped, have a sweet flavour and compact flesh, however, they lose their juiciness during storage. In colder fruit-growing regions, considerable losses have been seen due to internal browning. It therefore appears to be one of the few varieties that are specifically suitable for growing in hot fruit-growing regions.


Variety/brand name	Ladina
Type	Resistant
Cross	Topaz x Fuji
Variety owner	Agroscope (CH)
	<p>Stands out due to its particular aroma that is reminiscent of peaches and exotic fruits. The fruit has a flat shape, the colour is an intensive red and the flesh is juicy. According to screening carried out by Agroscope, this variety is not only scab resistant, but it also seems to be hardly susceptible to fire blight. During storage, dark spots can appear on the skin. This aspect is currently being investigated in the trials.</p>


Variety/brand name	Lb17906
Type	Resistant
Cross	Topaz x Coop38
Variety owner	Laimburg research station (IT)
	<p>This cross was selected due to its excellent storability. The tree is characterised by its compact shape. The uniformity of production must still be verified. The variety ripens between Fuji and Cripps Pink. The fruits are strikingly bicolour with a bright red blush. The flavour lies between slightly acidic and balanced, and the fruits can be stored well. The apple has a pleasant aroma.</p>


Variety/brand name	Lumaga Galant®
Type	Resistant
Cross	Resi x Delbard Jubilee
Variety owner	Fruture (CHI)
	<p>The trees have an average vigour. The apple ripens slightly earlier than Golden Delicious. It is a bicolour apple with an attractive red colour and a light haze on a green background. The variety is less sweet than Gala, the flesh remains firm during storage. The size of the apples (smaller than Gala) makes additional thinning research necessary.</p>


Variety/brand name	PremA34
Type	Resistant
Cross	Unknown
Variety owner	Plant and Food Research (NZ)
	Ripens between Gala and Golden Delicious. The fruit size is somewhat smaller than Gala and the fruits develop a good colour in higher-altitude and mountainous fruit-growing regions. The flavour is sweet. The fruits are not susceptible to russetting, however, due to the open calyx tube, they can suffer from internal fungal growth.


Variety/brand name	SQ159 Natyra®
Type	Resistant
Cross	1980-015-047 x Elise
Variety owner	Wageningen University (NL)
	The vigour leaves much to be desired. The apple ripens at the same time as Braeburn, is very aromatic, juicy and crisp with a red and sometimes brownish colour. Young trees can suffer from various physiological defects, varying from cracking to an accumulation of chlorophyll near the stem.


Variety/brand name	UEB32642 Opal®
Type	Resistant/yellow skin
Cross	Topaz x Golden Delicious
Variety owner	Institute for Experimental Botany Prague (CZ)
	Ripens two weeks after Golden Delicious. Has firm flesh and a unique and intensive flavour. The russetting can extend from around the stalk over the side of the apple. For this reason, the variety is sold as a rustic apple.


Variety/brand name	Dalinette Choupette®
Type	Resistant
Cross	X 4598 x X3174
Variety owner	INRA (FR)
	This variety is productive and easy to grow. The extremely firm fruits ripen after Fuji and have a matt red colour on a green, not always attractive, background. The flavour when picked is acidic, even when the sugar content is high. When eaten, the flavour is balanced and good, and the aroma is intensive.

Variety/brand name	Xeleven Swing®
Type	Resistant
Cross	Unknown
Variety owner	J.L. Carriere (FR)
	Ripens at the same time as Fuji, the flavour is mainly sweet, in combination with a firm fruit. The trees are productive and do not suffer from biennial bearing.

Variety/brand name	PremA96 Rockit®
Type	Snack
Cross	Unknown
Variety owner	Plant and Food Research (NZ)
	Ripens somewhat after Golden Delicious. The fruit size is uniform, the colour good, the specific gravity extremely high and the flavour aromatic. The fruits have a very good shelf life.

Variety/brand name	MC38 Crimson Snow®
Type	Colours easily
Cross	Unknown
Variety owner	Chance seedling (AU)
	Ripens at the same time as Cripps Pink. Extremely productive trees with fruits that are genetically larger than those of Fuji. Excellent colouring that makes a high pack-out possible. The storability of the sweet, moderately aromatic apples is good.

Variety/brand name	Fengapi
Type	Colours easily
Cross	Gala x Pink Rose
Variety owner	Feno (IT)
	Ripens at the same time as Golden Delicious. Achieves an attractive colour, also in less suitable fruit-growing regions. The flavour is mainly sweet. Good and uniform fruit size. The storability must still be investigated.

Variety/brand name	Minneiska Sweetango®
Type	Striking fruit quality
Cross	Honeycrisp x Minnewashta
Variety owner	University of Minnesota (USA)
	Ripens at least one week before Gala. It produces large fruits that develop insufficient colour in hot fruit-growing regions. As a result, this apple is suitable for growing in cooler, mountainous regions. The flesh is extremely crisp, in combination with a balanced flavour, which makes the apple extremely attractive. The storability is, for an early ripening variety, good, however, is limited to a few months. Care must be taken due to the high susceptibility to bruising and slight damage.

Variety/brand name	Shinano Gold Yello®
Type	Yellow skin
Cross	Golden Delicious x Senshu
Variety owner	Nagano Fruit Tree Experiment Station (JPN)
	The moderately productive tree bears fruits that have a spherical to cone-like shape. They have a straw-yellow colour when fully ripe. The fruits are more or less free of russeting. Cracks can form around the stalk. The fruits have a sweet flavour with a good acid content and extremely juicy, crisp flesh. The fruits can be stored well.