Profitability for Cultivation of Japanese Quince (*Chaenomeles japonica*)

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SUMMARY

An analysis of the cost for cultivation of Japanese quince (*Chaenomeles japonica*) was performed using background data obtained in the EUCHA-project (FAIR5–CT97–3894). Factors tested were fruit price, yield, plant density, harvesting capacity and payoff period. In Sweden, cultivation of Japanese quince fruits would be profitable at a fruit price of 6 SEK/kg (1 EUR = 9 SEK) if fruits were picked by hand. If fruits were instead harvested mechanically, a fruit price of 2–3 SEK/kg would result in profitable cultivation. In the short-term perspective, Japanese quince fruits seem therefore interesting for production of *e.g*. jam, syrup, aroma extracts and liqueur.

INTRODUCTION

The successful introduction of a new crop is dependent on its profitability in cultivation. Already at an early stage of domestication it is important to make a preliminary estimate of the cost of propagation, field management and harvest. These estimates can then be used to calculate net profit at different levels of the fruit price. The fruit price is in turn dependent on the market potential and the raw material needed for manufacturing of products. An analysis of cost of cultivation of Japanese quince was performed using background data obtained in the EUCHA-project (FAIR5– CT97–3894: Japanese quince [*Chaenomeles japonica*] – A New European Fruit Crop for Production of Juice, Flavour and Fibre) and the point for profitable production determined. The factors tested comprised fruit price, yield, plant density, harvesting capacity and payoff period. The analysis should be repeated in the future when more reliable information on the background data is available.

MATERIALS AND METHODS

The analysis of cost of cultivation of Japanese quince was based on a number of assumptions:
1) Japanese quince plants are cultivated using organic field management practices (no pesticides or herbicides are used and only approved fertilizers are applied)
2) Japanese quince are micropropagated and planted in rows (3 m between rows, grass cover between rows) with plant spacings within the row of 1.5 m (low density, 2222 plants/ha), 1 m (normal density, 3333 plants/ha) or 0.75 m (high density, 4444 plants/ha). Grass between rows is cut.
3) The field is fenced to protect plants from hares and deer.
4) The soil in the row is covered by woven plastic and automatically irrigated and fertilised.
5) The orchard is estimated to be productive for 15 or 20 years.

6) A small yield is expected in the second season but the first significant yield is expected in the third season and is estimated at 1 kg/plant. The yield is then successively increased by one kg per plant a year to reach a maximum of 6 kg/plant in the eighth season. The plant is then pruned and a drop in yield occurs in the ninth season. From the 10th–15th (or 20th) season, three average yield levels are used in the calculations: low (4 kg/plant), normal (5 kg/plant) and high (6 kg/plant).
7) The fruits are picked by hand or by a mechanical harvesting device in "big boxes". Picking capacity is estimated to be 50 kg/hour and person in the standard alternative and 40 kg/hour and person in a less optimistic alternative. The capacity of the mechanical harvesting device is estimated to be 5000 kg/hour.
8) Cultivation is intended to take place in Sweden in this example, and all costs are therefore based on the prices in Sweden, 2001.

RESULTS AND DISCUSSION

Duration of a Japanese quince orchard

Establishment of an orchard is always expensive with a long period for payoff of investments. A Japanese quince orchard is expected to be productive for at least 15 years and 20 years seems a reasonable perspective. It is possible that longer periods should also be considered, although within a period of 20 years new and better varieties should appear and replace the old ones. A period for analysis for payoff of investments of 15 and 20 years seems therefore reasonable for Japanese quince.

For both 15 and 20 years production, a net profit is obtained for normal plant density, at every yield level, at a fruit price of 6 SEK/kg (Table 1). At a high plant density even 5 SEK/kg results in a net profit, except for very low yields and 15 years productivity.

Yield levels

The three average yield levels used in the calculations (4, 5 and 6 kg/plant, respectively) are moderate estimates based on single plant performance – no comparative trial has as yet been evaluated for the complete period of 15 or 20 years. However, in breeding populations a yield of 8–10 kg/plant has been obtained for some promising genotypes. The yield levels used are therefore considered realistic and represent the true yield to be sold when *e.g.* fruits have been graded or, in case of mechanical harvesting,

Table 1. Net profit for a Japanese quince orchard (one hectare) for different levels of plant density, yield, fruit price and period of cultivation (fruits are picked by hand at a speed of 50 kg/hour, see text for other background data and assumptions). A break-even point for a net profit at normal plant density is a fruit price of 6 SEK/kg. At a high plant density even 5 SEK/kg is acceptable if yields are normal or high (1 EUR = 9 SEK).

Period		Yield for 15 years			Yield for 20 years		
Plant density (plants/ha)	Fruit price (SEK/kg)	Low (SEK)	Normal (SEK)	High (SEK)	Low (SEK)	Normal (SEK)	High (SEK)
2222	5	-133261	-113928	-94595	-140383	-111775	-83167
	6	-62956	-34483	-6010	-49986	-7215	35555
	7	7350	44962	82575	40411	97344	154277
3333	5	-71690	-17350	-13691	-60262	-42690	25562
	6	33881	76590	119299	75446	139602	203758
	7	139452	195871	252290	211154	296554	381954
4444	5	-9554	29113	67779	20424	77641	134857
	6	131509	188454	245400	201669	287211	372752
	7	272571	347796	423021	382915	496781	610647

not all fruits on the plants have been harvested.

Plant density

Although the cost of the plants is the largest investment cost, as high a plant density as possible should be attempted. The more plants, the sooner yield will become high, which will bring income to cover the cost of investment. Considering the growth potential of a Japanese quince shrub, 0.75 m between shrubs in the row seems to be a lower boundary and 1.5 m a reasonable upper boundary. The higher the plant density, the sooner the investment will reach payoff (Table 1). At a high plant density the grower can afford a lower fruit price while still making a net profit. A high plant density is also a buffer against variable yields.

Harvest

Picking fruit by hand is expensive and therefore an accurate estimate of picking capacity is very important. Although 50 kg/hour and person seems realistic, a lower alternative (40 kg/hour) was tested to study its influence on payoff. A reduced capacity may for instance occur if fruits have to be graded during picking, if yields are low and if less experienced labour is used. However, a reduced picking capacity could be compensated for by a higher yield per ha. Thus, at a high plant density the payoff still occurs at 6 SEK/kg for both 15 and 20 years of cultivation (Table 2).

If a mechanical harvesting device were to be successfully developed, picking cost would be drastically reduced and the break-even point for fruit price would be considerably lowered accordingly (Table 3). A break-even point for a net profit at high plant density is a fruit price of 2–3 SEK/kg. In the analysis we used a moderate capacity of the mechanical harvest device (5000 kg/hour). However, a doubled capacity would only slightly influence the fruit price (results not shown). More importantly, mechanical harvesting would make it possible to increase plant density in the field to 5000 by reducing distances between rows and thereby increasing yields per ha.

Table 2. Net profit from a Japanese quince orchard (one hectare) for different levels of yield, fruit price and period of cultivation (fruits are picked by hand at a speed of 40 kg/hour, see text for other background data and assumptions). A break-even point for a net profit at high plant density is a fruit price of 6 SEK/kg (1 EUR = 9 SEK).

Period		Yield for 15 years			Yield for 20 years		
Plant density (plants/ha)	Fruit price (SEK/kg)	Low (SEK)	Normal (SEK)	High (SEK)	Low (SEK)	Normal (SEK)	High (SEK)
4444	5	-107300	-81816	-56333	-109000	-72886	-36773
	6	33762	77526	121289	72245	136684	201123
	7	174825	236837	298910	253490	346254	439018

Table 3. Net profit from a Japanese quince orchard (one hectare) for different levels of yield, fruit price and period of cultivation (fruits are mechanically harvested at a speed of 5000 kg/hour, see text for other background data and assumptions). A break-even point for a net profit at high plant density is a fruit price of 2–3 SEK/kg (1 EUR = 9 SEK).

Period		Yield for 15 years			Yield for 20 years		
Plant density (plants/ha)	Fruit price (SEK/kg)	Low (SEK)	Normal (SEK)	High (SEK)	Low (SEK)	Normal (SEK)	High (SEK)
4444	2	-45666	-9635	26397	-10789	45017	100823
	3	95396	149707	204018	170456	254587	338718
	4	236459	309049	381639	351701	464157	576613

CONCLUSION

In Sweden a profitable cultivation of Japanese quince fruits would require a fruit price of 6 SEK/kg if fruits were picked by hand (1 EUR = 9 SEK). If a mechanical harvesting device were developed, a fruit price of 2–3 SEK/kg would result in a profitable cultivation. In the short-term perspective Japanese quince therefore seems very interesting for production of *e.g.* jam, syrup, aroma extracts and liqueur, whereas the fruits of Japanese quince do not seem to be a competitive raw material for extraction of pectins due to the high cost of their production.