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PROFITABLE QUALITY: COST AND PROFITS CONCERNING MARKETING A PRODUCT PREFERRED BY CONSUMER

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Abstract

Price level is dependent on supply and demand, the moment of marketing, but also on the external and internal quality. Each commodity of fruits and vegetables has specific quality criteria much preferred by the consumer. For apples there exists yet a more complete description with respect to the optimum quality aspects. To reach the optimum quality the choice of the variety, picking in different time, better refrigerating and more sophisticated C.A. circumstances, wet forced air pre-cooling and refrigerated transport are strategies with higher costs, but also with higher benefits, to arrive at a profitable quality. Practical models with costs and benefits are described in this publication.

Keywords:
PROFITABLE QUALITY, CONSUMER PREFERENCE, OPTIMUM APPLE QUALITY, STORAGE COSTS

1. INTRODUCTION

A very important factor determining price is the quality of the product. This quality is dependent on consumer and trader preference. To reach the optimum quality costs are to be made. The question discussed is where is the equilibrium costs-benefits that gives the highest profitable quality.

2. MATERIALS AND METHODS

Factors influencing the price. Important effect of quality

The mean price level is dependent on supply and demand. The specific price of a lot in retail at the same moment is dependent mostly on the external and internal quality. Avermaete (1978) determined in a formula the relationship between the yearly mean price level of apples and the estimated production of apples and pears in a specific year.

Formula annual mean price for apples (1965-1975)

P	=	18,12 - 1,97 A EEG - 0,37 PEEG + 0,13 T here :
P	=	annual mean BEF/kg
AEEG	=	EEC apple crop in million tons in a certain year
PEEG	=	EEC pear crop in million tons in a certain year
T	=	trend (1,2...16)

(Avermaete, 1978)

Monthly prices increase in general for apples during the storage season. In a year with a high crop the mean price level is not only lower, but the price increase begins later in the storage season.(Avermaete, 1978).

Monthly indexes of apples for a year with a high crop and a low crop

High crop	Low crop
A : 88	A : 130
S : 82	S : 104
O : 79	O : 90
N : 83	N : 91
D : 97	D : 101
J : 105	J : 102
F : 106	F : 105
M : 119	M : 103
A : 136	A : 101
M : 154	M : 112
J : 170	J : 149
J : 130	J : 151

(Avermaete, 1978)

Daily price changes

For some commodities price level is higher on Monday or Friday than other days. (Hinton, 1973).

Index of the price for each day of the week (seasonal average = 100)

	Mon	Tues	Wed	Thurs	Fri	Sat
Lettuce, Salad	109	94	101	87	110	95
Onions	116	96	95	100	103	78

(Hinton, 1974)

Next the mean price level on the same day there is a big difference in price depending on the quality of the lot. In a formula Avermaete *et al* (1976) indicated different quality criteria determining price for apples on the Belgian market.

Relation between price and quality

Belgian and French Golden Delicious apples

PB = 13,79 + 1,61 TXX - 1,19 RoXX + 1,00 DXX + 0,45 ReX - 0,56 FyX R2 = 0,52

PF = 30,71 + 1,67 TXX - 2,93 FrXX + 1,46 DXX + 0,60 GX - 1,82XX B R2 = 0,46

where:

PB	=	for Belgian Golden
PF	=	for French Golden
RO	=	incidence of rot fruits
D	=	diameter
FR	=	quote for freshness
RE	=	refractometer value
FY	=	incidence of breakdown
B	=	incidence of bruising
T	=	time (Oct = 1 Nov = 2 June = 9)
G	=	greenness

(Avermaete et al, 1976)

Also, Jordan et al. (1989) estimated the relationship between quality and prices of peaches. Here also fruit weight, damage quote, ground color, firmness and maturity quote are important criteria determining price at warehouse departure.

Preference of consumer for quality

Fruit and vegetables have specific quality criteria most preferred by consumer. Schutz *et al.* (1984) described the most important criteria for different vegetable commodities.

Mean importance ratings for purchase pro criteria

	Colour	Appearance	Flavor	Texture
Tomato	8.8	8.8	9.4	9.6
Lettuce	8.9	9.1	8.4	9.5
Cucumber	8.2	8.5	8.5	9.4
Cauliflower	8.2	8.8	8.8	8.7
Potato	5.9	7.5	9.1	9.0
Onion	5.3	6.8	8.3	8.0

(Schutz et al.,1984)

Even for some apple varieties certain criteria are more positive evaluated by consumers than other (Pladdet *et al.*, 1992)

Relative importance of criteria interested by consumers

	Sugar	Acid	Firmness	Total
Jonagold	35%	15%	50%	100%
Cox's O.P.	40%	20%	40%	100%
Elstar	20%	30%	50%	100%

(Pladdet et al., 1992)

There exists sometimes a difference in quality rating before and after tasting an apple variety (Heirman, 1981).

Quality preference before and after tasting (scale 1 - 8)

Variety	Before tasting	After tasting
Gloster	2.2	5.1
Jonagold	5.8	6.0

(Heirman, 1981)

The consumer has not always a correct idea about the nutritious and health quality of the product : He doesn't see the difference in vitamin C content in an apple (Bohling, 1983) or in other healthy components. There exists also differences in preference from person to person and from area to area. There is a male-female differentiation, age-differentiation, social class-prestige, racial and nationality and occasion differentiation.

We can not indicate a steady figure for optimum quality but a range of values. For Jonagold apples in European countries the optimum Brix content is situated between 12 and 15, firmness between 45 and 70 N and acids (malic acid) between 0.5 an 0.7%.

Also for tomatoes on the French market northern areas prefer a more deep red colored tomato, southern areas a more pink.

The optimum apple quality

About the optimum apple quality there are different descriptions as a result of research (Baros 1993, Pladdet *et al.*, 1992, Herregods *et al.*, 1993).

The ideal apple in France:
Weight > 200 gr.
Firmness 7 kg/cm2
Refractometer value > 13ø Brix
Acidity - malic acid $\geq$ 4.2 gr/l
Red colour - intense, lined, spread over the fruit
Not wanted:
outside defects
fatty skin
mealy
too green
thick peel
acid taste
(Baros, 1993)

Optimum levels of firmness, sugar and acid concerning eating quality

	Sugar (Brix)	Acid (malic acid %)	Firmness (kg/cm2)
Jonagold	13 - 14	0.5-0.6	6
Cox's O.P.	14	0.7-0.8	5 - 6
Elstar	14	0,8	6

(Pladdet et al, 1992)

Quality and maturity characteristics at the optimum picking time (Jonagold)

Starch (scale 1 - 10)	6 - 7
Ground colour (scale 1 - 8)	< 7
Firmness (kg/cm2)	> 7
Refractometer (Brix value)	> 13.5
% Red Surface	> 30%
Fruit weight	< 220 g.

(Herregods et al, 1993)

It is clear that for apples juiciness, crispness, intensity of taste, are high preferred, but that mealiness, greasy skin, too green colour, to acid are rejected. Also, Thiault (1975) made for different kind of fruits as cherries, peaches apricots plums, melons, grapes, pears and apples levels of minimum taste quality founded on a sufficient high Brix value, a sufficient high firmness value and a minimum or maximum content of acids.

Costs and profits to reach a profitable quality

To reach an optimum quality the choice of varieties, the optimum picking time, better refrigerating techniques, more sophisticated C.A. circumstances, wet forced air pre-cooling, refrigerated transport are strategies, with higher costs, but also with higher profits. The problem is to find the optimum equilibrium between costs and profits, to arrive at profitable quality.

Picking in different times

When all the apples on a tree don't reach the optimum quality and storability on the same moment, it can be necessary to pick in 2 to 3 times. More costs but higher profits are possible (Herregods, 1993).

Storage rooms with better refrigerating techniques

A small increase of refrigerating costs can results in higher profits through less weight loss and less appearance of disorders and decay during storage. The temperature of the cooler, the defrosting regulation, a discontinue air circulation, a better insulation, a thermostat range not to small, a proper stocking pattern are important factors improving quality after storage.

Longer storage time with higher possible price

After some months of storage there can be a shortage of supply with higher prices. Even with higher costs the benefit price increase will be higher as a results of the higher product price (Pattou, 1991, Herregods, 1993).

Mean period with benefits after storage related to costs, losses and increase of price

Vegetables:

White cabbage:	from January
Red cabbage:	from March
Turnip-rooted celery:	from half December

(Pattou, 1991).

Fruits:

Jonagold apples	high crop year: from April	low crop year: from January
Conference pears	high crop year : from April	low crop year: from January

(Herregods, 1993)

To reach a long storage time with preservation of the external and intrinsic quality, more expensive storage techniques as C.A.-storage, U.L.O.-storage, N_2 flushing, ethylene absorption are necessary.

Investments costs (5 rooms each 80 ton) (BEF/kg)

	Regular storage	Ventilated CA	Ca scrubber	U.L.O.
Building	6 - 8	6 - 8	6 - 8	6 - 8
Insulation & doors	6	7 - 8	7 - 8	7 -8
Refrigeration	6 - 7	6 - 7	6 - 7	6 - 7
Scrubber	-	-	3	3
N2-generator	-	-	3	3
Computerization	-	-	-	2 - 3
Total	18 - 21	19 - 23	25 - 29	27 - 32

Storage costs after 6 months (BEF/kg)

	3 rooms, 80 tons each	5 rooms, 80 tons each
Regular storage	2,90	2,90
Ventilated C.A.	2,95	2,95
C.A. dry lime	3,20	3,20
C.A. scrubber	3,45	3,20
+ computer	4,20	3,64
+ N2 generator	4,20	3,64
Bins and heftruck	0,51	0,51

Storage costs and firmness

	Cost/kg	Firmness after 6 months and 8 days	Skin color (1=green, 8=yellow)
R.S.	0.06 US $	33	6.4
U.L.O.	0.12 US $	56	6.0
U.L.O. + continuous N2 flow	0.13 US $	59	5.4

These more sophisticated storage techniques make it possible to store apples and a very long time with high quality as yet applied in Belgium.

Supply of apples in Belgium (% of total production)

	Supply after April 1	Supply after May1	Supply after June 1
Period 80-84	19.6	12.6	7.0
Period 85-89	22.2	13.0	6.2
Period 90-93	25.3	16.3	9.0

Supply of peaches in Belgium (% of total production)

	Supply after April 1	Supply after May1
Period 60-64	0.4	0.0
Period 65-69	3.6	0.5
Period 70-74	9.4	3.8
Period 75-80	14.2	5.2
Period 80-84	15.4	6.2
Period 85-89	20.0	9.0
Period 90-93	24.7	11.7

For that reason there is a distribution of different storage systems necessary for respectively short, mean and long time storage.

Diversity in storage systems (tons) in Belgium

Year	Total capacity	Regular storage	C.A. storage	U.L.O. storage with Computer
1950	10.000	9.900	100	0
1960	45.000	44.900	100	0
1970	112.000	80.500	31.500	0
1980	134.000	74.500	59.500	0
1985	166.000	93.000	64.000	9.000
1988	178.000	91.000	71.000	16.000
1989	188.000	61.000	81.000	46.000
1990	205.000	51.000	94.000	60.000
1991	218.000	50.000	98.000	70.000
1992	247.000	50.000	98.000	99.000
1993	260.000	50.000	103.000	107.000

Refrigerating after storage, a need to keep quality

To keep Jonagold apples crisp, firm with a green-yellow ground colour 10 days after storage temperatures of about 5° C is necessary.

Development of colour after storage: Time to reach maximum yellow ground colour 7 (Jonagold)

	18o C	12o C	5o C
5.5 > 7.0	12 d	15 d	> 21 d
6.0 > 7.0	10 d	12 d	21
6.5 > 7.0	7 d	7 d	14

Development of firmness after storage: Time to reach minimum firmness 5 (Jonagold)

	18o C	12o C	5o C
5.3 > 5	4	3	13
5.5 > 5	6	7	> 21
5.5 > 5	7	7	> 21

Wet forced air-cooling before transportation of vegetables and strawberries and refrigerated transport

Before refrigerated transport a proper pre-cooling is necessary. Wet forced air cooling has a lot of benefits. The pre-cooling capacity for vegetables and strawberries is considerably increased last years in Belgium.

Pre-cooling capacity for vegetables and strawberries in Belgium (m^3)

Year	Capacity
1987	47.000
1988	58.000
1989	65.000
1990	79.000
1991	81.000
1992	81.000
1993	82.000

Pre-cooling and refrigerated transport of vegetables conducts to higher costs but reduces losses more and will be profitable (Meffert, 1985).

Pre-cooling and refrigerated transport Auction		No refrigeration
Pre-cooling	2 - 4	
+ Refrigeration 24 h.	1	0.5
Transport 500 km (wholesale trade)	26	22.5
Storage 24 h.	2	1
Transport 50 km (retail trade)	7	6
Storage 24 h.	5	2
Retail show-case	13	5
Total	57	37
Production cost	150	150
Losses	10	45
Total Costs	217	232

(H.F.Th. Meffert, 1985)

3. RESULTS

Development of the produce must be in close connection with the preferences of the consumer. - Fruit consumption shifts from a quantitative to a qualitative demand. Giving more satisfaction to the demand of the consumer implicates higher costs (integrated fruit production, different picking times, better pre-cooling, more sophisticated storage, sorting, handling, packaging and storage methods). A benefit study - higher costs, increase of quality and shelf-life, lower losses - is important. There is not always a clear relationship between the external and the internal quality or shelf-life. Only when a consumer can recognize a product with better quality, he will be willing to pay a higher price. Specific quality determination, norms and labels will be helpful.

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