

EVALUATING A GRADING SYSTEM

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ABSTRACT

It is extremely difficult and expensive to determine how consumers evaluate the quality of a product in a real market. Even laboratory experiments, with their obvious limitations, are expensive. However, in a pick-your-own strawberry enterprise it was possible to observe what consumers chose to buy when given a free choice. Analysis of a sample of consumers' purchases showed that only 3% of the samples picked by consumers met EEC standards. There appears to be no other experimental or observational evidence on the relevance of EEC fruit and vegetable standards to consumers.

INTRODUCTION

Most fresh fruit and vegetables sold in the EEC must meet minimum standards and be graded according to a uniform standard. It is important that there should be a continuous assessment of the ability of the system to reflect consumer requirements and add to marketing efficiency, but an extensive bibliography (1) does not show that any market research was carried out before or after the introduction of these standards.

There has been some research in the United States but I would not assume without evidence that people in the EEC act in the same way. For instance, the finding that consumers will tolerate a very high incidence of bruising in apples (8), probably depends on the population and on the variety of apple.

One reason why so little research has been done is that it is very expensive to find out what attributes of a product the consumer values, what combinations of attributes he prefers (e.g. a small Cox's Orange Pippin may be acceptable but not a small Granny Smith), and then to find out what sections of the population have different preference patterns. An enormous number of replicated selling experiments would have to be carried out, even when testing only five different levels of five attributes, with different price ratios. In fact it is virtually impossible to determine consumers' preferences in this way with short-season crops like strawberries, with crops whose prices and substitutes vary from week to week or with crops whose prices cannot be controlled by the experimenter. Laboratory experiments have their obvious limitations, chief of them being the artificiality of the environment and the costs of replication. However, it is considerably easier to assess an existing grading system than it is to prescribe an optimum grading system to take its place.

The study reported here tested the hypothesis that if consumers were free to choose the strawberries they wanted from a wider range of qualities than would be available in even a large number of shops, their choice would be consistent with the EEC grades.

METHOD

An unusual marketing system made it possible to examine, at a reasonable price, the strawberries selected by consumers given a wide choice in a normal commercial environment. In 1975 strawberries were being sold outside Dublin on a "pick-your-own" basis (2). Consumers would enter the field, pick the strawberries they wanted and take them to the edge of the field for payment. There was an excellent crop and I had no difficulty in picking 1 lb of Class Extra in five minutes. Towards the end of the season, when quality deteriorated, the study was terminated.

One hundred and sixty nine customers were chosen at random and asked how many pounds they had purchased and whether they were accompanied by children. A sample of

their purchase (a 1 lb punnet) was taken, the attributes mentioned in the EEC standard were measured and the sample was classified. The samples were classified on *the* basis of dirt, bruising and fungal infection (all with 2% tolerances). Samples were downgraded only if they exceeded the tolerances for a single defect, though under EEC standards tolerances are cumulative. The EEC grades are Class Extra and Class I (3). A Class III is permitted, as a temporary measure, during some times of the year (4) but no sales of Class III will be permitted after December 1982 (5). There is no Class 11.

RESULTS

If the EEC standards were strictly interpreted, only 3% of the samples met EEC standards and could have been sold legally in retail shops.

A major cause of downgrading was the requirement that all strawberries should have the calyx attached for Class Extra and Class I, but that for Class III it was permissible to have fruit with the calyx removed, provided they were packed separately. While this requirement is legally binding at retail, its importance would appear to be confined to wholesale. If the fruit is picked without the calyx, bruising is likely to be greater and disease organisms may enter the wound, so the fruit may deteriorate more rapidly. At retail the regulation appears to be irrelevant, as the fruit will be downgraded on other grounds if it has deteriorated. Customers in our sample frequently removed the calyxes deliberately, to save having to remove them later and to avoid having to pay for them when the fruit was weighed. For these reasons it was felt that presence or absence of calyx should be ignored when grading fruit for this study. Had it been taken into account 41 % of samples would have been below the minimum standard (with between 10% and 90% of the calyxes removed) and another 55% would have been downgraded to Class III even if the samples had been perfect in all other ways. As expected, people picking for jam were slightly less likely to pick fruit with the calyx attached than were people picking for freezing (Table 1).

TABLE I: Percentage of samples not meeting standards because of absence of calyx^a

	Percent of fruit with calyx			Total
	90-100 ^b	10-90 ^c	0-10 ^d	
<i>Bought for</i>				
Jam	3	24	73	100
Freezing	0	53	47	100
Eating fresh	4	48	48	100
<i>lb bought</i>				
0-6	4	47	49	100
6-9	5	37	59	100
over 9	0	40	60	100
<i>No. of children</i>				
0	4	34	61	100
1	10	54	36	100
More than 1	2	46	52	100
<i>All samples</i>	3	41	55	100

a Chi square statistics were inappropriate because there were many empty cells (e.g. Class Extra) and cells with few samples.

b 90-100% of fruit must have the calyx attached if the sample is to be Class I or Class Extra.

c If 10 %- 90% of the fruit have the calyx attached the sample may not legally be sold through the normal marketing channels.

d If less than 10% of fruit have the calyx attached the fruit may be in Class In. That is to say that, as far as possible, either all the fruit or none of the fruit should have calyx attached.

89% of samples were out of grade because of fungus damage, severe bruising or squashed fruit (it was not always easy to distinguish the cause of the damage), and 30% of samples had more than 30% of the fruit spoiled. The crop was not badly affected by fungus (botrytis) but fruit left unpicked was eventually affected and ripe fruit next to it were sometimes covered with mould. Some fruit, especially the over-ripe or fungus-infected fruit, were squashed or badly bruised in picking (bruising is generally less when the picker holds the stem and pinches it off the plant than when he holds the berry and pulls it off, leaving stem and calyx behind). There was some tendency for people picking large quantities, 9 to 50 lb, to have more spoiled fruit and for people buying for freezing to have less. People buying for eating fresh had a lot of samples out of grade, but fewer of the really bad samples (Table 2).

A subjective appraisal of the degree of ripeness was made; 1% were classified as under ripe, 52% as ripe, 36% as overripe, and 8% as very variable. ('Ripe' was taken to mean that the berries were fully developed and coloured and that the sample could be expected to last two or three days without refrigeration - fungus and bruising were, of course, ignored). There was a tendency for people to pick fewer overripe berries for jam making and more when picking large quantities. This suggests that most consumers want to have fully mature fruit for immediate use, and were prepared to overlook many of the defects of overmaturity. Experience showed that most samples, however unattractive, were quite edible when eaten the same day (with mouldy fruit removed) or when kept under refrigeration until the next day, but that the combination of overmaturity, bruising and fungus led to high spoilage even the next day, in the absence of refrigeration (Table 3).

TABLE 2: Frequency of fungus damage, bruising etc.

		Percentage of strawberries in a sample affected by fungus bruising etc.						Total
		Under 2	2~5	5-10	10-20	20-30	Over 30	
		(Percent of samples)						
<i>Bought for</i>								
Jam	9	0	11	34	9	37	100	
Freezing	29	0	6	24	18	24	100	
Eating fresh	9	3	12	19	26	31	100	
<i>lb bought</i>								
Under 6	9	4	7	24	19	37	100	
6~9	15	1	15	25	25	19	100	
Over 9	4	0	8	31	23	35	100	
<i>No. of children</i>								
0	12	4	8	30	18	28	100	
1	5	0	5	18	32	41	100	
Over 1	11	2	14	22	23	28	100	
<i>All samples</i>	11	2	10	25	22	30	100	

Note: The EEC standards require that the fruit must be sound, intact and undamaged and free from insect bites and traces of disease. Class III fruit may have slight bruising. Up to 10% (5% for Class. Extra) by number or weight of fruit need not satisfy the requirements of the class including the rules fixed for sizing such products. However, products must be of marketable quality and fit for consumption. In no circumstances may more than 2% of spoilt fruit be present. (3, 4, 6).

When it came to dirt; however, consumers were much stricter; only 3% of samples had any dirt, though Class III 'may have slight traces of soil, on condition that their appearance is not too much impaired thereby'. This was in spite of the fact that many of the most attractive and most visible strawberries on the plant lay on the ground between rows that had soil on them (Table 4).

Thirty-five per cent of the samples had more than 5% misshapen berries and 20% (with more than 10% misshapen) could have been downgraded on this alone. Some consumers said that they particularly prized large, though misshapen, berries (Table 5).

At the time of the study there were different size standards for large and small varieties, but this distinction has since been abolished (6). It is difficult to see why there ever should have been such a distinction. Table 6 shows that all samples were a satisfactory size. There were both large and small varieties in the field.

The colour of 115 samples was measured on a Hunter D25 Difference Meter and the L values were measured. Most samples had a mean between 24 and 38, which indicates that they were very red, as the normal value when picked commercially, for the commonest varieties in the field, Cambridge Favourite and Cambridge Vigour, is 55 (7) (a high L number indicates a light colour). Samples picked for jam-making tended to have a less uniform colour. People picking 9 to 50 Lb tended to pick redder strawberries with a more uniform colour. People with only one child accompanying them tended to pick redder strawberries and people with more than one child tended to pick a sample with lighter strawberries (Table 7).

An analysis of the variance of the samples shows that people tended to pick a uniform quality. Table 8 shows that there was considerably more variance in colour, diameter, area of cross section and volume between samples than within samples. This may be because people prefer uniform samples but it may also be because the quality available to someone picking in one small area on one afternoon is necessarily more uniform.

TABLE 3: Ripeness of strawberry samples

	Degree of ripeness					Total
	Under ripe	Fair	Overripe	Badly overripe	Varies	
	(Percent of samples)					
<i>Bought for</i>						
Jam	0	69	26	6	0	100
Freezing	0	59	29	12	0	100
Fresh	0	45	41	9	5	100
<i>lb bought</i>						
Under 6	0	43	47	8	3	100
6-9	3	68	22	4	3	100
Over 9	0	38	38	15	8	100
<i>No. of children</i>						
0	2	55	35	6	1	100
1	0	45	41	9	5	100
Over 1	0	50	34	9	6	100
<i>Total</i>		52	36	8	4	100

Limitations

The conclusions of this study apply to consumers in one area, buying strawberries in one particular way and it would be wrong to conclude that all consumers in the EEC would act in the same way. No single experiment or observational trial could lead us to that conclusion, but since this is the only one that has been carried out, and it fails to support the hypothesis that EEC standards are relevant to all consumers in the EEC, that hypothesis is suspect and should be tested in other markets and other countries.

It could be argued that people grew tired and were not selective in their picking, but in 1974 it had not been found that picking time was seen by the customers as a serious cost; when ready-picked Class I were available at 25p a pound, sales amounted to only 5% of the sales of pick-your-own at 20p. In fact the cost of transport frequently made p-y-o strawberries more expensive than those in a shop near the consumer's home. Most people enjoy the picking, the satisfaction of finding ripe berries among the leaves, of eating the berries and of being in the open air (2). It could be argued that because they enjoyed the picking consumers were willing to accept inferior produce.

It might be thought that people accompanied by children might get all the low-quality strawberries picked by their children, but in fact people not accompanied by children and

people accompanied by two or more children picked much the same quality, while the few people accompanied by one child picked significantly worse samples.

There is no reason to believe that customers will have markedly different standards when buying in pick-your-own fields and when buying in a normal shop. Experience of self-selection in supermarkets suggests that consumers are rather more fussy when they select the fruit and vegetable items they want than when they buy prepacks. It is hoped

TABLE 4: Frequency of dirty fruit
Percentage of dirty strawberries in a sample

	Less than I	1-5	Over 5	Total
	(Percentage of samples)			
<i>Bought for</i>				
Jam	97	0	3	100
Freezing	100	0	0	100
Eating fresh	96	0	4	100
<i>lb bought</i>				
Under 6	96	0	4	100
6-9	99	0	1	100
Over 9	96	0	4	100
<i>No. of children</i>				
0	96	0	3	100
1	91	0	9	100
Over 1	100	0	0	100
<i>All samples</i>	97	0	3	100

Note: The fruit must be clean, in particular free from dirt and all visible traces of chemicals. Class Extra must be free of earth and Class I must be practically free of earth. Class III fruit may have slight traces of soil on condition that their appearance is not too much affected by this. Up to 10% (5% for Class Extra) by number or weight of fruit need not satisfy the requirements of the class including the rules fixed for sizing such products. However, products must be of marketable quality and fit for consumption. In no circumstances may more than 2% of spoiled fruit be present (3,4,6).

that future research will clarify this point, as self-selection and pick-your-own operations appear to be the two cheapest ways of observing quality preferences under market conditions.

It might be argued that people picking strawberries are inexpert, likely to get tired quickly from stooping, are working over rows that have already been picked over once and that they may not see damage. Because of this they may not be getting the quality they want. However, the difference in the quality picked by people picking less than 6lb and those picking more than 12 Lb is small, suggesting that tiredness does not have much affect on quality. Customers were generally delighted with the quality of the strawberries they picked, not just satisfied.

One cannot dismiss these objections to the research method and it is hoped that future research on other markets in other countries will clarify the points. There might indeed have been some reservations about the conclusions if the results had been less striking, e.g., if 80 % of the samples had been Class I instead of 3%.

It has been argued that the consumer is a poor judge of quality. The justification for the standards is that they force the consumer to have a higher quality standard than he would normally have, in the same way that regulations on house construction have improved living standards. I cannot accept this argument. We are not dealing with matters of public health or safety; it would be considered presumptuous and officious in the extreme for us to impose our standards on the public in most other spheres. We are not dealing with the housing case where there is widespread agreement on what is desirable but some builders skimp to make excess profits. This observation has shown that quality as perceived by the customers is not the same as quality as perceived by the EEC; customers thought that the strawberries they had picked would be more acceptable on the table than almost all strawberries offered for sale in the shops.

The excuse cannot be made that the regulation was intended to apply only at wholesale; the law requires that it apply at retail. There is no solid evidence to suggest that the regulation is any more applicable at wholesale.

TABLE 5: Frequency of misshapen fruit

Percentage of misshapen fruit in a sample

	0	0-10	Over 10	Total
	(Percent of samples)			
<i>Bought for</i>				
Jam	60	17	23	100
Freezing	59	24	18	100
Eating fresh	69	12	19	100
<i>lb bought</i>				
Under 6	77	10	13	100
6-9	54	19	26	100
Over 9	62	20	19	100
<i>No. of children</i>				
0	66	13	20	100
1	82	0	18	100
Over 1	59	22	19	100
<i>All samples</i>	66	15	20	100

Note: Class Extra fruit must be of superlative quality and typical of the variety in shape, Class I may be slightly less uniform in shape but must be fully and normally developed, and Class III fruit may have defects in shape, or development, on condition that the fruit retains the characteristics of the variety (3,4, 6).

Note: Minimum size for Class Extra is now 25 mm and minimum size for Class I, 18 mm for both large-fruited and small-fruited varieties (6).

TABLE 7: 'L' values of strawberries measured on a Hunter D. 25 Difference Meter

	Mean 'L' values							Total
	0-30	30-32	32-34	34-36	36-38	38-40	40-100	
	(Percent of samples)							
<i>Bought for</i>								
Jam	0	10	10	25	30	15	10	100
Freezing	0	9	9	36	36	9	0	100
Fresh	3	8	17	24	28	16	3	100
<i>lbs bought</i>								
0-6	0	12	12	24	37	8	6	100
6-9	2	4	6	33	38	15	2	100
Over 9	6	6	33	17	17	22	0	100
<i>No. of children</i>								
0	0	7	11	31	33	13	5	100
1	0	7	33	33	27	0	0	100
more than 1	4	9	9	20	38	18	2	100
<i>All samples</i>	2	8	13	27	34	13	3	100

TABLE 8: Uniformity and sources of variance in strawberry samples

		df	Variance	
			s s	md
<i>Colour</i>	Total	1149	20421.9	17.77
	Within samples	1035	13052.5	12.61
	Between samples	114	7369.4	64.64
<i>Diameter</i>	Total	3760	79680.8	21.19
	Within samples	3592	55144.7	15.35
	Between samples	168	24536.1	146.0
<i>Area</i>	Total	3760	13426.2	3.57
	Within samples	3592	9235.9	2.57
	Between samples	168	4190.3	24.94
<i>Volume</i>	Total	3760	98286.4	26.14
	Within samples	3592	67414.1	18.77
	Between samples	168	30872.3	183.8

TABLE 9: Samples meeting EEC grading standards^a

	Class Extra	Class I	Class III	Out of grade	Total
	(Percent of samples)				
<i>Bought for</i>					
Jam	0	3	6	91	100
Freezing	0	6	29	65	100
Eating fresh	0	2	5	92	100
<i>lb bought</i>					
Under 6	0	4	4	92	100
6-9	0	1	13	85	100
Over 9	0	4	4	92	100
<i>No. of children</i>					
0	0	5	7	88	100
1	0	0	0	100	100
Over 1	0	2	8	88	100
<i>All samples</i>	0	3	8	89	100

^a Specifications were not applied rigidly. Samples were downgraded if they failed to meet the requirement on one attribute, rather than on the cumulative effect of several. Specifications for calyx, white-tip and uniformity were ignored. If specifications had been strictly applied only 3% of samples would have met EEC standards.

CONCLUSION

There is no evidence to support the hypothesis that the EEC grading standards reflect customers' purchasing patterns and there is evidence to show that in a subsection of one market EEC standards bear no relation to consumers' purchasing patterns. Research should be carried out elsewhere in the EEC, to see whether this is true everywhere. Arguments in favour of a compulsory grading system are based on the assumption that the grades reflect purchasing patterns of all or nearly all consumers and the trade; if they do not the arguments fall away.

Thanks are due to D. Twohig and S. Egan for their help in collecting the data and to J. Sherington for help in the analysis.

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