

Consumer evaluation of novel kiwifruit: willingness-to-pay

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Abstract: This paper introduces a research methodology that adds sophistication to the innovation process for agricultural goods. In recognition of the importance of innovation for the long-term success of firms and the need for market analysis that goes beyond traditional sensory and consumer preference testing, it is demonstrated how to measure the monetary value consumers place on new market goods. In experimental markets, New Zealand (NZ) consumers were willing to pay on average approximately NZ\$0.44 per 100 g to exchange the common green-fleshed Hayward variety for a new-to-market red- and yellow-fleshed kiwifruit variety. At the time of the study this was equivalent to a 179% retail price premium. Knowledge that this new variety was not genetically modified increased the price premium to 240%. These results were elicited from convenience samples and should be treated with caution if used as the sole basis for price setting.

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Keywords: experimental markets; genetic modification; variety-seeking tendency; New Zealand; sensory analysis

INTRODUCTION

The development of new products is as important for the fresh fruit sector as it is for manufactured foods.¹ A key factor, however, that sets apart the fresh fruit industry from that of manufactured foods is that a considerable proportion of product innovation occurs through the breeding of new varieties, which often have a long lag phase before becoming established in the marketplace. For example, the yellow-fleshed kiwifruit Hort 16A (marketed as Zespri™ Gold) came from a cross that was made in 1987 and was selected for its commercial potential in 1991. While the first exports occurred in 1998, it was not until 2003 that exports passed 10 million trays.^{2,3} In the battle for 'share of stomach'⁴ the fruit industry needs strategies to overcome the comparative disadvantage, relative to manufactured foods, of this lengthy innovation cycle. One such strategy is the systematic utilisation of consumer information throughout the innovation process to determine the market potential of new varieties. To supplement traditional sensory and hedonic measures, we present an approach for measuring the monetary value consumers place on a product and illustrate it in the case of a novel type of kiwifruit.

Although an integral part of any business, successful innovation is not straightforward. The expense and difficulty of innovation are widely recognised and clearly exemplified by success rates of around 10% of commercial launches.⁵ Indeed, with inadequate

market analysis being a common cause of failure,⁵ it seems probable that the high risk of failure may be reduced through sufficient appropriate sensory as well as consumer and marketing research. Horticultural industries routinely use sensory and hedonic testing in the breeding process.^{6–8} Descriptive sensory analysis is used separately or in conjunction with consumer science techniques such as hall tests,^{9,10} surveys¹¹ and focus groups¹¹ to collect information about the appeal to consumers of existing and new products. In conjunction with postharvest data, such testing is used to guide the selection of candidate cultivars and, among these, which will go to market. Yet, owing to the extreme competitiveness of today's marketplace, this traditional approach is insufficient to guard against market failure. The traditional approach provides knowledge about preference patterns, purchase motives and attitudes/beliefs that influence choice, but information about the monetary value consumers place on new products is typically not gained.

There are two reasons why information on monetary value should be collected. The first relates to the limitations of the current approach, while the second relates to the need to recognise that pricing strategies are central to the success of any new cultivar. The current use of sensory and hedonic measures to guide selection and commercialisation of cultivars builds on the simplistic assumption that the most liked cultivar will be the one that is most successful in the marketplace. While in most cases liking

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for a product is a prerequisite for purchase and consumption, a causal relationship does not exist. Taste is an important food choice factor,^{12,13} but in the marketplace liking does not necessarily translate to purchase. For most people, monetary considerations strongly influence food choice decisions.^{12,14} To compete successfully in a marketplace dominated by manufactured foods, it becomes necessary for the fruit industry to adopt a market-driven as opposed to production-driven orientation. A key difference between these orientations pertains to pricing strategy. Today, many fruit industry operators place a value on each piece of fruit as the way of recovering the cost of production—a strategy that is characteristic of commodity producers. Conversely, in the case of strongly branded or high-value goods (e.g. luxury items) the price that can typically be charged is many times higher than the production cost. To implement market-driven horticulture, it is necessary to obtain in advance knowledge about the price consumers will be prepared to pay for a novel or higher-quality product.

One research methodology, which is grounded in economics and frequently used to measure monetary or economic value, is known as experimental markets (or experimental auctions).^{15,16} Menkhaus *et al.*¹⁷ succinctly outline the value of such economic information, stating that is important not only for determining whether new products and product features enhance consumers' perception of value, but also for deciding whether or not to initiate commercial production and for formulating pricing strategies. Briefly, in terms of procedure, experimental markets are mostly conducted as group sessions. When willingness-to-pay (WTP) is elicited, they typically proceed as follows. At the start of the experimental market, each participant is given a sum of money in cash (typically \$25–50) and each is given free of charge a familiar product from the given category (the endowed good). During the market, each participant states the amount of money he/she is willing to pay to exchange the endowed good for the novel good from the same product category. Based on the collected WTP data, one or several identified buyers pay to make the exchange. Thus the procedure is non-hypothetical in the sense that stated economic values have real monetary consequences. A second defining feature is the realism of the procedure. Hayes *et al.*¹⁸ argue that the experimental markets procedure comes close to replicating the decision-making process undergone by consumers faced with new food products in retail stores.

The aim of this paper is twofold. Firstly, it seeks to introduce the experimental markets method as an approach for supplementing the horticultural innovation process. This included a consideration of the influence of tasting of kiwifruit on WTP, along with a comparison of hedonic and WTP measures. Secondly, by determining the perceived relative market value for a previously unknown yellow- and red-fleshed variety, Hongyang (which translates as Red Sun), this study aims to gather information that will further

help to direct the innovation process for kiwifruit. Specifically, WTP is measured as the premium relative to the traditional kiwifruit (Hayward cultivar) that participants are willing to pay for the novel Hongyang variety. In connection with the aim of furthering the innovation process for kiwifruit, a second objective is also addressed. This objective is outlined below.

Consumer acceptance of novel fruits

Kiwifruit is one of the most successful new fruit crops of recent times and conventional breeding is leading to the development of an entire category of kiwifruit varieties. In recent years the traditional green-fleshed Hayward cultivar has been supplemented with yellow-fleshed fruit with a novel flavour profile,^{2,6} as well as a small grape-sized kiwifruit with edible skin known as babykiwi (*Actinidia arguta* (Sieb. et Zucc.) Planch. ex Miq.).¹⁹ To some extent, these new products represent new fruits rather than new varieties of kiwifruit. Therefore knowledge about how consumers respond to new types of fruit and, more broadly, to novel foods is critical to the success of this category development. One aspect of this knowledge quest pertains to consumers' concerns regarding production technology. For many consumers the emergence of novel foods raises questions about whether or not they have been produced using genetic modification (GM). We have experienced that some people express an initial concern that a novel fruit has been developed using transgenic technology rather than by conventional breeding. For example, during a focus group discussion about Hongyang, one participant's spontaneous reaction was 'Yuk! It's not natural. What have you done to it?'. For novel products to be successful in the marketplace, it is important to quantify the impact of these erroneous assumptions. Therefore changes in WTP as a result of providing participants with information that Hongyang is not genetically modified are explored. We anticipate that consumers have concerns over whether GM technology has been used to produce a new product, and that labelling the product as GM-free will overcome such fears. Tentatively associated with this improvement in consumer welfare is a greater purchase likelihood and ultimately greater revenue generation for agricultural producers.

The GM issue aside, a more generic understanding of how consumers respond to novelty and their desire for novel products is also needed. While a general demand for new products exists in the marketplace, it is important to recognise that this demand differs among people. Consumers may be distinguished in this regard in terms of the personality trait of variety-seeking tendency (VST).²⁰ Operationally, the eight-item VST scale classifies people based on their self-reported desire for new and different foods (e.g. 'I think it is fun to try out food items one is not familiar with', 'When I eat out, I like to try the most unusual items, even if I'm not sure I would like them' and 'I am curious about food products

I'm not familiar with'). Through the finding by van Trijp and Steenkamp²⁰ that variation in food consumption is greater among people high than low in VST, this personality trait has become recognised as a characteristic that influences consumers' food choice behaviour. However, it remains unknown if VST also influences the monetary value consumers place on a new product.

METHODOLOGY

Experimental design and kiwifruit samples

The effect on WTP of giving participants the opportunity to taste Hongyang and the effect of providing participants with information that New Zealand (NZ) kiwifruits are not genetically modified were explored using a between-subjects 2 × 2 factorial design. This resulted in four experimental conditions (see Table 2): treatment I, taste fruit + no GM information ('taste only'); treatment II, not taste fruit + knowledge fruit is not GM ('not GM only'); treatment III, taste fruit + knowledge fruit is not GM ('taste + not GM'); treatment IV, not taste fruit + no GM information ('no information').

The kiwifruits used in this study (Fig. 1) were the familiar green-fleshed Hayward cultivar (*A. deliciosa* (A. Chev.) CF Liang et AR Ferguson) and the novel Hongyang cultivar (*A. chinensis* Planch.). Typically, Hayward kiwifruit has a greenish brown skin that is covered with hairs.²¹ It is larger and more cylindrical than a chicken's egg and usually weighs up to about 120 g. Red-fleshed kiwifruits are an infrequent occurrence in seedling populations of *A. deliciosa* and *A. chinensis*. The Hongyang cultivar originated in the Sichuan province of China²² where it is grown commercially on a small scale. It is smaller than Hayward and weighs approximately 60 g. The skin is dark green and virtually hairless. Hongyang has golden yellow flesh with red 'sunbeams' radiating from the core. For the purposes of this study, samples of Hayward and Hongyang were grown at research orchards in Hawkes Bay, New Zealand, harvested

at optimum maturity and subsequently stored in commercial coolstores at 0 °C. A standard ethylene ripening treatment (115 mg m⁻³ for 20 h) was applied 5 days prior to the experimental markets.

A priori it was assumed that consumers would perceive Hayward as familiar and Hongyang as novel. Although the yellow-fleshed ZespriTM Gold has been widely available to NZ consumers since 2000, yellow- and red-fleshed kiwifruit is not available on the NZ market. A thought-listing exercise conducted part way through the experimental market (see later) further confirmed this assumption. Many participants described Hayward as familiar. Conversely, Hongyang was described as new and different, and positive words such as exotic, exciting and interesting were used frequently.

Participants and experimental procedure

The participants in this study were 100 adults from the Auckland region (Table 1). All were regular

Table 1. Summary statistics of selected demographics (sample size 100)

Demographic	%
<i>Gender</i>	
Male	42.0
Female	58.0
<i>Age in years</i>	
18–29	27.1
30–45	33.3
46–59	22.9
60 or older	16.7
<i>Education</i>	
Secondary school or less	38.0
University degree	32.0
Trade, vocational or other	30.0
<i>Income in NZ\$</i>	
19 999 or less	30.0
20 000–34 999	18.0
35 000–49 000	30.0
50 000 or more	12.0
Chose not to disclose	10.0

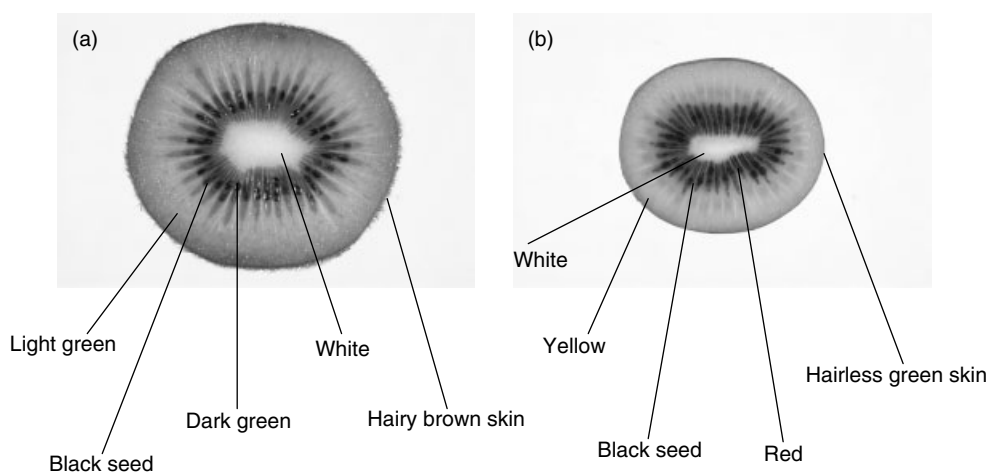


Figure 1. Kiwifruit cultivars used in experimental markets: (a) Hayward cultivar (endowed fruit); (b) Hongyang cultivar (fruit sold in experimental market).

consumers of kiwifruit (at least once a month when in season) and all were significantly involved in grocery shopping for their household. Eight research sessions were conducted, each attended by groups of 12 or 13 people. Within each session, data collection proceeded in a number of stages. Following the introduction, where each participant was given an identification number and NZ\$40 in cash, a survey containing the eight-item VST scale²⁰ and questions pertaining to kiwifruit purchasing behaviour was completed. Then, to familiarise participants with the sealed bid, fifth-price experimental market mechanism, a branded candy bar market with three replications was conducted. The use of cash payments and 'dry runs' follows the recommendations of Friedman and Sunder²³ for the conduct of economic experiments. The use of repetitions in experimental markets is also common and serves to account for learning effects. To place participants in a frame of mind for bidding for a novel product, each was endowed (i.e. given free of charge) with a Snickers[®] candy bar and presented with the opportunity to pay to exchange it for a Snickers[®] Crunchier candy bar. At the time of the study, Snickers[®] Crunchier was new to the NZ marketplace.

Before conducting the first repetition of the candy bar market, the experimental procedures were explained and examples were given. The rationale for stating an amount exactly equal to each participant's WTP was carefully explained. The market proceeded as follows. Each participant submitted a sealed bid indicating the maximum he/she would be willing to pay to exchange their endowed Snickers[®] bar for the Snickers[®] Crunchier bar on sale in the market. The WTP values were then ranked from highest to lowest to determine the identity of the four buyers and the market price (the fifth-highest price in this type of experimental market). This information was displayed on an overhead projector. To control for wealth effects, participants were aware that only one of the three repetitions of the candy bar market would be binding. The binding repetition was drawn randomly upon completion of the third repetition. To emphasise to participants that their bids had real monetary consequences, the four candy bar buyers paid the market price to exchange their endowed candy bar for the one on sale.

Next, participants learned that they would be taking part in another market, this time concerning kiwifruit (complete experimental instructions are available from the first author upon request). To familiarise participants with the two types of kiwifruit, samples of half a fruit (cut along the equator) were presented in 100 mL transparent plastic cups. Participants were allowed to remove the lids of the sample cups and familiarise themselves (without tasting) with the Hayward and Hongyang kiwifruits. At the same time as introducing the kiwifruit samples, a second questionnaire was completed. It measured initial reactions to kiwifruit samples, consumption patterns for kiwifruit and other fresh fruit, as well

as consumption patterns for candy bars. Next, each participant was given two Hayward kiwifruits in a transparent zip-seal plastic bag. They were then informed that four Hongyang kiwifruits would be sold using the sealed bid, fifth-price experimental market with ten repetitions. In addition to highlighting that this market would proceed similarly to the candy bar market, the steps in the sealed bid, fifth-price procedure were explained again. Participants were made aware that on average the weight of four Hongyang kiwifruits was the same as that of two Hayward kiwifruits. Wealth effects were controlled for by drawing a single binding round. After completion of the tenth repetition the binding round was randomly drawn and the buyers paid the market price to exchange their Hayward kiwifruit for Hongyang kiwifruit.

Information according to the experimental design was provided prior to repetition 1 and following repetition 5. By providing information prior to repetition 1 and following repetition 5, WTP data pertaining to two of the four experimental conditions were collected in each session. In the experimental treatments where participants tasted the kiwifruit (treatments I and III), liking scores for both Hayward and Hongyang kiwifruits were collected on nine-point hedonic vertical box-scales (1 = dislike extremely, 9 = like extremely). Information about the fruit not being genetically modified (treatments II and III) stated: 'The Hayward and Hongyang kiwifruits used in today's research session are not genetically modified. Both types of kiwifruit were developed using conventional breeding, an approach used by mankind for several thousand years'.

Statistical analysis

The first step was to ascertain that experimental treatment effects would not be due to differences in the demographic profiles of the participants in each of the four groups. Null hypotheses of equality of WTP distributions with respect to gender, age, education and income could not be rejected. Thus differences in participants' WTP across the experimental treatments were not likely to be associated with differences in demographic characteristics.

The eight-item VST scale²⁰ was internally reliable. Cronbach's coefficient α was 0.86 and principal component analysis of the correlation matrix resulted in a one-factor solution (eigenvector 4.17) which accounted for 52.1% of the total variance. All eight items loaded positively on this principal component. Individuals varying in VST were represented in the sample population (theoretical range 8–40, observed range 17–39, mean 31.0, standard deviation (SD) 5.1). Using a triadic split, participants were divided into three groups. When exploring the role of VST, only the two extreme groups were compared, namely individuals low in VST ($n = 31$, range 17–29, mean 24.8, SD 3.6) and high in VST ($n = 36$, range 34–39, mean 35.1, SD 1.7).

Table 2. Summary statistics for bids and bid distributions at aggregate level and by experimental treatment

Bids	All	Treatment IV 'no information'	Treatment II 'not GM only'	Treatment I 'taste only'	Treatment III 'taste + not GM'
Observations	197	49	49	50	49
<i>Summary WTP statistics (NZ\$)</i>					
Mean	1.051	1.007	1.081	0.832	1.229
Standard deviation	0.900	1.131	0.819	0.747	1.075
Median	1.000	0.900	1.010	0.888	1.000
Maximum	5.500	3.500	4.000	3.500	5.500
Minimum	0.000	0.000	0.000	0.000	0.000
<i>WTP distributions (%)</i>					
NZ\$0.00	13.91	9.80	9.80	21.20	14.29
NZ\$0.01–0.49	14.52	18.78	12.65	17.20	9.39
NZ\$0.50–0.99	24.77	32.65	28.16	17.60	20.82
NZ\$1.00–1.49	23.86	18.37	26.94	28.00	22.04
NZ\$1.50–1.99	9.54	5.71	14.69	4.40	13.47
NZ\$2.00–2.49	8.53	6.12	4.49	8.00	15.51
NZ\$2.50–5.50	4.87	8.57	3.27	3.20	4.49

RESULTS AND DISCUSSION

Experimental markets as a tool for new product development (NPD)

The first stated aim of this study was to introduce the experimental markets method and present the case for using it in conjunction with traditional sensory and consumer testing in horticultural NPD. This has been partly achieved through the above description of the experimental procedures. To fully achieve this aim, the findings of the study are presented and discussed below. Of particular relevance are the main WTP results and the comparison of WTP and hedonic scores. We begin with the former, which are shown in Table 2. This table, which contains WTP summary statistics and distributions, clearly reveals that, on average, participants were willing to pay a considerable premium to exchange two Hayward kiwifruits for four Hongyang kiwifruits. At the time of the study the average retail price for Hayward kiwifruit was NZ\$1.59 kg⁻¹ (range NZ\$0.85–2.49 kg⁻¹, SD NZ\$0.6 kg⁻¹). The weight of the two Hayward fruits with which participants were initially endowed was 227.2 g (for 25 fruits the average weight was 113.6 g (SD 1.3g)). Using mean aggregate WTP, this translates to a price premium of 191%. To the kiwifruit industry these results are strongly encouraging, suggesting that consumers are willing to pay a considerable premium for high-quality kiwifruit with novel characteristics. This conclusion is supported by data for the yellow-fleshed Zespri™ Gold, which by selling globally at a price premium brings 18% higher returns to growers than does the traditional green-fleshed kiwifruit.²⁴

The essence of the supplementary role that experimental markets can play in horticultural innovation is directly contained within the above key finding—traditional sensory and consumer testing does not yield this type of monetary information. Critics may argue that it can be obtained for example by asking willingness-to-pay questions in surveys. Indeed

this may be done. However, simply asking the question of willingness-to-pay during preference testing of kiwifruit results in an unsatisfying high correlation between the two responses (Harker FR, unpublished). While it is 'safe' and without monetary consequences for participating consumers to signal a high WTP, such hypothetical responses do not accurately reflect the complexity of purchase decisions. Experimental markets, on the other hand, enable researchers to elicit non-hypothetical and therefore more realistic and valid economic responses from consumers.

The data obtained when participants were allowed to taste the fruits also provide evidence in support of the value to horticultural innovation of the information gained in experimental markets. Recall that hedonic scores (1 = dislike extremely, 9 = like extremely) were obtained in information treatments I and III. The finding that Hayward (mean 8.0, SD 0.1) and Hongyang (mean 7.7, SD 0.2) were highly and equally well liked ($t(76) = 1.59, P = 0.12$) was supported by data collected in a sentence completion exercise that was conducted following the sampling of the fruits and which asked participants to complete the sentence 'This kiwifruit is ...'. In this exercise, both cultivars were described as attractive and good-looking. Interestingly, while the null hypothesis of equality of the two cultivars could not be rejected on the basis of the hedonic data, the WTP data revealed a different picture. On average, consumers were willing to pay a considerable premium to exchange Hayward for Hongyang. Clearly, the two types of data provide different information. Equally clearly, the WTP data supplement the information gained through traditional sensory and consumer testing.

Having presented the case for why experimental markets add value to NPD, the question arises of when in the innovation process to use this technique. To answer this question, we draw upon Menkhous *et al.*,¹⁷ who explain that the information elicited in experimental markets can be used to determine whether new products and product features enhance

consumers' perception of value, whether or not to initiate commercial production, and for formulating pricing strategies. In the context of horticultural innovation we suggest that, depending on the research objectives, experimental markets can be used in every stage of the NPD cycle. While it is not cost-effective that WTP be measured for every seedling in a breeding programme, it seems sensible that seedlings with new and unique characteristics, such as the novel red- and yellow-fleshed kiwifruit in this study, be measured early in the innovation process. It is important for breeders to know early on if consumers are willing to pay a premium for fruits of novel shape, appearance, size, taste, functionality, etc. Another key decision point at which WTP information would be valuable is that pertaining to whether or not a cultivar should move to commercial production. As such a decision requires substantial investment costs, knowledge that these costs will be recovered is critically important. Lastly, as noted in the Introduction, a move to value-driven horticulture requires price setting based on market feedback. Experimental markets can be used to obtain this accurately.

Sensory properties and consumer perceptions of Hongyang

In connection with the second stated aim, which seeks to further direct the innovation process for kiwifruit, several findings are of relevance. The first of these concerns the knowledge gained about the sensory properties of the Hongyang cultivar. In parallel with the experimental markets a sensory expert in-house panel comprising nine HortResearch employees routinely working with kiwifruit descriptively profiled the two cultivars. The panel work was undertaken in a state-of-the-art sensory facility and followed standard procedures for descriptive sensory analysis. Specifically, the protocol was identical to that used for descriptive sensory analysis in recent research.⁶ It was revealed that Hayward had higher intensities of sulphur odour, grassy flavour and acidity. These attributes are typical of the Hayward cultivar.^{6,25} Conversely, the texture of Hongyang was more gelatinous and the flesh of the core was firmer. The flavour of Hongyang was sweeter and higher in blackcurrant. In this respect, Hongyang and Zespri™ Gold have similar sensory profiles.⁸ The sentence completion data provided a few interesting qualitative insights regarding consumers' perception of the two cultivars. Hayward was described as looking fresh and inviting. Its larger size was generally considered favourable. Some participants thought that Hongyang, being smaller, represented less value for money. Conversely, others thought that the small size was an advantage, especially for children. We trust that kiwifruit breeders will integrate this knowledge in their continued innovation activities.

Exploration of consumers' willingness-to-pay

Analysis of the WTP data with respect to the effects of (1) tasting, (2) GM information and (3) VST provides insights that can be of value in further directing the innovation process for kiwifruit. Rejection of the null hypothesis of equality of WTP distributions (shown in Table 2) across the experimental treatments ($\chi^2(18) = 97.75$, $P < 0.0001$) revealed that differences in WTP were associated with telling participants that the fruit was GM-free and allowing tasting. Further analysis of variance of market price (i.e. fifth-highest WTP within a market round) revealed significant main and interaction effects ($P < 0.0001$). The highest market prices occurred for the 'taste + not GM' treatment (mean NZ\$1.468, SD NZ\$0.433) and the lowest for the 'taste only' treatment (mean NZ\$0.931, SD NZ\$0.323). In digging deeper into these results, the findings pertaining to the effect on consumers' WTP of knowing that Hongyang kiwifruit is not genetically modified are considered first. The results pertaining to the effect of tasting are given at the end of this subsection.

Influence of information that kiwifruit is not genetically modified on WTP

Globally, consumer acceptance/rejection of genetic modification in food production is under intense scrutiny by different stakeholders in the food system, including the public, the media, manufacturers, governments and scholars. Consumers in NZ and many other countries are highly sceptical of the use of genetic modification in food production.^{26–28} Given the general rejection of GM foods among NZ consumers,^{29,30} we expected and found (Table 2) that the information that Hongyang is not genetically modified positively impacted consumers' WTP. It was also the case that the effect on WTP depended on the extent to which an individual supported the use of genetic modification in food production.

Influence of variety-seeking tendency on WTP

A further insight regarding the GM issue emerged in connection with the exploration of the effect of VST on WTP. Recall that VST refers to an individual's desire to try new and different foods.²⁰ Correlation analysis revealed that, when participants were told that the kiwifruit was not genetically modified, the change in WTP was positively associated with VST ($r = 0.40$, $P = 0.05$, $n = 25$). That is, participants with a higher degree of openness to new foods responded most positively to the information that the kiwifruit was GM-free. Tentatively, this finding can be taken as further support for the concerns people have regarding whether novel products have been produced using transgenic technology. Exploring further the effect of VST on WTP, we found that participants who in each market round were buyers or could potentially have been buyers (i.e. participants with the fourth-highest WTP who did not become buyers as result of a tie and buyers from rounds not drawn as binding)

were significantly more likely to be high than low in VST. Specifically, among low-VST individuals, 66.7% were not buyers and 33.3% were potential buyers. In comparison, among high-VST individuals, 42.9% were not buyers and 57.1% were potential buyers ($\chi^2(1) = 3.69$, $P = 0.055$, $n = 65$). (We note that this result is probably not associated with differences in demographic characteristics, as these did not differ between the high- and low-VST segments.) This finding further demonstrates the influence of VST on food-related behaviour and supplements previous findings regarding the usefulness of this personality trait in explaining food choices.³¹

Owing to sample size, we were unable to use the sentence completion data to further explore the effects of VST. This is unfortunate given the richness of these data. For example, Hongyang's different appearance prompted approximately 10% of participants to mention how this cultivar would be very suitable for decorative purposes. This coincided well with others considering it a 'special occasions' fruit. While the red colouring of Hongyang was mostly received favourably, around 8% of participants thought that this colouring made it look unattractive. Some thought that the fruit looked like it was bleeding. The origins of the latter comments appear important to investigate further prior to making a decision about commercial production in NZ of Hongyang. Previously, in a series of focus groups exploring NZ consumers' reactions to Hongyang (Harker FR, unpublished), it emerged that some participants thought that the red central pattern was too vibrant in colour and too symmetrical to have occurred naturally. Many thought that the fruit had been genetically modified to produce the red colouring in the centre. Responding to consumers' expressed wishes for GM-free food products, the NZ kiwifruit industry does not use transgenic technology in its breeding programmes. It seems, however, that for the most part the NZ general public is unaware of this policy. On several occasions when presenting the results of the preference-mapping study exploring consumer acceptance of green- and yellow-fleshed kiwifruit,⁶ we have been asked whether the yellow-fleshed varieties were genetically modified. From a managerial perspective the findings of this research point to the need for the kiwifruit industry to consider more effective means of communicating to consumers its non-GM policy.

Influence of tasting of kiwifruit on WTP

It was not surprising that the 'taste + not GM' treatment led to higher market prices than the other treatments. Any fears that participants may have had that Hongyang was genetically modified were dispelled and, from tasting both cultivars, participants were aware of the sensory quality of the fruit. The finding that the lowest mean WTP and market prices occurred for the 'taste only' treatment was somewhat surprising. We found no evidence that the change in participants' WTP as a result of tasting

the kiwifruit was correlated with liking scores, and interpret this as the reduction in WTP not being related to lack of sensory acceptability of Hongyang kiwifruit. Rather, we suggest that curiosity about Hongyang and a desire to taste it were driving some participants to state high WTP values. The opportunity to taste the fruit eliminated this desire and enabled them to lower their WTP and thus reduce the 'risk' of having to pay to make the exchange. Unfortunately, the present data do not allow us to test this hypothesis, which must remain a question for future research.

Limitations and future research

The present research also points to the need for further research into the experimental markets methodology itself. In the present study we discarded WTP data from two participants. One individual consistently submitted WTP values significantly higher than the overall average (NZ\$8.00–40.00 *vs* NZ\$1.05). After the session this individual approached the senior author and told her how he had enjoyed taking part as he had a very competitive nature and always wanted to win. Rather than a true reflection of this individual's WTP to exchange Hayward for Hongyang kiwifruit, this personality trait in combination with the knowledge that the market price would be the fifth-highest WTP appeared to be the driving force behind this individual's high WTP. Prudence made us also discard bids from the person he was sitting next to and to whom he was seen talking, and whose WTP subsequently increased dramatically (mean WTP (rounds 1–5) NZ\$2.90 *vs* mean WTP (rounds 6–10) NZ\$8.30). In subsequent experimental markets we have used a thought-listing exercise³² that asks each participant to write down the thought that goes through his/her mind as they take part in this type of research session. While this has confirmed that a significant proportion of participants think about 'winning', we are still unclear about the implications thereof for the validity of collected WTP data. Therefore we recommend that further research be undertaken to establish to what extent 'auction fever' influences the monetary values elicited in experimental markets.

We note also that a small convenience sample like the one used in this study should not be used as the sole basis for price setting. Rather, appropriately drawn probability samples should be used. An approach for calibrating WTP elicited in experimental markets to such larger samples is presented by Fox *et al.*³³

CONCLUSIONS

In recognition of the growing importance of innovation as critical to commercial success and the need for market analysis that goes beyond traditional sensory and consumer testing, this paper has introduced a research methodology with potential to improve the NPD process for agricultural goods. To New Zealand,

where kiwifruit is a significant export earner,³⁴ this NPDP sophistication could be important in preventing the negative development in UK agriculture described by Hillman.³⁵ Specifically, we have introduced the experimental markets methodology and applied it to a new type of kiwifruit. Our findings show that consumers are prepared to pay a considerable price premium for the novel Hongyang cultivar, and they demonstrate once again consumers' unease about the use of genetic manipulation in food production.

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