

Quality on the Edge: Quality from a Manufacturing Perspective

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INTRODUCTION

Convenience is booming business. Some thirty years ago, first attempts in providing easy to handle and ready-to-eat foods to consumers were reported. During the last decade developments have been fast and major progress has been made in maintaining quality and safety of the fresh cut produce. And in that last remark not only the progress is indicated, but the major problems as well: what is quality, what is safe and what is fresh?

The chain concept and its benefits are built upon trust in predecessors and successors in that chain. Entire food supply chains and networks are built on that concept. For the fresh cut produce that is not different. Trust is fine, but... commercial companies are no fools. They need some proof of trustworthiness, some proof of quality, some proof of safety, some proof of freshness. So, even in the concept of chains and networks, some product properties have to be measured and some indication of quality, safety and freshness has to be provided.

About 60 companies are producing fresh cut, washed and packed vegetables in the Netherlands, most companies produce these products for local hospitals, restaurants, catering services and food services. Based on annual turn over, in Holland the top 6 products are mainly prepared for the supermarkets ("retails"). Sales of fresh cut produce in the Netherlands have increased from the early nineties from €100 million to about €300 million nowadays. Roughly 80% of these sales are realised in the retail sector.

In this paper, an overview will be presented of aspects important to commercial application of fresh cut horticultural and agricultural produce, how to acquire the proper information, and how (and to what extent) to trust your partner. An integrated view on fruit and vegetable quality, applicable throughout the chain will certainly make life and business easier.

INTRODUCTION TO 'VEZET B.V.'

VEZET's origins lie in a factory built in 1914 for salted vegetables by K. Wagenaar. The "Vereenigde Zuurkoolfabrikanten in Nederland" the "N.V. tot Exploitatie van Zuurkoolfabrieken" existed in 1956, whose objective was the manufacture and handling of sauerkraut, salted vegetables and other food. VEZET began to look for ways of expanding the range with products other than the well-known and trusted sauerkraut at the beginning of the seventies, with the help of Albert Heijn (supermarket - AHOLD). This was found in "vegetables, which were made so ready for consumption that the consumer only had to prepare them". In short, this product was called "ready-to-cook vegetables". This early period was marked with discussions about traditional products, such as different sorts of cabbage, endives, carrots, leeks, soup vegetables etc. The name was changed in 1973 to "Vereenigde Zuurkoolbedrijven B.V.", quickly abbreviated to "the V.Z.", which gave rise to the name VEZET. The name Vereenigde Zuurkoolbedrijven B.V. was also officially changed to "VEZET B.V." at the beginning of 1998. The factory underwent a large-scale expansion and adaptation in 1996-1999. Many ultra-modern provisions were introduced during this reconstruction to initiate further growth.

Now, in the year 2002, VEZET is one of Holland's largest vegetable processing companies and is the market leader in freshly cut, ready-to-cook vegetables. This modern vegetable cutting company has a range of about 250 different products (different mixtures, packages and sizes). The product range includes salads and raw vegetables, mixed vegetables and soup vegetables. Traditional cooking vegetables are also still a part of the total product range. Besides regular products a growing range of organically grown

products has entered the market as well. These products are owned and prepared in accordance with the Skal guidelines.

The total annual production is about 30,000 tons of fresh vegetables. About 450 people (permanent and flexible) are currently employed at VEZET. Since October 1973 VEZET has been the exclusive supplier of ready-to-cook vegetables to Albert Heijn B.V.. The existing premises were expanded several times due to the rapid growth in this market during the nineties. An other portion of the produced goods is sold as vegetable intermediates in bulk to industrial customers and for the food service market (e.g. restaurant chains and food services). These customers process the intermediates into for example soups, salads, pizzas, cheese spreads and mixed vegetables. Since 1997 ready-to-cook vegetables are also supplied to supermarket organisations abroad.

WHAT IS QUALITY?

Since quality of perishable produce is a rather subjective attribute, you know all more about that, it is very difficult to develop viewpoints, preferably measurable, that can be shared by the actor in the chain. A system that does work in practice is the so-called **manufacturing approach** (Sloof et al 1996). It is once defined what can be understood by quality in measurable attributes, and these findings are laid down in the product specifications. So, whenever a batch of produce does comply with the specifications, that batch is acceptable for the chain. The danger of this system arises when the specifications no longer reflect the preferences of the consumers / buyers. This happened a few years ago with tomatoes produced for Germany. No one in the chain, not even the companies where the tomatoes were supplied to, had anticipated the fierce and sudden rejection of the quality of the produced tomatoes. So, when applying this simple and appealing system, somebody has to watch continuously the changing trends and preferences of the market.

When including constantly the preferences of the market, we gradually shift towards the **User based approach** (Sloof et al 1996). In this system, the psychology on consumers, his preferences and his constantly changing buying behaviour is an essential part. Although this system reflects more accurately the actual situations, for practical purposes it is at the moment quite out of reach for commercial companies. As a matter of fact, as far as I understood, for scientific purposes as well, a very popular and workable intermediate between the two systems is the system of **keeping quality**.

Among the factors that affect the way consumers understand concepts of food quality and safety, the multiple food retailers, or supermarkets, are significant. As more food produce is moved through a reducing number of supermarket chains the power of supermarkets over food supply businesses grows. What consumers believe to stand for quality has become more closely aligned to the supermarkets' own definitions of quality, of which food safety is a part. Consequently, as greater numbers of consumers shop in supermarkets, suppliers are forced to adjust their own understanding of quality in line with that of supermarkets if they are to stay in business (Jongen, 2002). We come back to keeping quality as applied by commercial companies in the sector of cutting vegetables in the next section.

WHAT IS KEEPING QUALITY?

Keeping quality has been defined as the time a commodity remains acceptable for a large group of consumer (Tijssens et al. 1996). Problems arise immediately from this definition: what is a large group of consumers? What is still acceptable? Is it the always the same quality attribute that is limiting? All three questions can (and will) affect the eventual outcome of quality assessment and acceptability further down the chain. As already mentioned, the chain is largely built upon trust among the actors in a chain. The chain actors nevertheless need a clear description of what to measure (and to provide) to be a reliable partner.

Bacterial load (CFU) is largely accepted as the prime indication of freshness and keeping quality. So, washing the delivered commodities is a very central process in the

preparation of cut vegetables. There are however, indications that bacterial load is not at all so tightly connected to the keeping quality of the produce. And during continuous washing, the water itself tends to get a high bacterial load. In practice the bacterial load of leafy vegetables can be reduced by roughly one log-cycle, with (USA) or without (Holland) the legal permission to use chlorinated washing water. On top of that, by excessive washing in large tanks produce can pick up as much as 20% of their weight by sucking in water. Polluted water, Chlorinated water!?! What is the effect of this on the keeping quality?

What else do we have as an indication of quality and keeping quality? Appearance! But how to express appearance in a numerical way to be able to communicate with the partners in the chain? What to measure? Bacterial spots? Slimy patches? Then we are already too late. Wilting? Picking up that amount of water surely is an adequate remedy to that. Does it last? Maybe the technology developed during the last couple of years at the ATB (e.g. Herppich 2000) can provide some useful concepts. But what is needed above all are simple measuring techniques. Freshness of produce? In the USA the term freshness may be used as long as the produce is respiring. But that is not what is meant by freshness in the vegetable cutting and packaging business or even the freshness definition as being used by consumers.

Price? Expensive products will have a better quality! But does it? Always? Price mechanisms depend on more factors than careful production. And it certainly cuts down your profits. Higher quality can be paid a higher price. That is not impossible. People in the western world are most of the time willing to pay a higher price for quality and convenience. That is what the cutting business is all about. But again, how to evaluate quality? Instead of being a solution to the problem, economic factors seem to be the initiator of the problem. What can be done, and what is done on a regular basis, is making price covenants with suppliers and retailers, based on trust and previous experience.

So, all these attributes and product properties, however important for the evaluation of the quality for fruits and vegetables, can hardly be measured by objective means, and one is in practice stuck with the good visual and manual inspection of samples of batches of produce. And that is not too reliable to communicate up or down the supply chain. A great research opportunity!

INTERACTIONS IN THE CHAINS

VEZET puts quality high on its list of priorities. Quality is important in the whole chain from the raw materials to the final product as being seen (Figure 1), bought and eaten by consumers. VEZET is therefore very closely involved in the cultivation of vegetables and has been working for many years with growers, who follow a controlled cultivation programme. This is now being extended to a Eurep-GAP (Eurep = Euro-retailer produce working group, GAP= Good Agricultural Practice) certified cultivation. Quality is also an important item during the production process. During the whole production process from the incoming raw materials to the outgoing final products daily checks are therefore made to guarantee the (keeping) quality the client expects. Tracking and tracing is a subject that is receiving increasing attention since the whole chain is important in relation to keeping quality and clients want to know more about what has happened to a product and where it has gone to. Everything is becoming clearer and the chain has become more transparent with the increased implementation of automation methods. It becomes possible to take action in the chain at the right moment to guarantee the quality and safety of the final product. Certification of the production process and the methods of working, play an important role as well. VEZET is therefore certified according to EDI, BRC and SKAL regulations. It has the HACCP-certificate since 1998. With these certifications our costumers are ensured that a minimum set of (hygienic) procedures have been implemented.

VEZET, however, continuously tries to improve the product quality. The laboratory plays an important role in this. Continual checks and assessments are conducted in the laboratory, starting from the delivery of raw materials. A produce that

does not comply with the specifications, is returned to the supplier. Samples are regularly taken during the production process as well, so that the quality is guaranteed up to the end of the production process. For example metal detectors are used, to check each individual product package. Other attributes that are being monitored regularly are: microbial count (bacterial load), optical quality and the smell / odour of the product. Besides the benefits of having an own specialised laboratory, both the product and process are regularly innovated. A good way to innovate is to work together with skilled scientists from research institutes like ATO. These scientists are able to translate fundamental knowledge to practical applications and vice versa. An example of such a collaboration is the research project involving twelve companies, the branch organisation (Frugi Venta) and ATO. This project focuses on the efficiency of the (submerged) washing processing and the relation of this process with the overall product quality.

FUTURE RESEARCH NEEDS

As the reader of this articles probably noticed right now, more questions arose than answers were provided. The world, hence also the fresh produced companies, changes rapidly due to economical, political but above all consumer demands. Based on the wish of these modern emancipated consumers, new (European) legislations, commercial companies have to, and will improve their processes and the quality of their products. As a short conclusive summary and with the intention to tickle the reader, a short list of research needs from the perspective of the vegetable fresh cut industries is provided below.

From a product point of view:

- Thorough overview for **all** single and mixed produced products will be required:
 - What are essential attributes (colour, smell, microbial load?) that determine the product quality and the keeping quality?
 - Which attribute will drop most probable below a certain threshold or quality acceptance limit?
 - What is the (main) mechanism of deterioration?
 - Prediction of keeping quality and shelf-life as a function of the relevant external factors: temperature, moisture content, initial quality of the raw material etc.
- A Keeping Quality knowledge management system to store and share product specific information.

From a process and technology point of view:

- Fundamental research to the effects of (industrial) processes on the overall product quality. Hence, how does the keeping quality interact with the processes used in the industry?
 - What is the optimal washing method (type, temperature, residence time etc.) to produce an optimum (keeping) quality?
 - What is the optimal method to dry washed products, what are the optimal drying conditions?
 - What is the optimal product specific packaging material, modified atmosphere (MAP) and storage temperature?
- Mathematical modelling of most important process steps (cutting, washing, drying). Process oriented modelling can be used to support the design of and adjustments to equipment (e.g. what is the effect of implementing additional cooling into washing equipment).
- Further implementation of measuring and controlling systems in all processing steps to enhance the functionality (flexibility of process lines), to reduce processing costs and to improve product quality.
- Development of product quality probes / sensors / monitoring systems to

independently quantify the essential attributes of both the raw material and the final product. The system or method must be accepted by all actors in the chain.

From chain point of view:

- Optimisation and further collaboration between all actors in the chain:
 - Research to the demands and preferences of consumers. Based on the outcome of this research, an accepted definition of product specific quality may be introduced based on relevant attributes. The sector needs a better insight of food quality and safety and they have to come to terms with consumers' changing perceptions of food quality and increasing awareness of food safety issues.
 - How to increase the trust between the actors in the chain and provide a sustainable relations vertically between the different suppliers? The focus will be on food quality through the entire food chain and the consumer demands in stead of short term profits of individual companies inside that chain (Van Kooten, 2002).
 - Transparency of the chain by further implementation of knowledge management systems (tracking-and-tracing). Modern consumers want to know what the origin of their vegetables is and how the food is being processed. Greater involvement of the public will decide how to manage and regulate technology innovation (e.g. averse of chlorination, with or without additives etc.).

Literature Cited

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Tables

Table 1. Difference between manufacturing and user based approach.

Manufacturing approach	User-based or perceived quality
oriented to non-perishables	oriented to perishables
only objectively measured properties	Subjective aspect of consumer evaluation (appearance, colour, ...)
Formalised into technical specifications	Perspective of the consumer
quality is replaced by 'meeting specs'	'fitness for use'
substitute for consumer preference	
Perspective of producer	

Figures

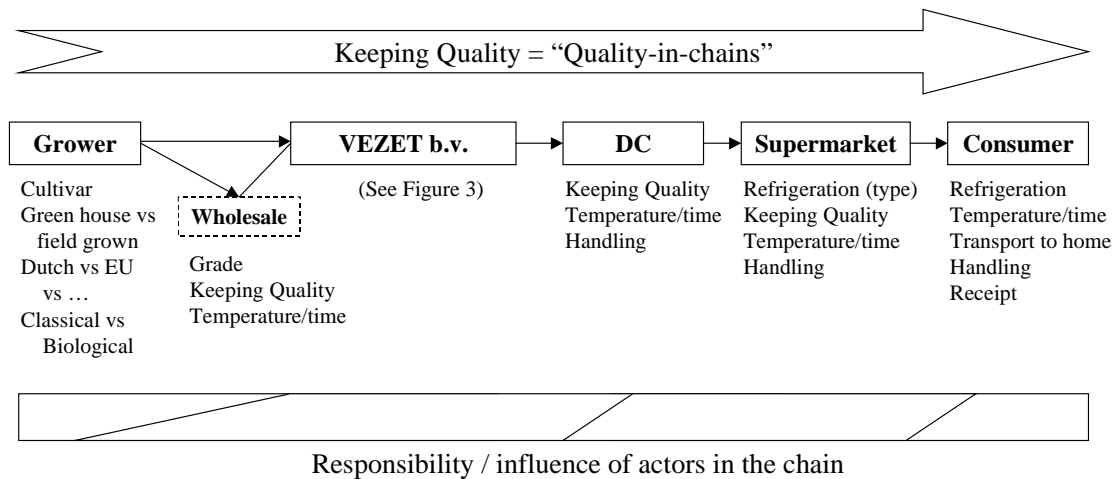


Fig. 1. Overview of the vegetable chain.



Fig. 2. Examples of products being produced. Mixed vegetables (*left above*); cooking vegetables (*right above*), salad bowls (*left below*), food service market (*right below*)

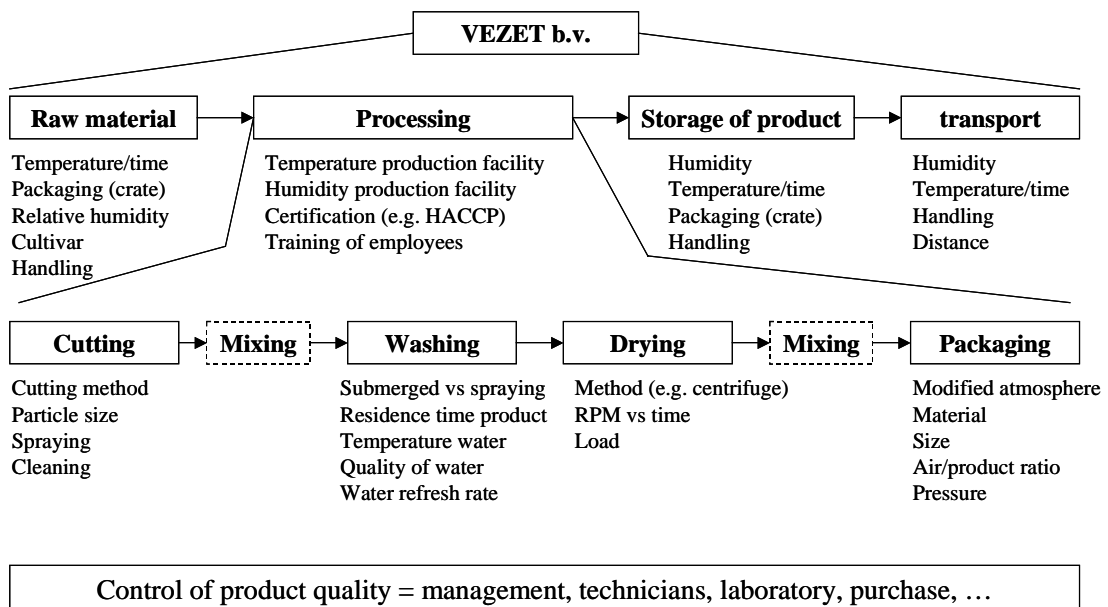


Fig. 3. Vegetable processing chain of Vezet. Key-words mentioned influences the overall (keeping) quality of the produce.