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Public Perception of the Crop Protection Industry and how this could be improved

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Executive Summary

By the utter fact food for human consumption is generally farmed by way of established monocultures, it is never a choice not to use crop protection, but rather what approach is employed, i.e. is it by way of physics, chemistry, biology or ecology?

Public perception of the New Zealand crop protection industry is not that of an exemplifier (at least not from an anecdotal perspective). Improvement is required. What is also clear is the fact that the general public's understanding of the crop protection industry is limited, with a high level of uncertainty when it comes to what constitutes the practice of crop protection.

For a small country like New Zealand, only producing enough food to feed circa 40 million people (six million being local plus annual visitors), quality of product needs to be our leading competitive X-factor. For this reason, all that is involved in the food production cycle (and how aspects such as crop protection are perceived by the public) needs to be known and appropriately addressed by the industry. Perception is an individual's "world view" – right or wrong and matters to the individual (the ultimate end consumer).

Little research has been conducted analysing the public's perception of the crop protection industry with respect to New Zealand. In a world of heightened societal concern regarding threats to human health, nutrition and the environment, such things as "people's perceptions" can translate into real effects in the marketplace. Given the importance of both crop protection and the perceived quality of New Zealand produce both locally and internationally, it was important that a pilot study be conducted to ascertain where improvement could take place as far as people's perceptions of the New Zealand crop protection industry is concerned, hence the research question of this report being:

Public Perception of the Crop Protection Industry and how this could be improved.

As far as the methodology employed for this study, a survey instrument was the chosen research strategy for this report. Following an extensive review of the literature and science based findings, it was deemed appropriate that the retailer (12) for the purpose of this project, be utilised as a suitable proxy for the general public. A non-parametric technique, namely descriptive analysis was chosen for the survey review. A qualitative construct as far as survey design was subsequently employed.

Key findings gathered through the results included such things as high levels of ambivalence regarding people's attitudes with respect to the protection of food through the production cycle.

This phenomenon does not help with fostering a positive or even neutral attitude associated with all things crop protection.

Great progression as far as safer more targeted products have characterised the crop protection industry over recent decades. Due to an array of reasons we are now also seeing significant investment taking place in a new category of crop protection, namely biologics.

Pseudoscience, media sensationalism, pressure groups, naivety were all found to be causes giving rise to negative perceptions associated with the crop protection industry.

This report outlines a raft of recommendations taking into account a range of tactics that need to be better promoted, fast tracked or simply communicated by way of a more united industry voice.

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1. Introduction

1.1 Background

As environmental issues and those relating to nutrition and human health continue to attract a greater degree of focus, New Zealand primary industries face a range of evolving crop protection challenges. Some of these challenges are driven by factors external to New Zealand (e.g. changing international regulations, development of 'private standards' set by major overseas retailers) while others are driven by factors internal to New Zealand (e.g. the potential effect of the Hazardous Substances and New Organisms 1998 Act on agrichemical availability, increasing public concern about the social and environmental effects of agrichemicals, establishment of new pests or diseases). What is clear is that if New Zealand's export-orientated primary industries are to survive, they need to develop new types of crop protection strategies to supply high value export markets (Butcher *et al.*, 2008).

This report outlines the critical crop protection challenges facing industries today (largely from a premise of perception) and also covers a range of enabling technologies and strategies that can be used to meet these challenges. Public perception of the New Zealand crop protection industry is not that of an exemplifier (at least not from an anecdotal perspective). Improvement is required. One of the key challenges for development of all these technologies and requirements to keep pace with a changing global end consumer (both domestically and internationally) is the relatively low return on the investment needed for development. The return on investment issue is particularly apparent for minor crops but even our largest sectors are not exempt from this issue. This means that the identification and removal (where possible) of any unnecessary impediments, i.e. negative perceptions/ or connotations that may adversely impact upon commercial development of essential new crop protection technologies, is something that all primary production sectors can work together on (Butcher *et al.*, 2008).

By the sheer fact food for human consumption is generally farmed by way of established monocultures, it is never a choice to not use crop protection but rather what approach is employed, i.e. is it by way of physics, chemistry, biology or ecology?

It is clear the general public's understanding of the crop protection industry is limited, with a high level of naivety when it comes to what constitutes the practice of crop protection.

For a small country like New Zealand, only producing enough food to feed circa 40 million people (6 million being local plus annual visitors), quality of product needs to be our leading competitive X-factor. For this reason, all that is involved in the food production cycle (and how aspects such as crop protection are perceived by the public) needs to be known and appropriately addressed by the industry. Perception is an individual's "world view" – right or wrong and matters to the individual (the ultimate end consumer).

1.2 Problem Statement

Little research has been conducted analysing the public's perception of the crop protection industry with respect to New Zealand. In a world of heightened societal concern regarding threats to human health, nutrition and the environment, such things as "people's perceptions" can translate into real effects in the market place. Given the importance of both crop protection and the perceived quality of New Zealand produce both locally and internationally, it was important that a pilot study be conducted to ascertain where improvement could take place as far as people's perceptions of the New Zealand crop protection industry is concerned.

1.3 Research Question

As the title suggests, the research question of this report is:

Public Perception of the Crop Protection Industry and how this can be improved.

1.4 Research Objectives

Identify causes (drivers, sources etc.) giving rise to negative perceptions associated with the crop protection industry.

Understand where improvement is required and what this may look like?

Provide subsequent recommendations that are conducive to a more market orientated industry and one that has strong social licence in a world where this endorsement has become one's right to operate.

Bridge a research gap (little research has been devoted to understanding the public's view of crop protection in New Zealand). We just have anecdotal evidence.

2. Literature Review

2.1 The Perception Process

Different people tend to perceive the events around them in different ways. This tendency is a result of their personalities and their differing backgrounds and experiences. It is also a result of how we, as individuals, process various stimuli. Perception is a process where a person selects, organises, identifies, and interprets the sensory information they receive in order to understand their environment. Perceptions act as filters, thus preventing us from being overwhelmed by all of the noise (stimuli) around us. Perceptions can be shaped by learning, memory and expectations (Kenyon and Sen, 2015).

2.2 Understanding Public Concerns About Pesticides: An Empirical Examination

Despite the apparent escalating public concern over pesticide use and the significant implications of this concern for food consumption and the agricultural industry (Ritter *et al.*, 2006; Osman, 2011; Nicolopoulou-Stamati *et al.*, 2016), relatively little research has been devoted to understanding the public's view of pesticides here in New Zealand. This report will aim to collect and collate all that may relate to this pertinent question and then by use of a survey instrument examine the public's view of pesticides (using a range of retailers as a proxy to the general public), with relevance to New Zealand. This will provide a subsequent discussion, with managerial suggestions and guidelines thereafter.

Whether real or imagined, public perceptions of the risk posed by pesticides and other agrichemicals used in food production can translate into very real effects in the marketplace (Dunlap and Beus, 1992).

Perception is the keystone of building knowledge, not just about products and everything associated with them but also about everything else in the world. Although it is common to refer to perception as if it were somehow different from the truth, this is not the case: perceptions may differ between individuals but for each person their own perception is the whole truth (Sethna and Blythe, 2016). This is sometimes difficult to remember – but in fact, our whole experience of the world happens inside our heads, filtered by our senses and moderated by our previous experiences within any given environment (Sethna and Blythe, 2016).

Perhaps one of the most dramatic examples of how seriously public perceptions of agrichemical risks can affect the economic wellbeing of farmers and agribusinesses is the Alar controversy that unfolded in the United States in 1989. The national attention and consequent drop in demand for apples and apple products resulting from publicity given to the Natural Resources Defense Council's report on the potential carcinogenic effects of Alar-treated apples cost the apple industry an estimated \$100 million in Washington State alone (Yates, 1989). Within days of the airing of the *60 Minutes* program on Alar, the Washington State Apple Commission voted unanimously to transfer \$1.7 million into a crisis management campaign as a counterattack to stem the tide of "anti-apple" sentiment resulting from the incident (Kelley and Yates, 1989). Even though the Director of Washington's Department of Agriculture claimed that the controversy was being fueled by emotions rather than facts, the economic consequences were nonetheless devastating to the state's apple industry. As a result of the controversy, the use of Alar by the apple industry was effectively terminated (Marshall, 1991).

Were consumers justified in their reaction to the Alar report? Are pesticides and other agricultural chemicals a serious threat to human health and to the environment? The answers to these questions, as one might expect, vary considerably depending on the source. Some argue that the risks posed by synthetic agricultural chemicals are minor compared to the risks from naturally occurring chemicals. They contend that many naturally occurring chemicals in foods pose a more serious threat than do synthetic chemicals (Ames and Gold, 1990). Others contend that the food system is increasingly adulterated with potent chemicals and carcinogens that pose a serious threat to human health as well as to wildlife and the environment (Steinman, 1990). In between these relatively extreme views is a wide continuum of opinion on the risks posed by pesticides to humans and the environment.

Despite continuing disagreements over the degree of risk posed by pesticides and other agrichemicals, it appears that people have become increasingly concerned about pesticides and other agrichemical use over the last few decades. Consumers of food have become increasingly more sophisticated, especially amongst the more affluent of global demographic groups that New Zealand exports to (Deloitte, 2013). This increase in concern corresponds to the emergence of a more societal concern with environmental quality and technological threats to that quality, the emergence of a growing health consciousness among the public, and growing distrust of government regulations aimed at protecting both the environment and human health (Dunlap and Scarce, 2011).

2.3 Not a Positive Perception

In short, the public tends to view pesticides as constituting a relatively major risk, which is not surprising. Pesticides are viewed as a threat that is not well understood; that has delayed, long-term, and potentially fatal consequences, and is therefore “dreaded”. In view of these findings, it should come as no surprise to learn that the public supports efforts to reduce pesticide use in agriculture. A 1990 national survey sponsored by the American Farm Bureau Federation (AFBF) found that only 19 percent agree that farm chemicals should continue to be used at levels perceived to be used during this era, while 66 percent agreed that farmers needed to limit the amount of chemicals they were using. The final 15 percent of the survey population believed that the use of farm chemicals needed to be banned (Porter/ Novelli, 1990). An even larger majority (89 percent) agreed that “we should reduce the use of chemicals as much as we can because the less chemicals in our food the safer we are” (Porter/ Novelli, 1990).

While the high level of public concern over pesticides appears to translate directly into support for increased governmental efforts to limit agrichemical use (Porter/ Novelli, 1990), it is unclear as to how much impact such concern is having on consumer behaviour per se – outside of extreme cases such as the Alar controversy already made mention of. The AFBF survey, for example, found that consumers’ pesticide concern had minimal impact on consumption as, *“Two out of three consumers (64 percent) do not avoid any foods because they might be harmful to one’s health”* (Porter/ Novelli, 1990).

Finally, with reference to the AFBF survey, the findings suggest that pesticide use in agriculture is seen as a serious risk that elicits a fairly high level of public concern. Despite this perceived risk, these and other surveys indicate that much of the public still sees a role for pesticides in modern agriculture. The AFBF survey found that *“Over two-thirds (69 percent) agree that chemicals increase farm productivity and that, without them, food would be less plentiful, have more blemishes and be more costly”* (Porter/Novelli, 1990). Other information reviewed from a survey conducted out of Kansas and Oregon, USA likewise reported majorities agreeing that pesticides increase the availability of food. These studies also found considerable dissent concerning whether pesticides increase or decrease the price of food, cost of food production and the quality and safety of food (Kansas State University, 1983). These results appear to reflect a fair amount of ambivalence in the public’s overall view of pesticides – a relatively high level of concern with pesticide impacts but less confidence that pesticide use in agriculture can be eliminated, and a consequent desire for the

government to regulate pesticide use. Such results also suggest the importance of examining these various facets of attitudes toward pesticides in more detail than has previously been the case.

2.4 Correlations Surrounding Public Attitudes Towards Pesticides

A related topic clearly deserving more attention is examination of the personal characteristics associated with differing attitudes towards pesticides. The studies have generally found only modest variation in pesticide concern across various segments of the public (Sachs *et al.*, 1987), although most have found women to be somewhat more concerned than men (Mason, 1980; Pilisuk *et al.*, 1987) and younger adults to be a bit more concerned than their older counterparts (Mason, 1980).

The relationship between education and concern over pesticide use is less clear. Both Pilisuk *et al.*, (1987), and Porter/ Novelli, (1990) found a slight negative relationship between education and concern over pesticides but Blair and Sachs (1988) reported finding a slight positive relationship. Similarly, no consistent evidence could be found for the positive relationship between income or residence and concern over pesticides. The consistent gender differences are compatible with other studies showing that women tend to be more concerned about a range of technological risks than men (Pilisuk *et al.*, 1987). In order to understand the sources of attitudes toward pesticides, more attention clearly needs to be given to possible variation in these attitudes among differing segments of the public.

2.5 Public Perception of Biological Control

While pesticides are still a significant component of many control programs, their perceived negative environmental and health benefits have stimulated research to develop alternate pest management strategies such as biological control (McNeil *et al.*, 2010). Although the levels of success have been variable, biological control is still considered as an important means of pest control, either alone or as a component of integrated management programmes (Jervis, 2005; Wajnberg *et al.*, 2007).

It is clear that for any management approach to be successful, it must not only be economically viable for users but must also, on a much broader scale, be acceptable to the general public (Knight and Warland, 2004). At this sociological level concerns may range from potential dangers for human health to possible undesirable ecological consequences following the implementation of any given management strategy (Rosati and Saba, 2004).

In Canada, across the entire country (a country with demographic similarities to New Zealand) a survey conducted under the auspices of the Biocontrol Network, a Canadian research and

development organisation, determined how the Canadian public perceived biological control as an alternative to the use of synthetic pesticides for pest control. The questionnaire was developed within a “how consumers perceived risk as it relates to food” framework, given that many biological control agents are already used in agro-ecosystems. The approach of perceived risk was deemed appropriate given the diversity of opinions concerning the use of genetically modified (GM) plants to reduce herbicide and insecticide use in certain agricultural crops and public concerns about GM products being used in foods (Royal Society of Canada, 2001).

With respect to results attained through this Canadian survey, while only 60 percent of the individuals completing the questionnaire stated they were interested in general issues of science and technology, more than 80 percent expressed an interest for both environmental issues and those relating to nutrition. 55 percent of all respondents considered themselves informed about the concepts or principles of biological control but this ranged from 34 – 76 percent between provinces. While men and women were nearly equally represented in the survey (45.5 percent vs. 51.5 percent), the latter group ranked the perceived risk associated with food significantly higher (this finding was derived through principle component factor analysis). With respect to a question asked through this survey about various means for controlling pests from the perspective of food safety, there were markedly different levels of perceived risk, with organic farming and biological control being seen as significantly safer than synthetic chemical pesticides. While nearly 25 percent of individuals questioned considered that biological control would be more harmful to the environment than insecticides, the vast majority felt that there would be less risk associated with consuming food when biological control agents, rather than synthetic chemical means were used to control pests (McNeil *et al.*, 2010).

In discussion of these Canadian survey results, it is quite clear that within the broad frameworks of environmental concerns and perceived health risks, Canadians generally consider biological control agents as a safer, acceptable alternative to traditional pesticides for the production of food crops.

More than 70 percent of the people questioned indicated they would prefer to buy food produced when farmers had used biological control agents rather than insecticides to control pests. However, 45 percent expressed concern about eating such food, if the question included “beneficial microbes” as an example of a biological control agent. One possible reason may be an association between the term “microbe” with contamination of food products or human health problems, or both. However, in all cases, the public perceived a significantly lower risk associated with the consumption of foods treated with any form of biological control than those treated with synthetic chemical pesticides.

Less than half of the people questioned said they would be willing to pay more for such products, and more than 80 percent of the respondents thought that food products should be labelled if biological control was used in the pest management programme (McNeil *et al.*, 2010).

As far as biological pesticides (biopesticides) are concerned (a subset of biological control), this market is forecast to grow at a CAGR of 16.3 percent during the next 5 years, reaching an estimated annual sales of USD\$7.6 billion by 2022. The global market for crop protection is currently circa USD\$55 billion (Meticulous Research, 2017), with the synthetic pesticide growth rate forecast to be significantly less steep. This forecast growth rate for biopesticides is being driven by the increasing investment from leading crop protection companies operating in the biopesticide market, growing awareness about environmental safety with the use of biopesticides and increasing organic farming and demand for organic food. It is also driven by resistance management, rising costs associated with the development of synthetic chemicals and the growing prevalence of government initiatives to promote the use of biopesticides across the globe (Meticulous Research, 2017).

The leading companies have employed various strategies to expand their product and application offerings, global footprint, and augment their market share. The leading players currently in the global biopesticide market are BASF SE, Bayer CropScience AG, Marrone Bio Innovation, Certis USA L.L.C., The Dow Chemical Company (DowDuPont), Monsanto Corporation and Bayer (soon to become one), Isagro S.P.A., Camson Bio Technologies Limited, Andermatt Biocontrol AG, Som Phytopharma India Limited, Syngenta, International Panacea Ltd, The Stockton Group (STK), BioWorks, Inc., Novozymes, Inc., Koppert B.V., W. Neudorff GMBH KG, Invivo Agrosiences, Valent U.S.A. LLC, and FMC Corporation (Meticulous Research, 2017).

2.6 What does “Social Licence” mean in the context of the Crop Protection Industry

Social licence is a buzzword that has gained traction in various industries and has recently firmly established itself as part of agriculture’s vernacular. It is now also part of the scientific language (Monk, 2011).

For centuries, farmers have been producing food to feed their neighbours, communities and the world. With particular reference to New Zealand, going back a few generations most people had a direct connection to the farm and understood how agriculture worked. Farmers didn’t have to talk

about what they did because people knew. People implicitly trusted in the food they ate and that farmers were doing the right thing (Gunningham *et al.*, 2006).

The world is now a very different place than it was a few generations back and New Zealand is no different. With regards to New Zealand, only a very small percentage of the population has an affinity with the land, whilst the balance of the population knows very little about agriculture (Key Research, 2014).

Couple this with the fact that people have greater access to information today than they ever have and a desire to know more about the food they eat and how it's grown (a more sophisticated consumer) and it brings us to the conversation about social licence.

It is becoming increasingly apparent in the world of agriculture that public acceptance and support can be as important, if not more so, than the approval of regulators.

We need look no further than the impact activist pressure is having on such things as glyphosate and neonicotinoid chemistry with all the proposed restrictions, albeit not backed by science based evidence. Similarly, provincial bans on urban pesticides, i.e. Christchurch City Council and glyphosate, highlights the power public pressure or pseudoscience has to trump real science. Regarding glyphosate, this is despite the fact there are 800+ studies that have found no links between glyphosate and cancer, including a recently published long-term study of U.S. farmers and exhaustive data assessments by the European Food Safety Authority and the Europeans Chemicals Agency (Fraley, 2018).

Farmers and industry must now rely on public trust for their right to operate, otherwise known as their social licence.

Social licence is defined as:

“Social License refers to the level of public trust granted to a corporate entity or industry sector by the community at large and its key consumer base.

Public trust is the belief that activities are consistent with social expectations and the values of stakeholders, and earned through industry engagement, operating practices, and expressed values. Social license is slow to build, but quick to erode. Industry tacitly garners public trust by doing what is right” (Thompson and Boutilier, 2011).

As a result, it is more important than ever before that the agriculture industry stands up and tells its story.

Consumers want to know that both farmers and the plant science industry are being good corporate citizens, as they should.

Stakeholders within the agricultural industry often talk about how farmers are the original environmentalists, and the importance of being good stewards of the land. This is true and has great merit. Farmers depend on the land for their livelihoods and they need to take great care to protect it and ensure its viability for years to come.

The plant science industry is committed to developing tools that help farmers do just that. The industry is constantly innovating to come up with new ways to help farmers grow more with less, and meet the needs of the world's growing population in the face of changing climate conditions.

Pest control products and new crop varieties developed through plant biotechnology (the latter being outside of New Zealand) have helped dramatically improve farmers' yields all around the world. In terms of output, without crop protection technologies farmers here in New Zealand would need to farm significantly more land to produce what they do today (O'Callaghan, 2018). This kind of improved productivity means valuable natural wildlife habitat can be left intact despite a growing population.

Thanks to the use of pesticides farmers have been able to widely adopt conservation and no-till practices. The result has been improved soil health, reduced erosion, and a reduction in the amount of greenhouse gasses generated by agriculture (O'Callaghan, 2018).

In countries outside of New Zealand, i.e. the Americas, the plant science industry is developing new crops that better tolerate drought and salt etc., notwithstanding the tactical crop protection resistance that many of these crops have been bred to have. This holds particular promise in the developing world where these kinds of innovations could help bring entire regions out of poverty.

Kiwis should also know that in most respects, New Zealand rates well on the usual measures of national governance. OECD indices of the quality of product market regulation typically places New Zealand well ahead of its comparator nations. EPA and ACVM (New Zealand agencies involved with pesticide products) ensure all crop protection, before coming to the market, are safe for both human health and the environment (Sherwin, 2014).

2.7 A Market Orientation Framework

A business that increases its market orientation will improve its market performance. This proclamation has been issued continuously by both marketing academics and marketing managers for more than 30 years (Hult and Ketchen, 2001).

The definition and meaning of market orientation is a business philosophy where the focus is on identifying customer needs or wants and meeting them. When a company has a market orientation approach, it focuses on designing and selling goods and services that satisfy customer needs in order to be profitable. The successful market oriented company discovers and meets the desires and needs of its customers through its product mix (Kohli and Jaworski, 1990).

Market orientation works in the opposite direction to past marketing strategies such as product orientation, where the focus was on establishing selling points for existing goods. Rather than trying to get one's customers to like or become aware of the benefits of one's products or services, with the marketing orientation approach an organisation tailors everything about the product or service to meet the demands of customers (Langerak, 2003).

As a synopsis from a raft of contemporary literature, many marketing gurus define market orientation as a coordinated marketing campaign between a supplier and its buyers.

The main disadvantage with a market orientation approach is lack of innovation. If an organisation spends all its time satisfying customer needs, one may lose sight of what potential technical breakthroughs there might be. Product oriented companies, on the other hand, tend to be more technically or scientifically innovative, but lose out because they have less knowledge about what the consumer actually wants.

At times, market orientation may reveal customer desires that are not cost effective to implement. This leaves the business having to determine which consumer-stated needs will yield optimum returns for the business, while still meeting general customer expectations or needs. This also promotes long-term development strategy, as options that are not cost effective today may become cost effective down the line (Ross and Westgren, 2006).

Market orientation is more of a culture than an individual process. It is the mindsets, values, beliefs, norms and behaviours of companies, together with the systems, structure and control of the organisation (Slater and Narver, 1995).

Market orientated commercial enterprises define their activities as service activities aimed at satisfying their customers. What drives them are customer needs – they are listed as their main objective (Slater and Narver, 1995).

2.8 Market Orientation and Performance: The Conceptual Model

A company that follows the market orientation approach reacts to what consumers want. Most of the decisions it makes are based around data related to consumer requirements, not what the organisation believes is right for them (Matsuno *et al.*, 2002).

The majority of highly-successful companies today are market orientated. A surprisingly high proportion of businesses and industries that fail tend to exhibit behaviours that are more focused on their products than consumers (Matsuno *et al.*, 2002).

For an organisation to achieve consistently above normal market performance, it must create a sustainable competitive advantage (SCA) (Aaker, 1989; Porter, 1985). That is, it must create sustainable superior value for its customers. The logic of SCA is that for a buyer to purchase offering X, the buyer must perceive that the expected value to him of that offering (i.e., that proposed solution to his need) exceeds the expected value to him of any alternate solution (Aaker, 1989).

The value of a seller's offering to a buyer is the difference between what the buyer perceives as the offering's expected benefits and what the buyer perceives as its expected total acquisition and use costs (Zeithaml, 1988). Any seller has numerous alternative opportunities for creating additional buyer value through increasing a buyer's benefits and/ or decreasing a buyer's total acquisition and use costs (Forbis and Mehta, 1981).

The desire to create superior value for customers and attain SCA drives a business to create and maintain the culture that will produce the necessary behaviours. Market orientation (incorporating the internal culture and climate) effectively and efficiently creates the necessary behaviours for the creation of superior performance for the business (Kohli and Jaworski, 1990).

A market-orientated seller understands that, through the numerous means of creating additional benefits for buyers' total acquisition and use costs, there are many potential sources of SCA (Aaker, 1988). Thus, a market-orientated business continuously examines these alternative sources of SCA to how it can be most effective in creating sustainable superior value for its present and future target buyers. To maximise its long-run performance, the business knows it must build and maintain a long-

run, mutually beneficial relationship with its buyers. Accordingly, a market-orientated seller decides how best to share with its buyers the superior value it creates for them (Forbis and Mehta, 1981).

2.9 Organic Farming Systems: Being Driven by both Producer and Consumer

Organic farming systems, fuelled by demand, has firmly embedded itself as a niche market offering in mainstream supermarkets. The term 'organic' has been embraced by the consumer, subsequently creating a strong social licence that is directly reflected in consumer purchasing preferences, relating directly to the philosophy and practice adhered to with this system (Monk, 2011). This is accomplished by alignment to clearly articulated standards and independent auditing and verification. Despite a growing following, organics still only represents a niche of the overall market-place for food and farming. A point to hone in on however with respect to this system is the fact that the organic movement is a merger of farmers very interested in this particular system, coupled with a consumer desire surrounding the organic story and subsequent support thereof. As a case study, the organic sector showcases that the combination of strong self-governance utilising objective and independently audited standards, setting the bar high on this front and then articulating this to the end consumer, is key to a robust model and therefore the social licence of farmers (Monk, 2011). Further to this case study analysis, the success of the organics movement from a perception standpoint can be attributed to the following:

- Broad stakeholder involvement (the process). This is alluded to in the heading of this section.
- The package of goods that are delivered (perceived delivered) by the process (the content or standard).

It has been deemed imperative that these "pillars" are always reinforcing each other. This augers well for delivering both trust and confidence with key stakeholders, from farmers through to the end consumer (Monk, 2011).

3. Methodology

3.1 Introduction

This chapter explains the research methodology used for this exploratory pilot study. It outlines the choice of research instrument utilised, together with the different dynamics pertaining to this

instrument including the sampling procedure and descriptive analysis employed for assessment of collected survey data.

3.2 Research Instrument

A survey instrument was the chosen research strategy for this report. Within the field of social sciences, the survey remains the dominant methodology. Brown and Gilmartin (1969) suggest that approximately 90 percent of sociological research employs survey design. Based on anecdotal evidence and expert advice, it was clear that the survey instrument was the best mechanism for the purpose of answering the research question for this report.

A “survey” could be described as a systematic method for the purpose of obtaining information from (a sample of) entities. The goal is constructing qualitative or quantitative descriptors of attributes pertaining to the larger population, of which the measured entities are members or a proxy (Groves *et al.*, 2009). The word “systematic” is deliberate and meaningful as it distinguishes surveys from other research methodologies (Micheel’s, 2010). The phrase “(a sample of)” is outlining the fact that a number of surveys simply utilize a sample of the population as opposed to the population in its entirety.

3.3 Proxy Reporting for the “Public Perception” Survey

Proxy reports are survey responses provided by a respondent about another member of the sampled unit. Proxy reports are used in surveys as an alternative to interviewing all individual sampled unit members, when attempting to obtain individual reports is neither reasonable nor practical (Millar and Tucker, 1993).

Although a common methodological assumption is that the best method of collecting information about a target individual is from that individual directly (Mathiowetz and Groves, 1985), a review of the literature on proxy reporting found little evidence that self-reports were inherently superior to data provided by a proxy (Moore, 1988). However, this finding should be qualified by Moore’s caveat that well-designed studies of the self/ proxy issue are rare and the range of topics covered has been limited.

When differences between self and proxy reports have been observed, they seem in varying degree related to the relationship between proxy and self, the type of information being asked about, the importance of the information to the proxy, the characteristics of the proxy, whether the proxy participated in the event and the method of survey administration (Brickart *et al.*, 1990). For the

purpose of this project and the type of proxy utilised, the knowledge of the “self”/ general public was ratified by the close association and length of experience of the proxy population (see results section).

3.4 Retailers as a Proxy for the Consumer: The Survey Target

It is clear through a plethora of different literature pieces that retailers see themselves as proxies for consumers. Food consumers have a very high level of trust in information provided by supermarkets; that is, what is being sold is deemed safe for consumption (Deloitte, 2017; Lowe *et al.*, 2008). Conversely, the retailer is, of course, focused on the consumer to ensure that it does not lose the consumer. The retailer at all times is trying to limit damage to its customer base and not lose its individual customers. Any loss of reputation may drive customers to its competitors. It is this that is at the root of the retailers’ concern. For these reasons, given these science based findings, it was deemed appropriate that the retailer (12) for the purpose of this project be utilised as a suitable proxy for the general public.

General public interviews would have involved too great a scope for the purpose of this report given the nature of diverse views which would need to be collected and collated across various demographic groups, i.e. sex, socio-economic status etc.

Employing a psychometric paradigm methodology to review the public as a continuation and elaboration of this project would certainly aid in filling the gap that currently exists in this space.

All information gained through this survey instrument is to be used anonymously as promised to survey participants (lead food retailers from across New Zealand).

3.5 Survey Analysis Technique, with a Qualitative Construct

A non-parametric technique, namely descriptive analysis was chosen for the purpose of the survey review.

Descriptive statistics are used to describe the basic features of the data in a study. It facilitates for the provision of simple summaries about the sample and the measures. Together with simple graphics analysis, it forms the basis of virtually every quantitative analysis of data (Freeman and Julious, 2007).

Descriptive analysis provides a powerful summary that enable comparisons across people or other units. This non-parametric technique has also been chosen because it is conducive to a more widely readable report.

A qualitative construct as far as survey design has been employed. This is because given the short time frame allocated to this project, coupled with the fact this is still somewhat of a pilot study, one can get away with a smaller survey population than in a quantitative survey and attain rich data for the purpose of building a “view” of a target demographic, in this case the general public, by way of food retailers as the proxy (Altman, 1991).

4. Results

The following results entail collated responses from 12 retailers representing a cross-section of New Zealand food retailers, utilised as a proxy to the general public for the purpose of this pilot study.

Results were varied but not inconsistent from findings gathered through the literature review. It was made very clear that people by and large do not possess a strong understanding of the crop protection industry or what transpires at an operational level when it comes to the protection of food through the production cycle.

Through the following results, there are some obvious trends and patterns, which for the purpose of the project topic, bode well for strong recommendations conducive to perception improvement of the crop protection industry.

Question 1:

Experience in the food retailing sector

Q 1b. What is your length of experience in the food-retailing sector?		
Less than 10 years	5	42%
Decades In Industry	7	58%
Total	12	

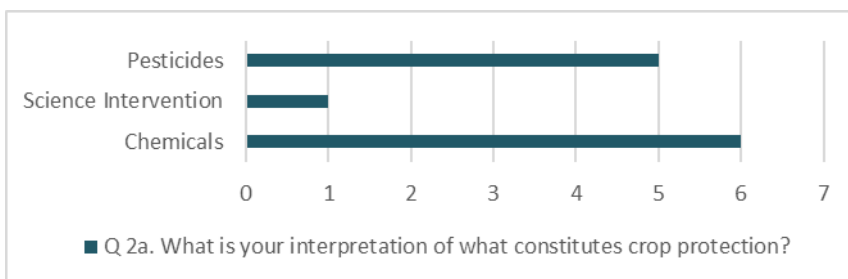


Greater than half the sample size, 58 percent (with respect to the individual representing their retailer for this survey) had in excess of 10 years’ experience. This has been deemed as a great positive for the purpose of these results, as these seasoned individuals have experienced attitudes and characteristics on behalf of a wide range of people groups conducive to providing greater merit to their responses as a proxy to the general public. The balance of the survey sample, who have less than 10 years’ food retail sector experience, all had more than 5 years’ worth of experience when asked further probing questions through the survey process.

Question 2a

Interpretation of what constitutes crop protection

Q 2a. What is your interpretation of what constitutes crop protection?		
Chemicals	6	50%
Science Intervention	1	8%
Pesticides	5	42%
Total	12	



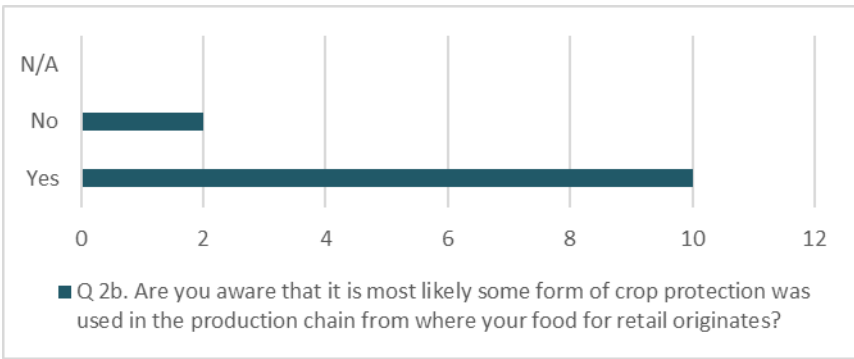
An overwhelming 92 percent of the survey population link crop protection to either “chemicals” or “pesticides”. A single retailer made mention of “science intervention”, which we know to be the more accurate definition defining this process. “Crop Protection” is the science and practice of

managing plant diseases, weeds and other pests (both vertebrate and invertebrate) that damage agricultural crops and forestry (Manktelow *et al.*, 2005).

Question 2b

Awareness of the fact that some form of crop protection was used in the production chain from where your food for resale originates

Q 2b. Are you aware that it is most likely some form of crop protection was used in the production chain from where your food for retail originates?		
Yes	10	83%
No	2	17%
N/A	0	0%
Total	12	



All retailers surveyed, apart from two, answered yes to this question (83 percent). The two retailers in who answered no were retailers of strictly organic produce. From a professional perspective, we know that even under organic growing environments, crop protection of some form is generally utilised, often in the form of products such as sulphur and copper, which are permissible under organic programmes here in New Zealand. For this reason, it was somewhat surprising (but a reflection of the population) how little is known about the concept of crop protection irrespective of the system and / or practice employed. The fact that a couple (2) of experienced retailers had this opinion sheds light on the complete lack of knowledge and scientific insight the general public has with respect to crop protection and the different aspects which often do constitute this process.

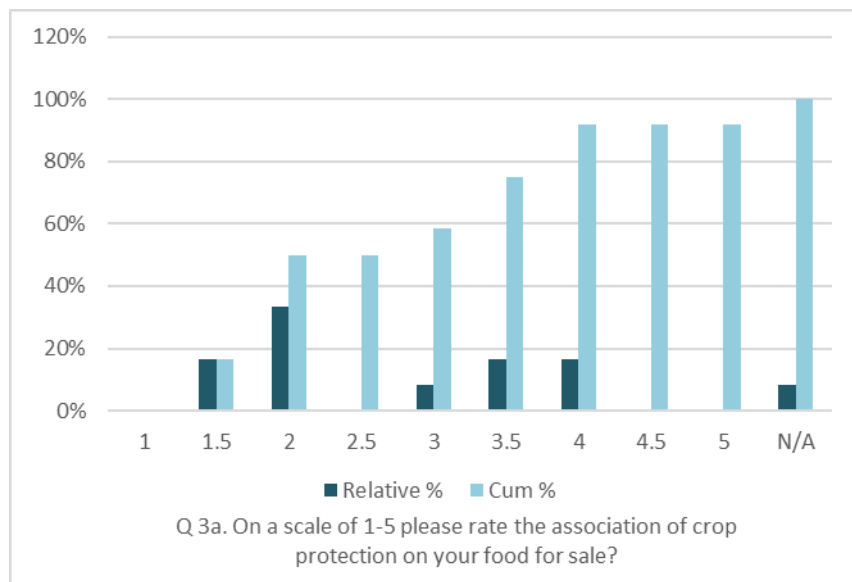
Question 3a

On a scale of 1-5 please rate the association of crop protection (or what you described as being crop protection) on your food for sale? “from your, or your businesses’ perspective”

1 = extremely negative

5 = extremely positive

Q 3a. On a scale of 1-5 please rate the association of crop protection on your food for sale?			
1	0	0%	0%
1.5	2	17%	17%
2	4	33%	50%
2.5	0	0%	50%
3	1	8%	58%
3.5	2	17%	75%
4	2	17%	92%
4.5	0	0%	92%
5	0	0%	92%
N/A	1	8%	100%
Total	12		
Average	2.636		



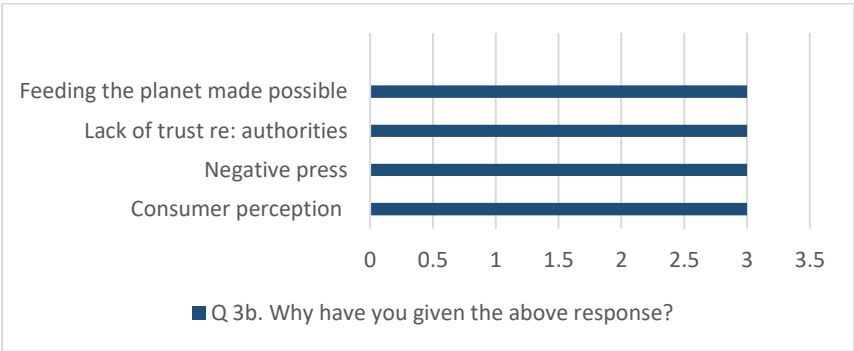
The general consensus regarding this question was somewhat divided. Half the survey population rated the association to be negative (less than 2.5/5). Five out of the 12 respondents rated the

association as 3 or greater (positive). One respondent marked this as non-applicable believing that crop protection was not utilised at all on the food for retail in which they sold.

Question 3b

The “why” behind the above answers

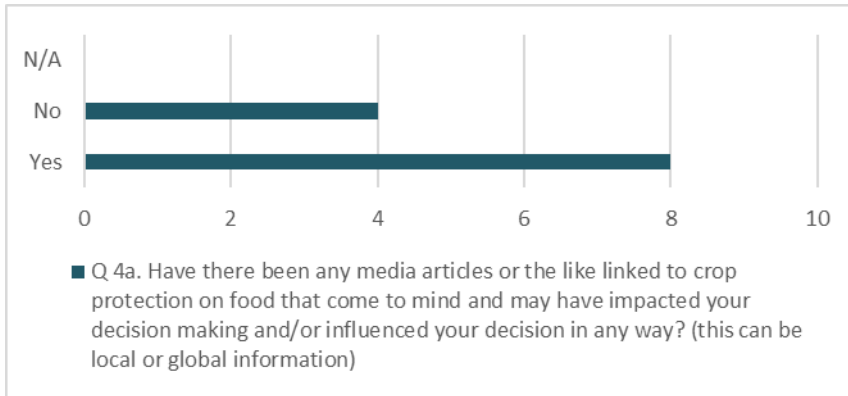
Q 3b. Why have you given the above response?		
Consumer perception	3	25%
Negative press	3	25%
Lack of trust re: authorities	3	25%
Feeding the planet made possible	3	25%
Total	12	



Question 4a

Media influence regarding crop protection and the individuals subsequent decision making process

Q 4a. Have there been any media articles or the like linked to crop protection on food that come to mind and may have impacted your decision making and/or influenced your decision in any way? (this can be local or global information)		
Yes	8	67%
No	4	33%
N/A	0	0%
Total	12	



A significant 67 percent of the survey respondents had been influenced by information appearing in the media, through channels such as social media, TV articles, hard copy collateral (i.e. newspapers, magazines etc.) A number of these 8 “influenced” respondents linked “pressure groups” associated with ethical issues etc. having an impact on their food for retail decisions.

Question 4b

On a scale of 1-5 please rate the association of this information on your food for sale “from your, or your businesses’ perspective”?

1 = extremely negative

5 = extremely positive

Q 4b. On a scale 1-5 please rate the association of this information on your food for sale?			
1	0	0%	0%
1.5	0	0%	0%
2	2	17%	17%
2.5	1	8%	25%
3	0	0%	25%
3.5	3	25%	50%
4	2	17%	67%
4.5	0	0%	67%
5	0	0%	67%
N/A	4	33%	100%
Total	12		
Average	3.125		

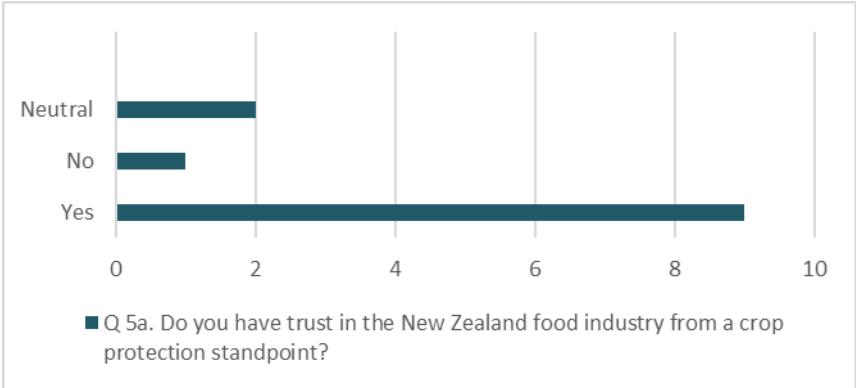
An interesting result but not all that surprising. In fact, this somewhat neutral (or a shade over) result aligns with findings found in literature surrounding this topic. Perceptions and media sensationalism

is generally negative when it comes to the association of crop protection and food. In consideration of this, the very topic and information surrounding this question is often not an active thought and/or consideration at point of purchase. The above result confirms this notion.

Question 5a

Trust in the New Zealand food industry from a crop protection standpoint

Q 5a. Do you have trust in the New Zealand food industry from a crop protection standpoint?		
Yes	9	75%
No	1	8%
Neutral	2	17%
Total	12	



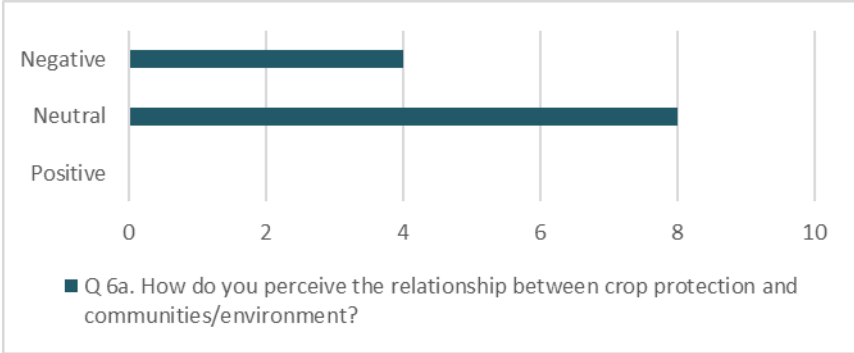
A significant proportion of the sample population (75 percent) has trust in the New Zealand food industry (as one would be inclined to expect within such a country). This positive ratio together with what is observed for the other two attitudes (no and neutral) resembled correlations with Statistics New Zealand results viewing public trust regarding the New Zealand Government (further detail within the discussion section).

Question 6

Perception regarding the relationship between crop protection and communities/ environment?

Positive or negative?

Q 6a. How do you perceive the relationship between crop protection and communities/environment?		
Positive	0	0%
Neutral	8	67%
Negative	4	33%
Total	12	

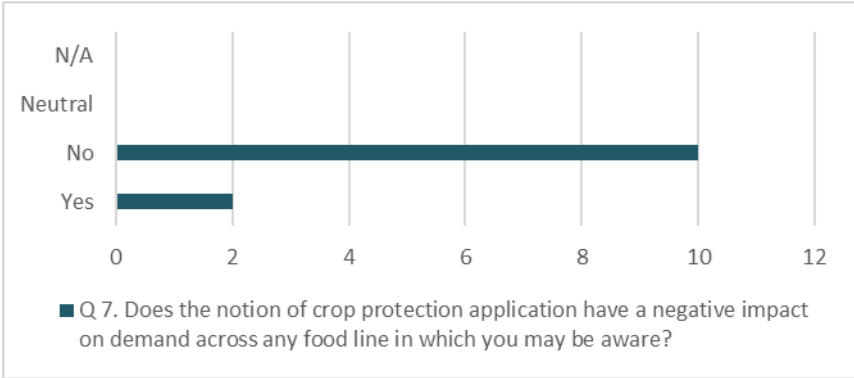


A negative relationship against a third of the sample population, a neutral result for the balance. Given the above result, it is quite clear that the notion of crop protection/ intervention pertaining to communities and the environment is not seen as a great positive but not the opposite either. This result somewhat demonstrates a tolerance of sorts given the significance of the impartial response.

Question 7

Does the notion of crop protection application have a negative impact on demand across any food line in which you may be aware?

Q 7. Does the notion of crop protection application have a negative impact on demand across any food line in which you may be aware?		
Yes	2	17%
No	10	83%
Neutral	0	0%
N/A	0	0%
Total	12	



Despite the perceived negative connotations associated with crop protection and food, the above result denotes that crop protection is not an active consideration for a vast majority of shoppers and does not play a large part in impacting upon demand.

5. Discussion

The use of a proxy report for the purpose of this “pilot study” within a New Zealand context in hindsight was a good approach. Given the sheer complexity associated with “perceptions” pertaining to individuals (varies by sex, socio-economic situation, age etc.) and the fact that this initial pilot report has been subject to a short time frame as far as a deadline is concerned, proxy reports have served this piece of work well. As it turned out, all 12 individuals surveyed, in a mostly interview format, had wide ranging food retail experience. The prompt was therefore to take all this experience into account, capturing general trends with relevance to all those “shoppers” in whom they have had experience and or have witnessed with respect to food perceptions. On this basis, the results collected and collated have strong merit pertaining to New Zealand’s food shoppers.

It was very clear by way of the results that what constitutes crop protection in the eyes of our survey population was conveyed by the use of the word “pesticides” (42 percent) or “chemicals” (50 percent). These two descriptors are clearly utilised as a catch-all category for any and all crop protection practices. In reality and certainly in today’s era, this direct association is not necessarily accurate and instead conveys a gross ignorance of what constitutes crop protection. Crop protection is the best and most accurate descriptor and should be interpreted or associated with a holistic view, taking into account scientific intervention, biological control and other, somewhat less intrusive forms of action than simply “chemicals” and “pesticides”. This notion of what constitutes crop protection would certainly be more aligned with current practice and therefore the “truth” with respect to what transpires in the process of protecting our food that we eat. Here in New Zealand, as far as crop protection is concerned, we are seeing a concerted move away from broad spectrum organic phosphates etc., to softer “greener” technologies which are more targeted. In addition to this targeted approach, the use of integrated pest management (IPM) is becoming increasingly more utilised across sectors. The UN's Food and Agriculture Organisation defines IPM as "the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimise risks to human health and the environment". IPM emphasises the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms. IPM allows for safer pest control. In addition to IPM, integrated weed management (IWM) is another methodology which is now being practiced across the board, constituting crop protection here in New Zealand.

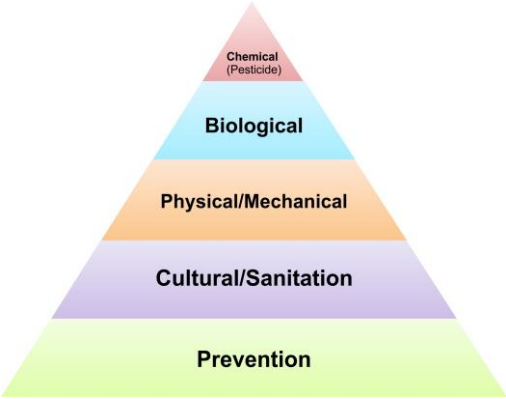


Figure 5. 1: IPM triangle which outlines important measures to be considered in an IPM approach

Similarly to IPM, IWM means integrating multiple methods to manage weeds, using the combination of practices that is most effective for solving the specific weed issue at hand.

These weed management techniques form a “toolbox” in which each “tool” can be integrated into a weed management plan catered to the particular farm and problem. The toolbox includes chemical (herbicide), mechanical, cultural, biological practices and prevention of weed introduction and spread.

IWM tactics span a wide range of types and complexity. Not all IWM tactics are very complex. Some examples include: equipment cleaning, timely scouting, altering herbicide tank mixes, rotating herbicides, cover cropping and changing tillage practices.

Integrated weed management is not an alternative to herbicides in conventional crops. For many decades, herbicides have been the primary means of weed management in conventional crops due to their simplicity, effectiveness and affordability. IWM is about using all options available to best solve the problem – in many cases in conventional crops, herbicides are part of this solution.

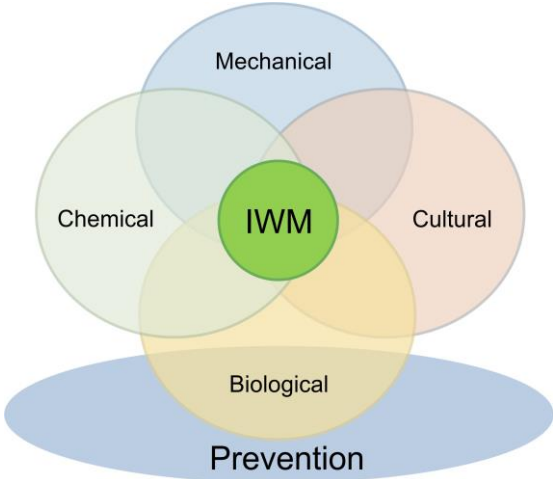


Figure 5. 2: The 5 types of management tactics that can be used in integrated weed management.

In summary of the above, despite the simplicity of these approaches which are now widespread, the public (it would appear given the retailers' responses within this survey) do not know of such on-farm management practices which given the influence of public perception, does not bode well for the crop protection and wider agricultural industry of New Zealand.

In addition to the above, the global crop protection market, namely the multinationals occupying this space, have been systematically buying up biological companies in recent years. BASF purchased Becker Underwood, Syngenta purchased Pasteuria and DevGen, Bayer has bought AgraQuest and Prophyta and Monsanto and Novozymes announced a collaboration they are calling the BioAg Alliance. The alliance is a long-term strategic alliance to transform research and commercialisation of sustainable microbial products. From an operational perspective, biological products as a result of these acquisitions are now being utilised, with a pipeline of products to come into the fold in the not too distant future. In essence - the product suite by and large has changed from what was previously employed in years gone by. Safer, greener technologies are now being used in New Zealand agriculture as far as crop protection is concerned.

In stating the above however, the New Zealand regulatory framework, namely the EPA and ACVM are two government-lead authorities acting as gate-keepers with respect to what is permissible for use in New Zealand. It may appear that the EPA could possibly alter their framework for these biological type products so as to fast track greater use of such products.

The EPA under the Hazardous Substances and New Organisms Act 1996 (HSNO Act) manages risks to the environment and human health. The EPA is responsible for regulating the introduction and use of hazardous substances and new organisms in New Zealand. An approval must be obtained from the EPA before a hazardous substance or new organism can be imported into, or manufactured in, New Zealand.

The Ministry for Primary Industries (MPI), under the Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM Act), manages risks to public health, trade in primary produce, animal welfare and agricultural security. The ACVM Act overlaps with the HSNO Act because a number of the compounds used in agriculture (such as pesticides) are also hazardous substances.

If any biologicals or synthetics are (or contain) a hazardous substance or new organisms, an approval under the HSNO Act is required as well as the registration under the ACVM Act. This seems somewhat logical, however, the process is not too dissimilar from that which is employed for synthetics. In the USA for example, the EPA and USDA are approving biologicals at a much faster rate

since they consider them more environmentally friendly than pesticides (denoting synthetics in this instance). *"EPA will fast-track that development, so much so that if the company with the new product asks for a label on three crops, EPA might grant a label for 20 crops ... and that's basically because these new products present little or no challenge to the environment and the soils which grow our crops"* – Bob Streit, Seedworld (Independent Consultant).

In summation of the above few paragraphs, maybe the EPA here in New Zealand needs to review this process, taking into account further international learnings for the purpose of ensuring it is not hindering this movement towards biologicals, instead helping to hasten such a process. If the USA is operating in this vein, New Zealand, with our lack of scale and heavy reliance on all things associated with perceptions both locally and abroad, should ensure a robust and careful review ensues in this space.

Undoubtedly, regulators have a big role to play in consumer perception. Regarding the progress the crop protection industry has made and what the future holds for any new technology, there's obviously an adoption curve - a time for society to get comfortable. This is required for the achievement of social licence. Social licence certainly has regulation as a piece of it (Thompson and Boutilier, 2011). There is still the belief that if government agencies look at something and consider it to be safe, this augurs well for positive uptake and acceptance. Another reason for an EPA review of this new technology (biologicals) framework.

From a general global perspective, biological agents are safe, effective and fit well into sustainable food production systems (Meticulous Research, 2017; O'Callaghan, 2018). More and more new biological products are reaching the marketplace with greater investment in proof of efficacy, broader testing across geographies and with advanced technology and fine tuning to meet the growers' pest control needs. With several older chemistries leaving the marketplace, biologicals are meeting growers' needs and better serving the desires of food consumers.

As per the results of this project's survey pertaining to the association of crop protection on food through the production chain, the general consensus was divided with a degree of ignorance also apparent (with individuals (retailers) not believing crop protection is applicable on their food for resale). In light of these findings, and taking into account the work conducted by the Canadian research and development organisation, the Biocontrol Network, with respect to how consumers perceived risk as it relates to food, consumers were more amenable to biological control on their food than they were with respect to synthetics.

In summarising results and feedback from this localised New Zealand study, with specific reference to question 3a (*association of crop protection on food for sale*), it seemed somewhat obvious that part of the survey population sees a significant number of positives around crop protection and it would be naïve to think that by simply letting nature take its course we will be able to feed the world. There are some negative connotations around historic contamination and chemical issues, as well as the ongoing issue of pseudoscience impacting the perception of scientists within this field. Pseudoscience in context to this project I reference popular but erroneous views as shown in anti-vaccination and anti-fluoride etc. One of the biggest issues in crop protection is around the lack of trust the general public has of crop scientists, often driven by social media pseudoscience. This feedback formed the general sentiment of those who associated crop protection on the positive side of the ledger with the score ranking out of 5.

In recent years, crop protection continues to make headlines, and often the industry and associated products within are not painted in a very positive light. Chemical control methodologies have been blamed for every sort of evil imaginable, with the neonicotinoids labelled as the worst of the worst for harming bees. Yet without these substances, the quality of life we know wouldn't exist.

So where's the disconnect? Is crop protection an actual danger?

The fact of the matter is, the crop protection products that are registered by the Environmental Protection Agency are already intensely scrutinised. Manufacturers can spend anywhere from USD\$250 million to USD\$500 million dollars in bringing a product to market. Part of this expense is related to the numerous toxicological studies that are submitted to the EPA for review.

With respect to the EPA, both globally and locally here in New Zealand, a comprehensive and robust submission is required and involved in registering a crop protection product and the EPA has high standards for ensuring that products do not have a high risk for harm. In view of this, it would appear that it is just so much easier to sensationalise a headline that says, "glyphosate causes cancer". This has become a perennial issue for the industry. People are looking for "easy" answers. As an industry, we have done a very poor job in effective science communication.

On looking at solutions to this problem, RISE or Responsible Industry for a Sound Environment is one organisation based out of the US that is dedicated to dispelling the myths that surround crop protection. This trade organisation represents manufacturers, formulators, distributors and other industry leaders involved with the industry.

This organisation shares positive information about the industry and subsequent products with policy makers and monitors the public perception towards the crop protection sector. Surprisingly, despite the volume and visibility of activists' protests, the majority of the population doesn't seem to give crop protection (of any format - pesticides, chemicals, biologicals etc.) much thought when acquiring goods, according to RISE's research. This finding aligns with our local survey findings through question 7, whereby a resounding 83 percent of the respondents stated that the notion of crop protection having been applied through the production chain did not have a negative impact on demand. Through the interview correspondence via the survey, the general sentiment was that crop protection was not an active consideration for a vast majority of shoppers. It is very important for a small number (2/12 according to findings through this report) but they have their needs fulfilled with organic products. Most customers are after the perfect apple or broccoli without insects and they realise that in order to get these products some form of crop protection is required.

People do have a perception that organic products are as effective as EPA-approved products, but the organic products don't have to prove they work. Unless there is EPA testing, there is no way to guarantee its effectiveness.

Sustainability has been considered synonymous with organic products, but, choosing organics over synthetic products on principle could be hurtful in the long run. Reason being, if one were to review some of the toxicity profiles of some of the "organic" crop protection products like azadirachtin (neem oil), this organically certified product is extremely hazardous to pollinators and bees. It is therefore a false argument that organics is better than synthetics.

Regardless of the above fact, media does influence decisions albeit pseudoscience at times as a possible premise to the argument. This phenomenon showed up through the answers to question 4 of this project's survey, whereby 67 percent of the survey population confided that media does have influence of some form (not necessarily impacting upon demand but could be a catalyst to the formation of a social movement and subsequent pressure groups). Other influencers within this category as such that cropped up through this survey process included pressure groups or social movements around ethical issues associated with a number of issues, such as irradiation and carcinogens. Pressure groups seek to influence policy or public bodies. Usually they arise as the result of social movement (Della Porta and Diani, 2015).

Given the importance of attaining social licence as a prerequisite to doing business and the fact that communication by way of social media can move so swiftly in today's era, the rise and influence of pressure groups on democracy must not be underestimated. In recent years, big businesses bowing

to such pressure have included: McDonalds and their announcement that it would phase out the use of chickens raised with antibiotics. The Ringling Bros. and Barnum & Bailey Circus in 2016 said it would stop using elephants in its shows. Animal rights groups who complained for decades prevailed in this instance. Nestle in early 2017 announced that it would remove artificial colours and flavours from Nestle Crunch and Butterfinger candy bars in the U.S. This is a case not so much of pressure from organised groups, but pressure from consumer behaviour. Consumers are increasingly buying “natural” and organic products and Nestle is simply responding to that demand trend. Genetically modified crops present a similar case of possibly misdirected pressure (Royal Society of Canada, 2001). In light of these pressure groups, it still appears to be upstream value chain participants who will or won't change behaviours, largely due to the commercial ramifications otherwise. The general public, namely food retail shoppers will tend not to consciously think of crop protection intervention of any sort but rather trust the retailer in whom the food is for resale.

This aspect of trust, which we have established is assumed of food retailers, is also influenced by the trust aspect that the general population has in the wider food industry and in short the government. The following bar graph depiction (Fig. 5.3) sourced from Statistics New Zealand is the most recent data pertaining to trust in New Zealand government institutions, including the ACVM and EPA with reference to crop protection. In recent years, the gauge of trust has been stable, with distrust of New Zealand government services even declining amongst the population.

Given the proxy of this project were food retailers, the below Statistics New Zealand findings correlate. One would always expect a dilution the further down the value chain one measures, i.e. 75 percent of the retailer sample population voted in trust of the New Zealand Food Industry as a whole, vs. 43 percent below. The general public (downstream participants) in the results below echoed a high degree of impartiality (45 percent). The impartial response from the retailers in this project was rather a lot more decisive with a neutrality rating of only 17 percent (2/12).

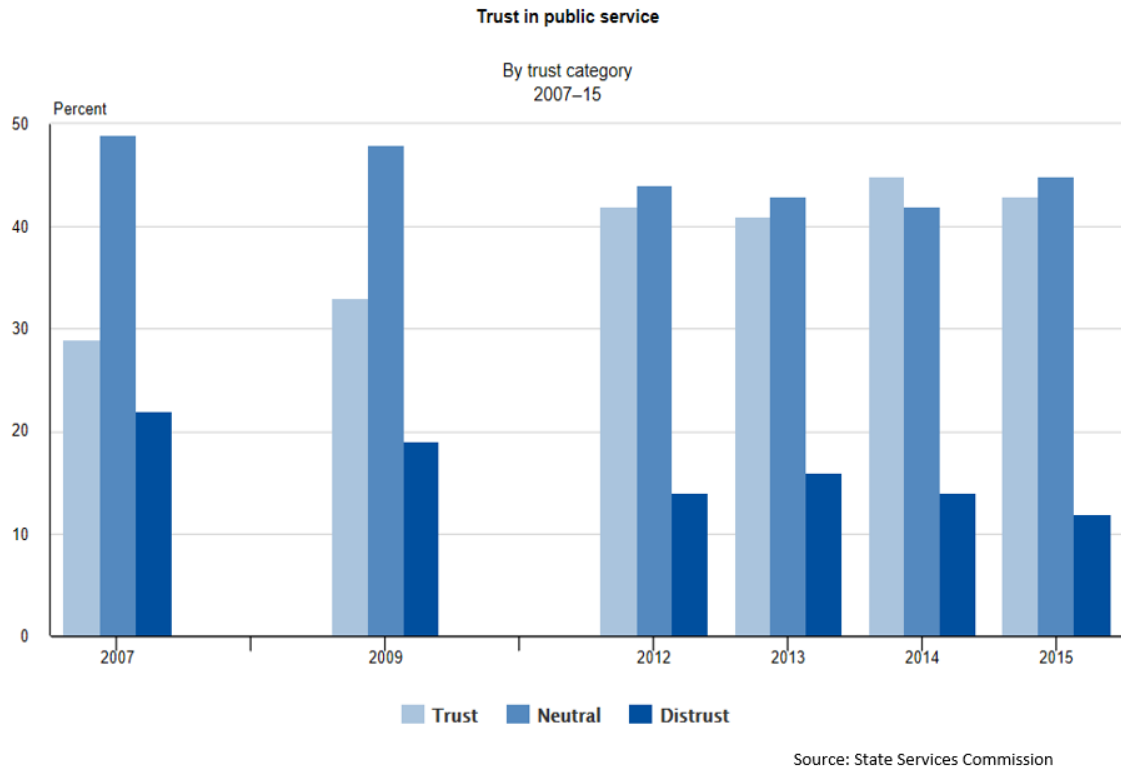


Figure 5.3: Trust in Public Service

Pursuant of this “trust” discussion, the linkages observed by way of this report’s survey (food retailers) and the Statistics New Zealand data, whereby the trust aspect in percentage terms was considerably less, shows the results in the two surveys mirror a similar pattern, although some big differences in percentage terms.

Albeit somewhat explained by the public’s position on the value chain, a critical problem that clearly exists is getting this trust to the consumers. Invariably, some will never believe as they believe in what they believe and good science will never persuade them otherwise. It is how to communicate with the masses in a way that is understandable to them. One big challenge all science based industries have in New Zealand (and the world) is getting scientists to communicate to the everyday man or woman.

The correlation between crop protection and communities is certainly not positive and might always be a “necessary thing” – but hopefully not evil. The aim of the crop protection industry both locally and globally needs to be to grow the neutrality ranking, subsequently reducing the negative mindsets. As far as practical application is concerned, the industry has grounds for daring to be somewhat transparent and overt on this front – especially in today’s market. Organochlorine (OC) insecticides, used successfully in controlling a number of diseases such as malaria and typhus, were

banned or restricted after the 1960s in most of the technologically advanced countries. The introduction of other synthetic insecticides – organophosphate (OP) insecticides in the 1960s, carbamates in 1970s and pyrethroids in 1980s and the introduction of herbicides and fungicides in the 1970s–1980s contributed greatly to pest control and agricultural output (European Commission, 2001). Each of these classes presented a step change as far as overall safety is concerned (both to the environment and communities), with subsequent phase outs and restrictions being imposed as the softer, more targeted options became available. Today we are looking at biologicals and even botanical based solutions. These progressions to where the industry has got to today bodes well for an improved social licence and subsequent public trust.

6. Recommendations and Guidelines for Stakeholders involved in the Crop Protection Industry

- Perception is reality. Crop protection value chain participants need an intrinsic understanding of why certain perceptions exist e.g. drivers, sources etc. with respect to food consumers. Understanding this and then working in such a way as to cater and appease the end consumer would be regarded as market orientation – a key business endeavour (and culture) likely to transpire into sector or organisational success.
- Whether real or imagined, public perceptions of the risk posed by pesticides and other agrichemicals used in food production can translate into very real effects in the market-place. In light of a world spoilt for choice, if we do not need to carry this risk, why would we? Sell the market the good and true story (this is where we need to get to). Examples of what is currently taking place that the crop protection industry needs to better promote to the market include:
 - Softer, more targeted crop protection working in conjunction with natural ecology is now wide spread practice across New Zealand agriculture. Practices including IPM and IWM are common vernacular that are employed across the industry. Also, the fact that the industry has progressed as far as safer and softer control options are concerned over the last few decades. From organochlorines through to organophosphates, to carbamates, pyrethroids and today the use of IPM friendly products through to biological control options. This progression has been a step change as science and technology advancements have made this possible. Not to forget, these technologies along the process have aided in many global pest and disease eradications and have

subsequently made possible more with less as far as food production is concerned. This kind of improved productivity means valuable natural wildlife habitat can be left intact despite a growing human population and urban encroachment into rural territories. The use of crop protection has also enabled New Zealand farmers to widely adopt conservation and no-till practices. The result has been improved soil health, reduced erosion and a reduction in the amount of greenhouse gasses generated by agriculture.

- The New Zealand crop protection industry is highly regulated, governed by two regulatory bodies, EPA and ACVM. Thus, the barriers to entry regarding what is permissible in New Zealand is tightly controlled. According to OECD indices, New Zealand rates ahead of comparison countries as far as product market regulation is concerned.
- The increasing use of biological type products - naturally derived products being brought into the crop protection arsenal. With an increasing focus on sustainability and safety to the environment, the use of biologicals is developing as an important management tool in modern farming. This has clearly been recognised, as is evident by the global funding in this space. A new category of crop management such as plants, fungi and bacteria. From a perception perspective and as captured within the literature review of this project, the general public perceive there to be less risk associated with the consumption of foods treated with any form of biological control. This is compared to those treated with synthetic chemical pesticides. Through an extensive Canadian study from where this information was attained, 80 percent of the respondents thought that food products should be labelled if biological control was used in the pest management programme.
- How we analyse the environment around us and develop a picture of the world is of great interest to marketers and how we best sell New Zealand's provenance stories. Ensuring that the companies or sector brands (or place of origin) become part of the world-view of the potential consumer is the main purpose of marketing communications - understanding perception processes is what puts the product there. This is paramount for New Zealand agribusiness given our small scale and the fact we can only compete globally by way of quality product wrapped up

within a great story. For food producers and associated manufacturers, i.e. the crop protection industry, the packaging and labels on products provides a rare opportunity to communicate directly with an interested buyer. In today's crowded food market, consumers have an overwhelming number of food choices as they stand in the aisle at the grocery store. There are so many seemingly similar products that when it comes down to it, the product label and what it does and doesn't say has a big influence. There is possibly opportunity for greater and smarter revelation as far as New Zealand food for retail is concerned regarding the safe and sustainable growing practices employed. "In the end. It is the authenticity of the story around which an organisation (or country) is able to build its products and the way that this appeals to a consumer that will shape the value able to be secured from what we grow" Ian Proudfoot, 2017 KPMG Agribusiness Agenda.

- Business as usual is no longer an option in the agricultural industry. If we want to earn and maintain our social licence to operate we must actively tell our story. I firmly believe that once food consumers of New Zealand produce gain even the slightest understanding as to the crop protection aspect of the food chain and some of the particulars., i.e. regulation scrutiny, IPM practices etc., the trust aspect will only solidify and New Zealand primary participants will be able to continue strongly in their quest of producing food utilising world's best practice. The results from this project's survey echo a fair amount of ambivalence in the public's overall view of pesticides. All New Zealand food chain participants have a role to play (broad stakeholder involvement) in telling our industry's story and earning our collective social licence to operate.
- Social agendas are driving markets in ways they never have. Off shore, major retail chains are differentiating their value proposition based on product values that were never considered 10 years ago. As a regulator, MPI (Ministry for Primary Industries) is beginning to hear concern from producers and processors that whatever regulation governments put in place will be exceeded by retail chains wanting to show they are providing greater levels of protection than their competitors. This approach is being driven by the fact that public acceptance and support can be as important, if not more so, than the approval of regulators. MPI, by way of the EPA need to ensure they are not hindering the new wave of crop protection technologies by using outdated regulatory frameworks.
- We are clearly operating in an era of misinformation and polarisation. An issue which is not helping the cause of agriculture and more specifically the crop protection industry is that of

public trust of the scientific fraternity. This observation, identified through both the literature review as well as deduced through this project's survey (whereby various trends and patterns pertaining to how questions were answered) suggested pseudoscience is possibly triumphant over true science more times than what bodes well for the crop protection industry. Some drivers of this movement include social media pseudoscience, pressure groups and media sensationalism, resulting in a lack of trust of what crop scientists are suggesting. People are also looking for "quick" and "easy" answers. As far as recommendations to this problem are concerned, it would be remiss not to ensure social media channels are being optimised as far as effective science communication is concerned in a way that is easy to comprehend.

Another recommendation would include the need for New Zealand industry bodies, of which there are many, i.e. New Zealand Apples and Pears, Sustainable Winegrowing NZ, Foundation for Arable Research (FAR), Agcarm etc., to become more vocal with respect to promoting all the good practice which is employed, in a bid to silence and/ or dilute some of the inaccurate news stories or pressure groups touting inaccuracies. In light of this approach, it will be of utmost importance that the growers/ members falling under these industry bodies exude "buy-in" and that they too are taken along on the journey – amendable growers. This will be conducive to a movement merging as many key stakeholders as possible involved in the value chain.

- As per some research commissioned by agricultural banking specialist Rabobank, conducted by Key Research and captured within the literature review of this project, the world is now a very different place than it was a few generations back and New Zealand is no different. Unfortunately, a larger proportion of this country does not have any affinity with the land, coupled with a very limited knowledge of agriculture, if any (by a large faction of the population). As was revealed in the 2017 KPMG Agribusiness Agenda, recurring concerns voiced include: there is a lack of focus placed on the agri-food sector in the school curriculum; funding models for institutions that are geared towards volume in favour quality; and the understanding that teachers hold of the skill requirements of today's agri-food sector. These major issues provide another reason why industry bodies and the ag -industry of New Zealand needs to better up-sell and even educate on all that our industry does and what we stand for. At the moment, it is very clear that a large proportion of the general public is none the wiser. A concerted voice of conviction may help to convince of larger faction of the New Zealand public.
- With respect to what constitutes crop protection, we need to foster an industry wide change of

vernacular, fostering a more holistic view. The words “chemicals” and “pesticides” are descriptors clearly utilised as catch-all categories for any and all crop protection practices. In reality and certainly in today’s era, this direct association is not necessarily accurate and instead lends to misconstruing what constitutes crop protection. Crop protection is the best and most accurate descriptor and should be interpreted or associated with a holistic view, taking into account scientific intervention, biological control and other, somewhat less intrusive forms of action than simply “chemicals” and “pesticides”.

7. Conclusion

The perception of the crop protection industry, with reference to New Zealand, is not that of an exemplifier denoting many positive connotations.

It is apparent that consumers of food have become increasingly more sophisticated, especially amongst the more affluent of demographic groups, including New Zealand and many export nations to which New Zealand conducts trade. This sophistication corresponds with increased societal concern with environmental quality and technological threats to that quality and an emergence of a growing health consciousness amongst the public.

Irrespective of the science and what is right versus wrong, a person’s “perception” is what matters to them, in essence “the whole truth”. The results generated through this project’s survey were not inconsistent from what was found through the literature. It was made very obvious that there is a high level of ambivalence as to all things “crop protection” and what constitutes this practice. This naivety does not bode well for the industry and was identified as an area whereby better messaging and education needs to take place in order to allay some of these misguided perceptions.

As a crop protection industry, possessing an intrinsic understanding as to what these perceptions are “of the general public”, the reasons and causes giving rise to these perceptions, be them negative, neutral or positive, should lead to operating in a more market orientated fashion. This recommendation was in light of the fact that food provenance is of utmost importance to New Zealand and for this reason the whole story associated with what New Zealand is producing needs to resonate and sit comfortably with the all-important end consumer.

Regarding the survey findings and the way crop protection is conducted in New Zealand, it is clear that a more cohesive and concerted voice of “truth” is required on behalf of the industry, with particular emphasis on the many great aspects that are unfolding through this process. The opportunities for stakeholders, integration with ecology, access to markets etc. that crop protection practice here in New Zealand facilitates needs to be better sold and conveyed to the general public. This articulation needs to be conveyed in layman’s terms given the apparent perceptions that currently abound.

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9. Appendix

The below survey was answered by 12 leading New Zealand food retailers (as a proxy to the general public).

Participants involved with this survey were assured that anonymity of answers would be strictly adhered to.

Survey Questions:

Please note:

All information gained through this survey will be used anonymously. Information collected will be used to model trends and cross-check against contemporary literature, with an aim of discerning what best practice looks like going forward (on all fronts).

Question One

1a. What type of business do you run?

1b. What is your experience in the food-retailing sector?

Question Two

2a. What is your interpretation of what constitutes crop protection?

2b. Are you aware that it is most likely some form of crop protection was used in the production chain from where your food for retail originates?

Question Three

3a. On a scale of 1-5 please rate the association of crop protection (or what you described as being crop protection) on your food for sale? "from your, or your businesses' perspective"

1 = extremely negative

5 = extremely positive

3b. Why have you given the above response?

Question Four

4a. Have there been any media articles or the like linked to crop protection on food that come to mind and may have impacted your decision making and/ or influenced your decisions in any way (this can be local or global information)?

4b. On a scale of 1-5 please rate the association of this information on your food for sale "from your, or your businesses' perspective".

1 = extremely negative

5 = extremely positive

Question Five

5a. Do you have trust in the New Zealand food industry from a crop protection standpoint?

5b. Please can you provide reason as to your answer?

Question Six

5a. How do you perceive the relationship between crop protection and communities/ environment? Positive or negative?

5b. Why?

Question Seven

7. Does the notion of crop protection application have a negative impact on demand across any food line in which you may be aware?

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