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Research Note: Breeding Priorities for the High-Value Pea Processing Sector

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Research Summary

Industry Overview: A recent market report provided by Pulse Canada states that globally, over 4,500 new food products containing pea and pea protein ingredients were launched in 2023 alone (Der 2024). While overall, the plant-based food sector growth has slowed relative to projections, the potential of the market has continued to attract new entrants into the Canadian pulse processing space, resulting in what processors have described as a highly competitive and price-sensitive market. China is accused of dumping pea protein into the North American market at below-market prices, adding to the competitive pressure on domestic processors. Despite these challenges, the food industry continued to drive growth in the demand for pea protein globally in 2023, with the pet food sector dominating demand at 83% while packaged food made up the balance at 17% (Der 2024). In the current environment, the sector has focused on the product and process innovation necessary to capture and create market share in the food ingredient industry.

Purpose of the research: This work provides valuable insights into pea protein markets to inform the direction and priorities of field pea innovation. We engaged stakeholders in higher-value pea markets to identify the traits most important to this industry and assess the potential premium high-protein peas might command. To our knowledge, pulse processors have not been consulted on gene editing for pulse breeding. This research looks to address this gap by gathering input from pea processors on the use of gene editing in varietal breeding. The full research report can be found here - <https://ageconsearch.umn.edu/record/358976?ln=en&v=pdf> - while a detailed summary of the survey and interview findings is accessible at <https://ageconsearch.umn.edu/record/358728?ln=en&v=pdf>.

Methods: Prior to conducting this research, we undertook a review of the literature of the Canadian pea and pulse industry to obtain a comprehensive description of both domestic and international markets for peas. Meetings were held with the Canadian Pulse Association, Saskatchewan Pulse Growers Association, Alberta Pulse Growers, and Manitoba Pulse and Soybean Growers to discuss the research objectives. Based on the meetings and the literature review, a short online SurveyMonkey survey and semi-structured interview instrument were developed to explore the pea attributes that processors valued, and the price premiums being offered for high-protein peas. The anonymous survey included nine questions related to processing capacity, varietal attributes of importance to processors, and premiums paid for pea protein. Open-ended, multiple choice and Likert scale questions were used in the survey. The 10-question interview guide asked respondents their thoughts on the plant-based food market, the pea attributes of value to processors, the use of gene-editing in pulse breeding, and the marketing potential of climate-smart peas. The University of Saskatchewan Behavioral Research Ethics Board approved the research project on April 10, 2024.

Introductory emails and follow-up reminders were sent to 34 prospective participants. Primary processors, food ingredient processors, and food manufacturers were invited to participate. The 12

who agreed to participate were sent a follow-up email providing additional information about the project, a copy of the consent form, and a link to the online survey. Virtual interviews lasting 45 to 90 minutes were conducted using Zoom between May and November 2024.

A semi-structured interview format allowed respondents to offer their opinions on the high-value pea market and information relevant to pea plant breeding for this market. The questions asked in the interviews varied depending on the type of products produced by the processor and the role of the representative participating in the interview. Participants held diverse positions within their organizations, including CEO, as well as roles in export sales, procurement, operations, and R&D, providing a variety of unique perspectives and adding to the breadth and depth of information gathered through the interview process.

Zoom's recording feature created an audio and written transcript of the conversation with participants. Thematic analysis was used to identify patterns and themes within the transcripts. Each transcript was read in its entirety and then read again to identify key ideas and concepts. The transcripts were read completely a third time, and statements were labeled based on the key concepts they represented. The transcripts were then reviewed to organize the key ideas into themes and categories to identify connections and patterns within the data. After this process was complete, the transcripts were reread in their entirety, guided by the emerging themes to ensure that all data relevant to the identified themes had been captured.

Findings

Gene-edited peas: While respondents overall understood the value of gene editing in terms of its benefits for plant breeding, all raised concerns about ultimate consumer acceptance of the technology. Processors generally felt consumers may not understand or accept gene-editing technology and might not distinguish it from GMOs. Most processors believed that introducing gene editing at this time could potentially be detrimental to the food ingredient market and the entire pulse industry in Canada, impeding the marketability of products containing peas.

Higher protein peas: While all respondents could agree that more protein content was beneficial and an important breeding priority for dry fractionators, it was not overall the highest breeding priority or primary concern for most stakeholders interviewed. There was no current market “pull” from ingredient buyers to increase the protein content of the pea flour, concentrates, and isolates that are available. Buyers were often described as overly sensitive to any price increases in the pea protein ingredients they were purchasing from processors. Processors believe that in the current market environment their customers would not be willing to pay more for a higher protein content product. Processors' experience with high protein varieties has led to a heightened awareness that improving specific attributes in breeding can result in compromises in terms of the other attributes the new

variety offers. There was concern over the possible trade-offs associated with breeding higher protein peas, either in terms of the loss of desired attributes (such as yield) or the creation of undesirable characteristics that negatively affected the processing or product quality of pea protein ingredients.

Climate-smart certification: Most of the processors interviewed indicated that they had some interest in or had taken steps to develop sustainability initiatives within their company. Many saw the benefit in such a designation as a potential competitive advantage, even if they did not necessarily think it had a market value in the form of a price premium. Though respondents saw potential benefits for the industry in adopting a climate-smart program, and a few thought farmers might benefit when marketing their peas under such a program, most agreed that pea ingredient buyers were not currently asking for this certification and would not be willing to absorb the cost of such a program through an increase in the price. While there was general agreement that industry-wide standards would be needed for a program to be feasible, most believed getting consensus on the definitions and standards necessary to develop such a program was a significant hurdle. Amongst those who supported the idea of industry standards, there was some concern about the administrative and financial burden that it would bring for their individual companies. Several indicated they felt it might eventually be something the industry would support, but for now, companies were focusing on their own environmental and sustainability projects.

Price: Price was described as a key factor for pea ingredient buyers, and processors were very aware of the need to be price-competitive, commenting that any additional cost resulting from purchasing higher-protein peas or establishing certification programs (for example) could not be passed on to buyers but instead would have to be absorbed by processors or producers. To remain profitable, companies were focusing on finding ways to keep the prices of their products down while increasing sales volumes through product innovations. To support product innovation, the sector has developed technology to improve specific attributes of peas, including taste and solubility.

Attributes of value to processors: The plant breeding priorities of processors were varied, reflecting the diversity of processing technology being employed and the specialized nature of the products that processors are continually developing in response to the evolving demands of the food ingredient market. Concerns focused on the need to have a consistent amount and quality of peas to meet operational needs at an affordable price. Consistency in the incoming raw material was a concern as this affected the efficiency of processing. Specific concerns raised included size, water absorption, and hull thickness. The ability to separate the protein from other elements within the pea was a concern with existing varieties. Pea protein taste was described as a limiting factor in peas as a functional ingredient in food manufacturing. The types and functional properties of the proteins in the pea were identified as important to processors.

Discussion

Respondent prioritization of other attributes over higher protein content for breeding, hesitation in adopting gene editing, and reservations about climate-smart certification may be explained by the significant competition and low profit margins associated with the food ingredient market. Processor interest in the types and functional properties of the proteins in the pea arise from the market demand for specific desired functions from pea ingredients but also signal processors interest in improving the efficiency of their processing, reducing the time and processes required to extract select proteins from the pea. Many processors described themselves as continually innovating and refining their processing of peas, often in response to an identified market need or request from a customer for new functional properties.

Gene-editing: Issues raised when discussing gene-editing included the implications for the image of pulses, segregation of gene-edited varieties, regulatory considerations, as well as the implications for the commodity markets and international trade of pulses. Processors viewed the current consumer understanding of peas as non-GMO as an advantage over other plant-based food ingredients such as soy. The words “natural,” “clean,” and “healthy” were used to describe pulses. Some processors anticipated a negative response from consumers and, in turn, negative implications for the pea ingredient market, while others were unsure how consumers might react and talked about a need to proceed with caution, advocating for significant consumer research and information sharing before adopting this technology. The implications of gene editing for accessing international pulse ingredient food markets and the larger Canadian commodity export markets were raised. Several processors felt the use of gene-editing could end up being a trade barrier for commodity sales which was the primary market for Canadian peas.

Higher protein pea varieties: A number of possible explanations for why increasing protein was not the highest priority were identified including a lack of demand and price sensitivity by food manufacturers, the current industry focus on functionality and product innovation, concerns related to the attributes of existing high protein peas, and related to this, fear of the trade-offs and potential “losses” of desired attributes if new high protein varieties were developed that could adversely affect both processing and products.

Although more protein was not a general concern, the functionality of the protein and therefore the attributes of the proteins within the pea, were of interest to processors. The current industry focus on functionality and efficiency is requiring processors to better utilize the protein within existing varieties. The proteins that will benefit a particular processor depend on the processing technology being applied and the products that the processor is trying to create. These desired properties change as the market evolves.

Focus on efficiency: Processors are focused on product innovation related to other elements of the pea including fiber and starch, reflecting their desire to get maximum value out of the entire pea. The growing market demand for pea fiber ingredients was identified by several respondents as an important future opportunity for pea processors. Many processors are utilizing pea starch and fiber in their own products or selling them as ingredients to other food manufacturers. The image of pulses as “healthy” is enabling inroads into ingredient markets and is thought by some to be creating a competitive advantage for peas as the replacement ingredient of choice relative to alternatives such as fiber additives or corn starch.

Alternative plant-based ingredients: The plant protein ingredient market is evolving quickly, and pea processors are beginning to discuss the attributes of faba beans that offer an attractive plant-based protein alternative to peas. Food ingredient manufacturers are also beginning to use chickpeas as a source of plant protein. With existing technology capable of processing a variety of pulses, alternative pulses are already emerging as contenders in the protein ingredient market and if production increases sufficiently, these other crops may potentially eclipse pea as the functional pulse ingredient of choice within certain markets.

Focus on yield: Yield was repeatedly mentioned as a priority for plant breeding. Most felt the price premium received for the higher protein content did not offset the yield loss experienced by producers when growing some of the high protein varieties that have been developed. Processors felt it was imperative that breeding for specific traits did not result in yield drag and that new varieties continually improved yield to meet the anticipated rise in demand by the market. Processors understood that peas compete for seeded acres with other crops, making it important that the per acre return be sufficient to persuade the producer to grow peas.

Trade-offs in plant breeding: Processors were aware of the trade-offs that occur with plant breeding. In the past, breeding for specific attributes had resulted in gains and losses in terms of the other traits the new varieties offer. They believed there was often a price to pay for any attributes gained, including yield drag. Breeding efforts that have focused on attributes of value to producers have occasionally led to the release of varieties that proved difficult to process or market because of undesirable traits.

Conclusions

Processors described the functionality of peas as an important strength that can currently be exploited in the ingredient market. Although more protein content has value, most processors are looking for improvements in other breeding traits that would facilitate the separation of the elements of the pea, improve processing efficiency and consistency in the final pea products, or enhance specific attributes in the pea, such as a particular protein, to expand the functional applications. While processors saw the value of gene editing in advancing pea breeding for desired attributes, they

had concerns about the consumer response to employing this technology in pulses that were marketed based on being non-GMO.

Processors stated they compete based on technology and product differentiation, focusing on developing functional pea ingredients that add value to food manufacturer's products. The competitive nature of the industry helps explain the interview findings that processors value pea attributes that improve the efficiency of processing or the functional value of peas as a food ingredient, and the importance processors place on improving yield through plant breeding. Addressing disease and production issues that will improve yield should continue to be a priority for breeding. Areas where policy interventions might be beneficial include financial support for the industry, supporting producer adoption of new pea varieties, industry standards for climate-smart programs, public acceptance of gene-editing, and an enabling and supportive regulatory environment for both processing and gene-editing.

At a time of growing competition in global markets, plant breeding is anticipated to play a key role in maintaining Canada's competitive advantage in supplying the quality and volume of peas needed to meet market demands. This research highlights the importance of understanding the needs of the entire supply chain and the increasingly specialized nature of the pea ingredient market. Improved ongoing communication and collaboration amongst the supply chain stakeholders could be beneficial in ensuring the quality and marketability of future pulse varieties. Including processor evaluation as part of the plant breeding process may identify issues with new varieties that have implications for value-added markets that would not otherwise be assessed. As more informed participants in varietal development, processors felt they could also play a role in promoting new varieties to growers for adoption. The challenge in breeding for these specialized attributes is that they are often specific to the product and food manufacturer, and processors readily admit that product innovation and market focus are evolving very quickly. What is of value today may not be tomorrow.

References

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