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Protein Catalyst

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# MARKET PATHWAYS FOR NOVEL FEEDS

## Canola as a Case Study for New Animal Feed Ingredients

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## ABOUT THIS REPORT

As part of its Protein Catalyst initiative, the MBOLD Coalition commissioned this case study to examine canola's development as a model for how novel feed ingredients can successfully reach commercial scale. Canola's evolution—from a crop with significant antinutritional constraints to one of the world's most widely used protein meals—offers valuable lessons for emerging ingredients navigating complex regulatory, nutritional, and market environments. Understanding the scientific, organizational, and industry strategies that enabled canola's adoption provides a practical context for accelerating the commercialization of new, sustainable feed ingredients.

This report synthesizes historical research and industry documentation to trace the coordinated efforts that shaped the acceptance of canola meal across the livestock sector. It highlights the role of breeding breakthroughs, research infrastructure, quality standards, nutritionist engagement, extension and outreach, and value-chain alignment in establishing canola meal as a trusted feed ingredient. The findings are intended to inform industry stakeholders as they evaluate pathways for commercializing new feed ingredient sources.

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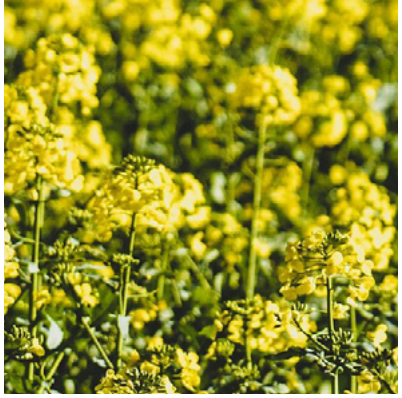

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## INTRODUCTION

Few agricultural commodities illustrate the full arc of novel crop development as clearly as canola. What began in Canada as an emergency wartime industrial use lubricant crop grew into an important source of vegetable oil and high-quality protein meal. The transformation of rapeseed into canola, and canola meal into a globally accepted feed ingredient, required decades of coordinated public research, deliberate industry/sector organization, strategic branding, and sustained market development.

This case study traces the development of canola from its rapeseed origins through the genetic breakthroughs that created the canola standard, with particular attention to canola meal: how its quality limitations were identified and resolved, how a research infrastructure was built to characterize its value for different livestock species, and how a coordinated commercialization strategy overcame nutritionist skepticism to establish canola meal as a mainstream feed ingredient.

## CANOLA AS A CROP: ORIGINS AND DEVELOPMENT

Pre-canola rapeseed (*Brassica rapa* and *Brassica napus*) varietals contained two major compounds that made them commercially problematic. The oil was high in erucic acid, a fatty acid with potential negative impacts on cardiac health, and the meal contained glucosinolates, which negatively impacted feed palatability and animal health. These constraints severely limited both the edible oil market and the utility of the meal as a livestock feed ingredient.

### Development Process

The transformation from rapeseed to canola began with improvements in oil quality. Canadian scientists screened rapeseed germplasm for erucic acid content, releasing the first low-erucic *B. napus* variety in 1968 and a *B. rapa* equivalent in 1971. The latter introduction followed the release of new data on erucic acid's potential antinutritional impacts (Downey K. , 2017). Canada reacted quickly to address this challenge, launching a full-scale production conversion to low erucic acid varietals that was 86 percent complete by 1973 (Downey K. , 2017) (Bell, 1982).

The second breakthrough addressed meal quality. Though the glucosinolate problem had been recognized since the mid-1950s, progress in developing new varieties was hampered by the slow pace of analytical methods. The identification of a low-glucosinolate variety in 1967 enabled University of Manitoba breeders to develop the first *B. napus* "double-low" variety (combining low erucic acid and low glucosinolates) in 1974, with a *B. rapa* equivalent following in 1977 (Bell, 1982) (Downey R. , 2006). Investment by the Canadian federal government was central to this progress (Rapeseed Association of Canada, 1974).

In 1978, the Rapeseed Association of Canada (RAC) registered the canola trademark (a contraction of "Canada" and "ola"), designating varieties with less than 2 percent erucic acid and less than 30 micromoles per gram of glucosinolates (Brewin & Malla, 2012) (Downey K. , 2017). By 1980, the six-million-acre Canadian rapeseed crop had largely been replaced by double-low canola varieties (Wilder, 2022) and the association had changed its name to the Canola Council of Canada.

# CANOLA MEAL

## Product Description

Canola meal is the protein-rich co-product remaining after oil is extracted from crushed canola seed. Depending on processing conditions and variety, canola meals typically contain 35 to 40 percent crude protein, total dietary fiber at 38 to 40 percent of dry matter, and 1 to 3.5 percent oil. Its amino acid profile is particularly notable for high methionine and cysteine content, making it a good complement to soybean meal. Canola meal also provides good levels of minerals and vitamins (Raboanatahiry, Li, Uy, & Li, 2021). Canola meal was proposed for inclusion in the Association of American Feed Control Officials (AAFCO) official list of defined ingredients in 1987, with an official definition approved and published in 1991 (See Figure 1).

AAFCO FEED INGREDIENT NO. 71.77

**Canola Meal**

| PROPOSED | PUBLISHED | AMENDED |
|---|---|---|
| 1987 | 1991 | 1995 · 1998 · 2011 · 2013 |

Is the low erucic acid, low glucosinolate meal obtained after removal of most of the oil by mechanical extraction, or by direct solvent or prepress solvent extraction of whole seeds obtained from the genus *Brassica* (*Brassica napus*, *Brassica rapa*, or *Brassica juncea*) from which the oil shall contain less than 2% erucic acid and the solid component shall contain less than 30 micromoles of any one or any mixture of 3-butenyl glucosinolate, 4-pentenyl glucosinolate, 2-hydroxy-3 butenyl glucosinolate, 2-hydroxy-4-pentenyl glucosinolate, and allyl glucosinolate per gram of air dry, oil free solid. When produced from *Brassica juncea* it must also contain less than 5 micromoles of allyl glucosinolates per gram of air dry, oil free solid. It must contain a minimum of 12% crude fiber and a maximum of 30 micromoles of glucosinolates per gram. It is used in the diets of animals as a source of protein, in accordance with good feeding practice.

***Figure 1:*** *AAFCO Ingredient Definition for Canola Meal (AAFCO, 2025, p. 445)*

The benchmark for protein meal in livestock nutrition is soybean meal, and canola meal's commercialization was based on that competitive terrain. Canola meal has slightly lower protein content than soybean meal, and contains more fiber, which is a disadvantage for energy density, particularly for poultry feeds (Dao & Moss, 2025). Its residual glucosinolates require attention in monogastric diets, but ruminants tolerate canola meal's glucosinolate levels well. Dairy feeding trials have established that cows fed canola meal produce more milk per day compared to those fed other commonly used protein supplements (Downey K. , 2017) (Raboanatahiry, Li, Uy, & Li, 2021). This performance advantage in dairy applications has become one of the most notable arguments for commercial adoption of canola meal.

### Early Limitations and the Path to Adoption

The development of double-low varieties mitigated the early constraints imposed by erucic acid and glucosinolates but did not immediately translate into market acceptance. The lingering reputation of high-glucosinolate rapeseed meal resulted in a more cautious approach towards the new product. Overcoming that resistance required an organized, sustained research effort designed to characterize the nutritional value of the new canola meal across species, document its safety and performance, and actively communicate those findings to feed industry professionals.

## COMMERCIALIZATION OF CANOLA MEAL

### Organization of Research Infrastructure

Seeking to overcome barriers to commercialization[1], the Rapeseed Association of Canada (RAC) created a multidisciplinary research committee with expertise spanning oil and protein chemistry, animal nutrition, plant breeding, and industrial oilseed processing. Critically, this committee had both the mandate and the authority to allocate research funds, not merely to advise on priorities. RAC was charged with addressing three main "'hold-up' problems—market development, product research, and extension" (Gray, Malla, & Phillips, 2001).

Initially, funding for RAC's efforts came from crushers and exporters through a voluntary levy system.[2] These funds were augmented by federal support through the Rapeseed Utilization Assistance Program (Gray, Malla, & Phillips, 2001). Federal funding ran on a dollar-for-dollar matching basis with RAC, providing approximately $200,000 (CDN) per year by 1970-71 and $375,000 (CDN) annually by 1980 (Bell, 1982) (Wilder, 2022).[3] From 1968 to 1980, these efforts funded more than 210 projects across multiple institutions, generating over 200 published scientific papers and multiple semi-technical progress reports (Bell, 1982). In addition to supporting RAC, the Canadian government also funded associated research through the National Research Council (NRC), Agriculture Canada, and at Canadian universities (Phillips & Khachatourians, 2001).

[1] In 1964, the Canadian federal government's Department of Industry identified several main barriers to large-scale development of rapeseed. These included an underdeveloped crushing industry, oil refiners with no incentive to invest in rapeseed, feed manufacturers demonstrating similar indifference, and product quality problems that undermined market confidence (Bell, 1982).

[2] The voluntary levy was $0.50(CDN) per tonne on rapeseed exports and domestically crushed rapeseed.

[3] In today's dollars (April 2026), $200,000(CDN) in 1970 would have a nominal value of approximately $1,650,000 (CDN), while $375,000 (CDN) in 1980 would be approximately $1,450,000 (CDN).

## Research Priorities and Species-Specific Characterization

The research committee's priorities were market-focused, supporting multiple animal feeding trials to demonstrate canola meal's nutritional value to the feed industry. Poultry received the most research attention, followed by swine and ruminants.

In terms of research focus, antinutritional factors (primarily glucosinolates) received the most attention, followed by protein and amino acids, digestibility, metabolizable energy, and energy value more broadly. The research committee also funded the development of analytical methods, processing technology, and early work on fiber reduction in the meal. By the late 1970s, this research had produced a body of evidence supporting practical feeding recommendations for major livestock species, and meal usage in Canadian manufactured feeds began to show steady growth, with adoption in the dairy, beef, swine, and poultry industries (Bell, 1982).

## Industry Coordination

The institutional vehicle for canola meal commercialization was the Canola Council of Canada (CCC), an industry association that brought together producers, crushers, exporters, and researchers. The CCC was the first agricultural association in Canada to "encompass all links in the value chain," (Canola Council of Canada, 2026) collecting levies from growers, crushers, and exporters, and providing a revenue base for product and market development, research, and extension (Wilder, 2022). A co-investment model combined these levies with matching federal funds, leveraging investment and creating stakeholder alignment.

The Council's research committee served as a planning forum, a priority-setting body, and a mechanism for allocating funds. Its multidisciplinary, interagency membership gave it credibility with both the scientific community and the feed industry. Importantly, it could say no; scientifically sound research proposals were rejected if higher-priority questions for market development remained unfunded (Bell, 1982). That discipline ensured that resources flowed toward the work most likely to unlock commercial value, rather than toward whatever attracted the most grant applications.

## Branding and Quality Standards

The registration of the 'canola' trademark in 1978 served as both a marketing and a quality assurance mechanism. By establishing legally defensible composition standards for canola, the Council gave buyers a reliable basis for distinguishing the new product from legacy rapeseed. This was essential for overcoming the reputational legacy of high-glucosinolate meal and for building confidence in international markets (Downey R. , 2006).

In Canada, new canola varieties must also meet certain quality standards for erucic acid and glucosinolates to be registered by the Canadian Food Inspection Agency for commercial production.



## Engagement with Animal Nutritionists and Feed Formulators

Animal nutritionists at several Canadian universities conducted extensive feeding trials specifically designed to generate the evidence base that feed formulators needed. This research was communicated through peer-reviewed publications, industry symposia, progress reports, and extension activities.

The extension function was not incidental. Feed manufacturers and refiners, as the research committee noted, often lacked the staff and internal capability to identify or act on research opportunities independently (Bell, 1982). Active outreach focused on communicating research findings in practical, actionable formats was used to connect industry with science.

## Market Development

Canola meal's market development was not limited to Canada. Sustained export development efforts, anchored in the quality guarantee of the canola trademark and supported by an expanding crush industry, opened markets around the world. Canadian meal exports, which had been negligible before 1980, grew dramatically once the double-low transition was complete and nutritional characterization was in place. Producers in Europe, the United States, and Australia also began to adopt and produce canola in the late 1980s and early 1990s. This international diffusion of the canola standard amplified the value of Canada's investment in variety development and product characterization.

The expansion of private sector investment and the introduction of herbicide-tolerant varieties in the 1990s brought significant agronomic gains (higher yields, improved weed management, greater crop flexibility) but also introduced new complexities. Market concentration among a small number of seed companies raised concerns about the pricing of new technology and the freedom of subsequent innovators to operate (Brewin & Malla, 2012). The dependence of herbicide-tolerant varieties on specific chemical systems created new regulatory and reputational risks (Wilder, 2022). Residual antinutritional factors in double-low meal (including sinapine, tannins, phytate, and fiber) continued to limit feed inclusion rates, particularly in poultry diets, driving the development of yellow-seeded varieties with lower hull content and improved digestibility. These issues did not undermine canola meal's market position, but they illustrate the ongoing challenges that accompany the success of a major commercial crop.

From a product with essentially no commercial standing prior to 1980, canola meal has grown into the second most widely used protein meal in Canadian-manufactured feeds, replacing soybean meal as a primary protein source in many dairy, beef, and swine rations and serving as a cost-effective complement to soybean meal in poultry diets. Globally, canola and rapeseed meals ranked second only to soybean meal as the most widely traded protein ingredients in animal feed (Casséus, 2009) (Roche, 2015).

## CANOLA AS A FRAMEWORK FOR NOVEL FEED INGREDIENTS

The development of canola meal from a nutritionally problematic co-product to a globally accepted feed ingredient is a well-documented commercialization journey in the history of animal nutrition. It took decades to move from identifying the problems with erucic acid and glucosinolates to fully converting the Canadian crop to double-low varieties and establishing canola meal as a mainstream protein source. It required the coordinated efforts of government agencies, laboratories, university researchers, producer associations, industry, and trading partners. This collaboration pooled investments across multiple stakeholders who individually could not have justified the cost.

An examination of their efforts offers several potentially significant insights into efforts to develop markets for new feed ingredients:

- **Product Definition Precedes Market Development**
  The canola brand represented a quality standard backed by breeding targets and analytical methods. Without the double-low standard the entire market development effort would have lacked a credible foundation.
- **Focus on Research with Commercial Purpose**
  Prioritization of research aimed at market development (including feed trials) provided a strong base for the formulation of canola-based feeds. A feed ingredient without practical feeding recommendations is an ingredient that won't be widely adopted, regardless of its theoretical nutritional value.
- **Extension and Outreach**
  Feed manufacturers and nutritionists do not spontaneously adopt new ingredients on the basis of published literature. Active communication of research findings was a necessary and deliberate component of the canola meal market development strategy.
- **Industry Coordination is Key**
  The combination of producer levies, government funding, multidisciplinary expertise, and research investment produced a research and development engine that no individual organization or company could have built alone, let alone sustain over several decades.
- **Quality Improvement is Iterative and Ongoing**
  The decades of effort that developed the double-low varieties and launched canola as a commercial crop were not the end of its development story. There has been ongoing investment focused on increasing yields, improving processing, and addressing antinutritional factors.
- **Incumbent Ingredients as a Commercial Benchmark**
  Canola meal's market development was evaluated against soybean meal. Emerging novel ingredients will also be characterized relative to the ingredients they seek to replace or complement.

The canola model may not transfer wholesale to every novel feed ingredient context. The economics of producer levy (checkoff) systems, the availability of public research infrastructure, and the regulatory environment will vary by crop and country. Despite this, the underlying principles (resolve the quality problem first, organize research for nutritionist impact, invest in extension and technical support, stakeholder coordination, benchmarking) apply broadly. For developers of other novel protein sources attracting research and commercial interest, the canola meal example offers both inspiration and a practical roadmap.

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