Czech University of Life Sciences Prague

CROP DIVA

The Feed Value Chain of Triticale in Czechia

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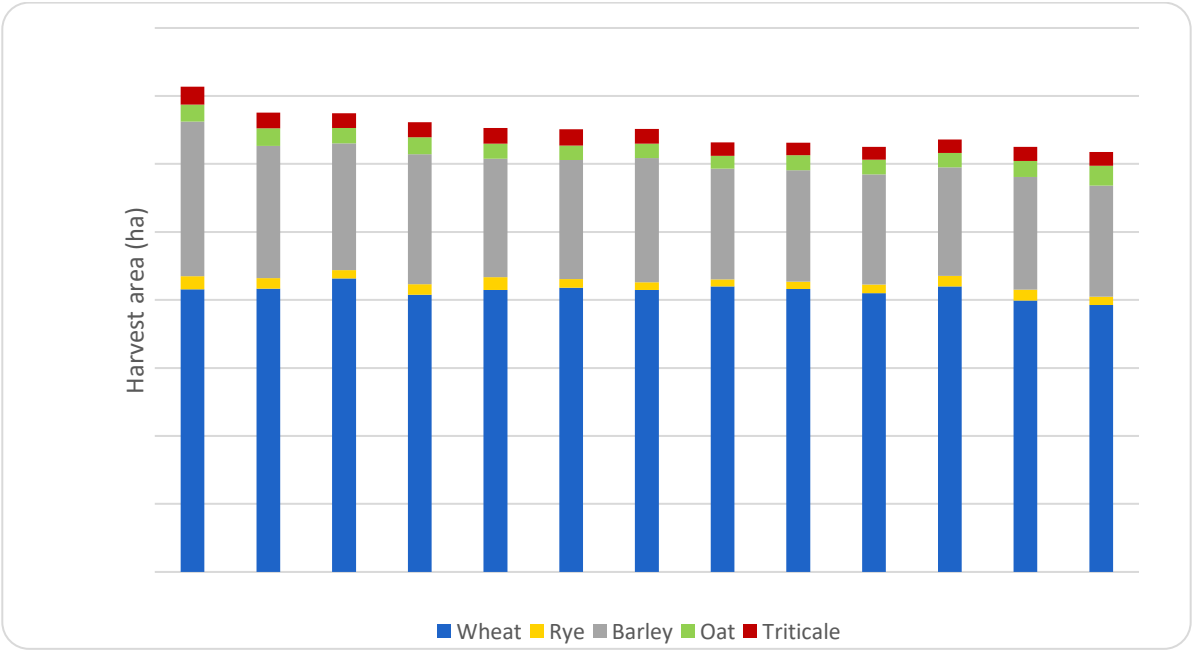
1.1 Triticale in the Czech Republic

Triticale is an interspecies hybrid of common wheat (genus Triticum) and rye (genus Secale). In the Czech Republic, the varieties of winter form are the most grown.Triticale is more tolerant of worse growing conditions than wheat, has a high yield potential and is characterised by good health. Triticale has a high feed value, which is due to its higher protein content and favourable amino acid composition, mainly higher lysine content. The protein utilization in feeding is higher than that of wheat (Konvalina, Moudrý et al., 2008). Plant phytosamide is also used as an early green feeding, the advantage of which is a large amount of formed mass and slower ageing. However, triticale can also be used for bakery products, it has not been established for bakery purposes in the Czech Republic. Triticale flour pastry is low and not flexible enough.

Triticale is a crop with a smaller range of cultivation and use, so a detailed commodity balance on its use is not monitored. In the Czech Republic it is mainly used for feeding purposes and for seeds (MZe, 2020).

The triticale harvest in 2020 amounted to 213.3 thousand tonnes and was 9.2% higher compared to the previous year. The average yield per hectare of 5.07 tonnes was reached on an area of 42.1 thousand ha (year-on-year increase of the area by 6.0%). In marketing year 2020/21, the domestic consumption of triticale is expected to be 5.8% lower, at 162.0 thousand tonnes. The total use is estimated at 180 thousand tonnes, 2.8% lower year-on-year. With an estimated import of 2.0 thousand tonnes, the export is expected to be 18.0 thousand tonnes. The estimated self-sufficiency rate is higher by 18.1 pps. year-on-year due to higher production and is 131.7% in 2020/21. The average annual price of agricultural producers was 3 768 CZK/tonne and was 5.8% lower year-on-year (ÚZEI, 2020). The development of sowing areas compared to other basic cereals is reported in Graph 1. The sowing area of triticale was 3.3% in 2021 (in 2009 it was 3.7%).



Graph 1. Development of the triticale sowing area in the Czech Republic and its share in the basic cereals group
Source: Own elaboration based on data from the Czech Statistical Office (2022).

Triticale is grown in the Czech Republic primarily for the purpose of feeding livestock, which has been confirmed by the interviews. We started to conduct interviews from the umbrella level with organisations of a research and control nature.

1.2 Overview of the interviews completed

Prior to conducting the interviews within the value chain triticale, we conducted an analysis of potential interviewees through the website and also on the basis of three interviews of a general nature focused on the market of triticale cultivation in the Czech Republic. The interviews were conducted with representatives of the following organizations: Faculty of Agrobiology, Food and Natural Resources of the Czech University of Life Sciences in Prague, Central Institute for Supervising and Testing in Agriculture and OSEVA UNI, a.s. At the same time, we received contacts from individual links in the chain to other cooperating entities.

Table 1. Overview of the number of interviews performed for each VC actor

VC actor	Numbers of interview
Organisation (extension, research, etc.)	3
Seed supplier, seed multiplier	4
Producer	4
Processor (feed mill)	2
Seller (directly to endconsumers)	2

As shown in the Table 1., 15 interviews were conducted, of which one was conducted by telephone, the other face to face. There are twenty varieties of triticale registered in the Czech Republic, of which only two are Czech origins. These two Czech varieties are in the maintenance phase, the other breeding activity has been terminated. Central Institute for Supervising and Testing in Agriculture recommends 10 of these 20 registered varieties for cultivation in Czech conditions, and not one Czech variety appears on the list of recommended varieties (ÚKZUZ, 2022). For this reason, no one interview was conducted with the triticale growers, but with seed suppliers and seed multipliers.
Triticale is monitored as a fodder crop, it is a short value chain. The chain ends with the feed processor, who sells the final product back to the grain supplier or sells it directly to other customers. There is no wholesale in this chain.

1.3 Results

1.3.1 Description of the triticale value chain

As mentioned above, triticale is monitored in the Czech Republic as a feed crop within the CROPDIVA project and its value chain is very short. Triticale is most often grown as a winter crop, used for direct green feeding or processed into compound feeds. These compound feeds are prepared based on individual customers' recipes and triticale is usually up to 20 % in them.

The Czech triticale value chain is stable and functioning. There are two main factors that influence a farmer's decision whether to grow triticale. The first factor is the price, or rather its comparison with the purchase price of wheat. The second factor is animal production, which is a very important link.

There are two possible distribution channels for triticale production. The first is that the triticale producer keeps all or part of the harvest to feed livestock (in green form or mixes the feed himself). In this case, the entire triticale value chain consists of only 2 actors (plus seed importers to the Czech market from abroad). The second distribution channel involves feed processors, where the triticale producer delivers the harvested grain to a processor who returns the final product to him: a compound feed for livestock. In a very small proportion, the entire batch of the final product is not bought back by the triticale producer but is resold to another customer by the feed processor. This is a very small percentage of the final product distributed in this way.

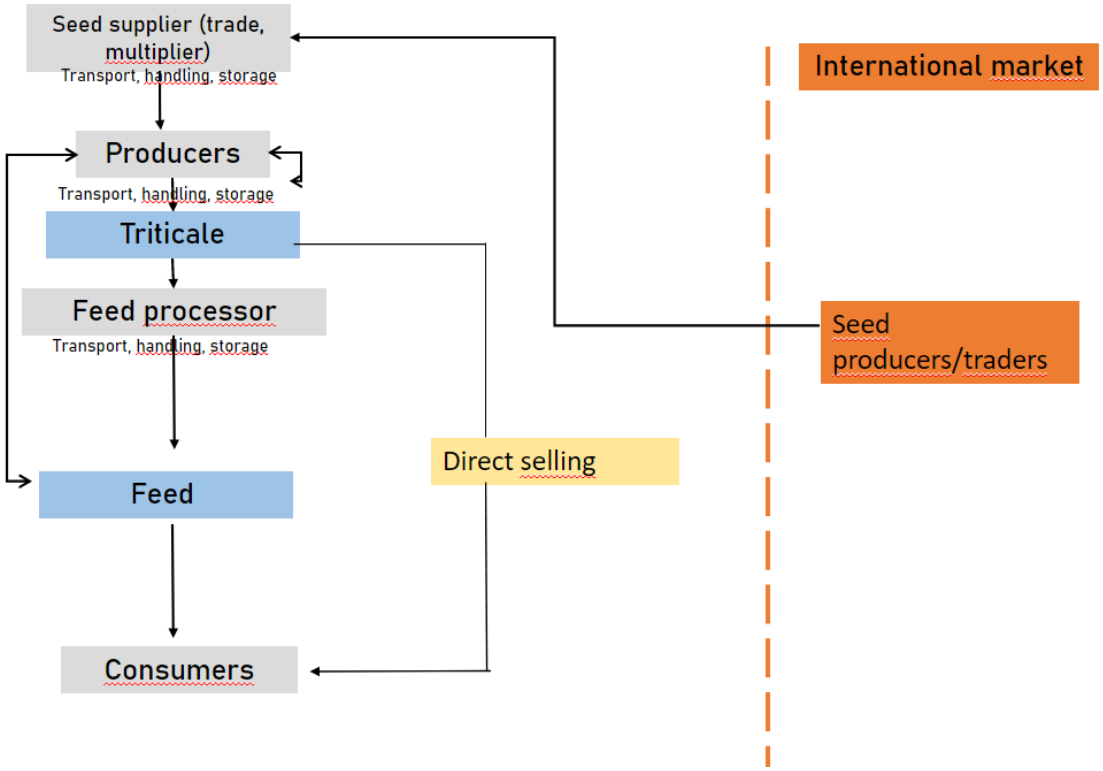


Figure 1. Triticale feed value chain in the Czech Republic

1.3.2 Input suppliers

Czech seed companies buy triticale seeds from foreign suppliers, mainly from Poland, Germany and the Netherlands. Czech native varieties of triticale (Kinerit, Kvido) are only in the maintenance phase. Breeding programmes have been terminated. Registration and recommendation of varieties is carried out by the Central Institute for Supervising and Testing in Agriculture, an organisation established by the Ministry of Agriculture of the Czech Republic. Seed control is then carried out by Czech Phytosanitary Services, which was affiliated with the first mentioned organisation a few years ago.

VC capacities & organization

Vertical and diagonal linkages

The seed trading companies are in contact with the growers not only as a supplier of inputs, but also as a buyer, when the producer arranges the multiplication of seed material for the seed supplier. These are long-term relationships, very often not contracted, when the farmer grows seed for the supplier company. He does not sell the material as seed himself.

Knowledge and technology of actors

Triticale is an unpretentious crop in terms of soil preparation, cultivation and harvesting. Triticale is more tolerant of poorer soil conditions, worse pre-crop, low soil pH. It is more stable in yields in areas where winter wheat is less successful. Cultivation and processing of triticale does not give rise to any special knowledge or technology requirements.

Entry barriers

There are no entry barriers from the point of view of seeds providers. The limiting factor is the decreasing numbers of livestock in the Czech Republic, on which the cultivation and processing of triticale is heavily dependent, as well as the feed-in price of wheat, which exceeds the feed-in price of triticale.

Varieties must be entered on a list of registered varieties, which is checked by the state.

Resource and infrastructure

Inputs availability

Seeds traders have a stable supply of registered varieties of triticale. Cultivation of triticale as feed is at the “maturity” stage of its life cycle in the Czech Republic. Therefore, there are no major deficiencies in terms of resources and infrastructure.

Existing and required infrastructure

The current infrastructure is stable, there are no requirements or gaps. Within the built infrastructure, communication takes place based on good relations and long-term cooperation.

Logistical issues

Logistical problems were not mentioned in the interviews. The logistics of the seed material are mainly provided by the seed company. Exceptions are cases where transport costs between the seed company and the farmer are optimised so that all the implemented journeys are utilised.

Market conditions

Market trends and demand

The supply of triticale seeds in the Czech Republic is sufficient. Farmers make their decisions based on the recommendations of the inspection authorities and their own long-term experience. One can trace the regional inclination towards a certain seed seller, which results from regionally set relations. The purchase by farmers is based on the personal offer of the commercial representative of the seed company and then based on the price of the seeds and the declared yield. Both spring and winter varieties of triticale are offered on the Czech market, with the fact that the winter varieties clearly prevail.

Market size

The size of the market corresponds to the share of cultivation of triticale in the basic group of cereals in the Czech Republic. As mentioned, triticale makes up only 3% of the cropping area of the basic cereals. The interviews showed that farmers are more likely to reduce the cropping area than vice versa.

Distribution channels

Seed sellers deliver seed material directly to their clients. This affects the building of personal relationships between farmers and seed suppliers to such an extent that there are often no contracts between these actors.

Framework conditions

Regulatory and institutional environment

Triticale is grown in conventional agriculture and is therefore not subject to organic cultivation regulations. Apart from the registration of varieties and control by the state authorities mentioned above, the cultivation of triticale for animal feed purposes is not subject to any specific regulations.
Each seeding company monitors the quality of the seed material at its own expense and sends it to Central Institute for Supervising and Testing in Agriculture.

Role of public sector (support, policies, etc.)

The cultivation of triticale for feeding purposes is not in the direct interest of the agricultural policy of the Czech Republic, it is not supported by subsidies and the public sector does not show any support for it.

1.3.3 Producer (farmer)

All farmers surveyed agreed that triticale cultivation is a marginal issue and is very strongly linked to livestock farming. However, the reduction in the number of feed animals and the widening price gap between wheat and triticale are factors that point to a future reduction in triticale area. None of the farmers said that they would like to increase the area sown to triticale in the future. Only one of the farmers surveyed stated that he grows the spring variety triticale for seed multiplication. The reason is a friendly relationship and historical bond with the seed supplier rather than significant economic benefits. From an agrarian point of view, farmers use triticale as an intermediate crop.

VC capacities & organization

Horizontal and diagonal linkages

The interviewed farmers mostly know the other farmers, they do not compete with each other in growing triticale. This is mainly because, as already mentioned, the farmers grow triticale mainly for their own use as livestock feed. They sell only the surplus to other customers, but this is a minor part, and it is a supplement to the main activities. The individual actors making up the value chain triticale are not organized, however, there is a good relationship between them on which their business is based. Only one respondent (agricultural cooperative) said that they take seeds and sell the output material (grain triticale) based on official contracts.

Knowledge and technology of actors

As it is a long-term experience with growing triticale in the Czech Republic, there are currently no requirements for additional knowledge or technology on the part of farmers (speaking about growing triticale for feed purpose).

Entry barriers

There are no entry barriers for triticale growers.

Resource and infrastructure

Inputs availability

Cultivation of triticale as feed is at the “maturity” stage of its life cycle in the Czech Republic. Therefore, there are no major deficiencies in terms of resources and infrastructure.

Existing and required infrastructure

The current infrastructure is stable and sufficient. If there is a problem with storage capacities, it is solved in cooperation with a feed processor, who dries and stores the triticale grain, or also stores finished feed mixtures.

Logistical issues

The logistics of the material are provided according to the capacities of the producers, mostly by their own means. According to the volume of the material transported and the available transport capacity, the logistics are mediated by the supplier (farmer) or to feed processor. The transport costs are optimized. For all respondents, the logistics is carried out based on a personal agreement, without contracts.

Market conditions

Market trends and demand

The demand for the cultivation of triticale and its processing as feed is stable and decreases or increases proportionately with the number of farmed animals. Growers who do not have livestock production do not grow triticale. The higher feed-in price of wheat and maize plays a role here too.

Market size

The size of the market corresponds to the feed needs for livestock kept in the Czech Republic. Over the last 20 years, the number of livestock has fallen mainly in the pig category (-56%), poultry (-15%) and cattle (-9%). Related to this is the decline of livestock farms, where their number has fallen by 47% over the same period (CZSO, 2021).

Distribution channels

Distribution channels between farmers and feed processors are mutually agreed upon. Other distribution channels are hardly built up. Only a small percentage of the final product - compound feed containing triticale - is placed on the market. And even in such cases, it is mediation of sales based on personal connections.

Framework conditions

Regulatory and institutional environment

Triticale is grown in conventional agriculture and is therefore not subject to organic cultivation regulations. Apart from the registration of varieties and control by the state authorities mentioned above, the cultivation of triticale for animal feed purposes is not subject to any specific regulations.

Role of public sector (support, policies, etc.)
The cultivation of triticale for feeding purposes is not in the direct interest of the agricultural policy of the Czech Republic, it is not supported by subsidies and the public sector does not show any support for it.

1.3.4 Processing firm (feed processor)

The processing of the triticale grain into the feed mixture takes place in two possible ways. The first is that the farmer is able to make the feed mixture himself, which means that he has the necessary technology (feed mixer) and does not need any external processor. In such case – the value chain ends with him. The farmers who have the possibility to make mixture feed by themselves have stated they will feed this mixture for their own livestock and they do not resell it. This is not in their economic interest. The second possibility is that the feed mixture is processed by the feed processor, who mixes the feed mixture according to the customer's recipe and the farmer buys the final product back for feeding. If the farmer does not buy back all the feed mixture, then the feed processor sells it to another customers. There are no pre-contracted orders for this sale, everything is solved according to the current situation and as one respondent said: "...I always sell whatever is left to someone. I don't need marketing or a contract to do that. "

VC capacities & organization

Horizontal and diagonal linkages
All types of cooperation have been described above. The feed processors know each other in the region, they do not cooperate in any closer way.

Knowledge and technology of actors
The knowledge and technology for processing triticale into feed mixture is well established and if any new technology for mixing compound feedmixtures appears on the market then it is purely an investment decision by the company following their strategy and objectives. The processing of triticale as feed does not encourage the producer to buy new technologies, as triticale does not have any special or different processing requirements compared to other cereals.

Entry barriers
They do not exist (except for the barriers given by the classic functioning of the market).

Resource and infrastructure

Inputs availability
Inputs are the production of triticale and other crops from growers, which are dependent on sown areas and subsequent harvest

Existing and required infrastructure
Described above (producer part).

Logistical issues
Described above (producer part).

Market conditions

Market trends, market size and demand
The demand for triticale cultivation and its processing as feed is stable and slightly decreases or increases with the number of livestock.

Distribution channels
Described above (producer part).

Framework conditions

Regulatory and institutional environment
The competent authority for supervising the production and marketing of livestock feed and its correct labelling is the Central Agricultural Inspection and Testing Institute, which registers or approves all feed processors in the Czech Republic. The State Veterinary Administration supervises the health safety of feeds - microbiological contamination (salmonella contamination) as well as the use of animal proteins, including fishmeal, in feed for livestock.

Role of public sector (support, policies, etc.)
The cultivation of triticale for feeding purposes is not in the direct interest of the agricultural policy of the Czech Republic, it is not supported by subsidies and the public sector does not show any support for it.

1.4 Discussion

Based on interviews conducted at all levels of the value chain of triticale cultivation for livestock feeding, it was found that interest in triticale cultivation and its processing in the Czech Republic is rather declining. The main factors influencing this trend are a) declining livestock numbers and b) low competitiveness in relation to wheat and maize. It could be said that despite the tradition of growing triticale in the Czech Republic, despite the knowledge of the nutritional benefits of triticale as feed and despite the knowledge of all the benefits of growing triticale as a crop (low-input crops), farmers make decisions based on economic aspects.

1.4.1 Past challenges & successes of the value chain

Based on interviews mainly with organizations involved in research, seed quality control, phytosanitary control, and seed companies, it was noted that in the past in the 1960s. and in the 1970s triticale was bred to satisfy both sides of the application, both feed, and food. In the bred varieties, very good feed results were achieved especially in terms of protein content, in particular lysine content, but triticale failed to make it on the food market. Triticale has not managed to cope with this obstacle to this day. Bakery companies only mix triticale in bread baking mixtures on a very small scale, due to poor baking properties. When triticale is used in flour mixtures for bakery processing, it is a product for the health food segment, where reduced gluten content is applied. The only success was the product “Grain

bread", which contained a high proportion of flour from triticale, however, it did not hold up in the Czech market.

The challenge that triticale has not been able to cope with was the reduction in livestock, with the demand for triticale as feed falling in direct proportion. Another factor influencing the demand for triticale, despite its good yields, is the low level of competitiveness in relation to feeding wheat or better said its price.

The value chain of cultivation and processing of triticale as livestock feed is based on historical experience, relationships and no significant problems were underlined by the respondents that would limit the functioning of this chain.

1.4.2 Current and foreseen challenges and chances of the value chain

From the point of view of growing and processing triticale for livestock feed, it could be said that there is currently no significant challenge on the Czech market.

In general, the challenge can be seen in the increased promotion and education of all the benefits of triticale in follows areas:

A) triticale cultivation
- large canopy cover, strong and profuse roots, high acquisition and use efficiency, good cover crop, resistance to yellow rust and powdery mildew, resistance to Fusarium head blight

B) the use of triticale as livestock feed
- higher protein content, (e.g. lysine, tryptophan), silage for feed

C) the use triticale as food
- bakery products, breakfast cereals, pasta, extruded snacks, malting/brewing products

D) technical usage of triticale
- biogas, bioethanol

Current possibilities for further use of triticale are available in the distilling industry. The first Canadian experiments 30 years ago with the use of triticale in the distilling industry showed that excellent quality of spirits, even Scotch whisky, can be achieved. However, the rye-triticale blend to produce specialty spirits has proved very promising.

Other prospective areas for the use of triticale are to produce biogas and bioethanol. With today's predominant "cold" way of sugaring using bacterial and fungal enzymes, the processing of triticale is also economically advantageous, and as far as alcohol yields are concerned, triticale can be identified as a prospective raw material to produce alcohol (Kučerová, 2006).

Table 1. Summary of the challenges, strategies and potential benefits

VC actor	3-5 main challenges (order: most important first)	Strategies undertaken/to undertake	Potential & benefits for the actor in the VC chain
Seed supplier + breeders	1. Sustainable demand 2. Improving the quality of varieties in relation to their use (bakery products, technical use)	1. Education: to support high performance triticale even in less favourable conditions 2. Support for breeding programmes	1. Boosting demand 2. Increasing revenues 3. Long-lasting potential through new varieties for widespread use
Producers (farmers)	1. Straightening competitiveness compared to wheat and maize 2. Decreasing livestock numbers (mainly pigs and poultry)	1. Concentrated pressure (via associations) on food chains to increase demand for domestic livestock products 2. Broad promotion of the nutritional benefits of triticale	1. Increased competitiveness in the feed market. 2. Increasing revenues. 3. Increase of cropping areas by low-input crop
Feed processor	1. Expanding the supply of compound feed with high added value of proteins	1. Cooperation with producers 2. Public relations (CZE market, foreign markets)	1. Increasing revenues. 2. Extension of the product portfolio 3. Acquiring new customers

1.4.3 Limitations

The interviews were conducted at all levels of the value chain, when we proceeded with the snowball method. Since it is a stable and short value chain, the degree of saturation of information was quite quickly filled.

A limiting factor may be that there were no actors among the respondents who, to a certain extent (to a limited extent), deal with the use of triticale other than for feed purposes. We are talking here mainly about the future possible use of triticale for the processing of biogas or bioethanol. Such producers and processors were not included in the research due to the nature of the research assignment.

1.5 Synthesis

Triticale value chain in the Czech Republic is in the stage of maturity within the life cycle. It is a short and stable value chain that has built up very good communication and distribution channels during its development, cooperation is built on good relationships. All respondents agree that the cultivation of triticale for feeding purposes is a marginal issue and is very strongly linked to the level of livestock

production in the Czech Republic. With the decreasing trend in the number of farmed animals, the interest in growing triticale also decreases.

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