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Cultivation and chain development of novel crops in Ukraine

Research into collaboration between the Netherlands and Ukraine in cultivation and chain development

Wageningen, the Netherlands, 19 August 2025

The Agency for a Healthy World

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Table of contents

1 Summary

Ukraine's strong agronomic expertise and favorable growing conditions make it an ideal partner for agricultural collaboration. Protein rich crops and fiber crops (used for biobased building materials) offer opportunities for innovation and value creation. For most parts of the agricultural supply chain, Ukraine has a significant amount of knowledge and expertise; For specific aspects within production, storage, processing and market, cooperation with Dutch partners in technologies, products and knowledge is expected to have an added value.

Ukrainian producers face many challenges, including labour shortages, limited mechanization, and underdeveloped infrastructure for irrigation, storage, and logistics. Dutch expertise can help address these issues across the value chain, from soil analysis and cultivation to post-harvest processing and market access. Precision agriculture, modern equipment, and knowledge exchange programs are particularly valuable.

EU policies and market developments towards protein-rich crops and sustainable/biobased materials also create new export opportunities. To realize this potential, both countries must overcome trade barriers, align regulations, and build strong partnerships. Dutch government and European support, through financial tools, regulatory collaboration, demonstrations and cluster development, can play a key role.

Ultimately, successful collaboration depends on a shared vision and mutual respect. Companies and governments from the Netherlands shouldn't force solutions to the market. Instead, Ukrainian stakeholders should lead the process, with Dutch and other EU partners offering support that builds long-term trust and strengthens agricultural chains in both countries.

Our definition for this study:
Novel crops: crops that are not widely grown in Ukraine yet.

2 Introduction

1 Introduction

Agriculture occupies a central place in Ukrainian society and economy. It constitutes a key sector in terms of employment, production, and export potential, while also serving as a deeply embedded element of social and cultural life. A large share of the Ukrainian population maintains a direct connection to agriculture, either through ownership of small household plots or through professional involvement in the sectors (between 2012 and 2021, the average employed population in Ukraine within Agriculture, forestry and fishing was 17,5%) (UkrStat, 2025). This is why crops can hardly be called 'novel crops' when talking about crop potential for Ukraine, because there is no crop that we encountered that was not grown in Ukraine before. The definition we use in this study for novel crops is 'crops that are not widely grown in Ukraine yet'. On a global level, the sector holds a key role as well, providing quality grains and oil seeds on an exceptionally large scale.

The Ukrainian agricultural sector is characterized by a broad and well-established ecosystem. It comprises producer organizations, processing associations and a wide range of domestic enterprises engaged in the production of agricultural machinery, inputs, storage facilities, and infrastructure. At the same time, the sector is increasingly engaged in international partnerships, reflecting an openness to innovation, modernization, and external expertise.

Collaboration between the Netherlands and Ukraine holds significant potential for adding value to both countries across various crop and supply chains. Ukraine is a large country with many different regions that have a favorable climate and good soil qualities for cultivation activities. The Netherlands is a relatively small country that is known for its expertise on amongst others crop diversification, high value crops and precision techniques. Both countries are globally relevant agricultural importers and exporters and might be able to learn a lot from each other and benefit from collaboration.

This research aims to identify opportunities for a win-win situation in collaborations between the Ukrainian and Dutch agricultural sector by effectively aligning demand, supply and possibilities of (novel) crops in Ukraine. It explores both commercial prospects and the role of government and sector organizations in supporting this partnership through activities such as exchange of technology and knowledge, support through government initiatives and support with export and import.

2 Background

Cultivation characteristics of Ukraine

Ukraine has excellent conditions for crop cultivation in terms of water supply, climate conditions and fertile soils. The country is largely flat, and the highly fertile chernozem soils and warm, moderately rainy summers, primarily in southern and eastern regions of the country, provide ideal conditions for crop cultivation (Román, 2024).

The country has an abundant supply of water for irrigation due to its vast river network including the Dnipro, Dniester, Pripyat, Donets, Southern Bug, and Desna rivers, as well as more than 3 000 lakes, and over 1 100 artificial water reservoirs. Before Russia's full-scale invasion into Ukraine, most of the irrigated agricultural areas were located in the central and southern parts of the country. Waterways provide effective means of transportation in general and also more specific of agricultural commodities.

Climate change-induced weather extremes and temperature rise are increasingly challenging the country's favorable agricultural situation. The southern and central regions are expected to become drier, while the western and northern areas are expected to become wetter (The World Bank, 2021). For now, irrigation remains necessary both in the North and South for certain crops. Overall temperatures will rise, and the frequency of extreme weather events such as droughts, heavy precipitation and river floods will also increase. The boundaries of natural zones will shift further in the northwestern direction, see Figure 1.

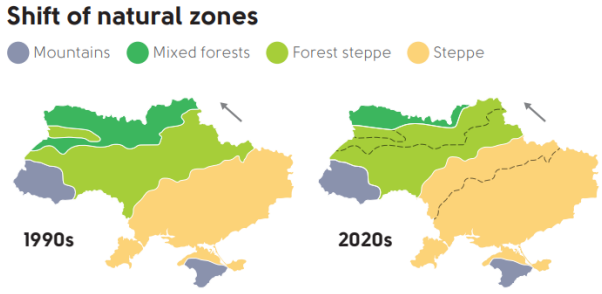

Figure 1: Shift of natural zones in Ukraine due to climate change. Source: Infographic report, Agribusiness of Ukraine (Latifundist, 2025)

Ukraine's agricultural sector

The total of agricultural land in Ukraine spans 41,3 million hectares (68,5% of the country), of which 32,7 million hectares consisted of arable land in 2020 (Statista Research Department, 2024). The country's professional agricultural sector can be subdivided into smaller family farms (covering

most agricultural entities) and larger commercial farms. Only 2% of the farms is larger than 5000 hectares. This 2% cultivates on about 25% of Ukrainian land (source) (Nehrey et Finger, 2024).

The agricultural output of Ukraine is dominated by grains and oil seeds. Ukraine is the world's largest exporter of sunflower oil and -meal (numbers from 2023), even despite the full-scale invasion of Russia that started in February 2022. This shows that Ukraine is not only flexible and resilient but also manages to uphold its agricultural sector in extraordinarily difficult circumstances.

In 2021, 56 % of Ukraine's agricultural area was used for growing cereals (Statistics Ukraine, 2022), while an additional 32.3 % was devoted to industrial crops (primarily sunflower, followed by rapeseed and soybeans). Other noteworthy crops that are cultivated include potatoes and crops for animal fodder, especially in western Ukraine, with less suitable conditions for grains and oilseeds.

Less than 2% is used to produce vegetables, mainly grown by the relatively smaller family farms. The most produced vegetable crops (numbers from 2021, see Table 1) are tomatoes, cabbage, pumpkin and squash, cucumbers, onions, carrots and beetroots, jointly accounting for 87% of the total vegetable production. From an international trade perspective, Ukraine is a net importer of vegetables, including for each of the previously mentioned most produced vegetables (Halytsia, Bogonos; 2024).

Table 1 shows the total cultivated area for different crops, along with the percentage of the total agricultural area of Ukraine, and the development trend for the area between 2019 and 2021. This timeframe has been chosen because from 2022 onwards, the agricultural area has been impacted by the ongoing full-scale invasion, and the data hasn't been updated. Data has been obtained of Statistics Ukraine, which was further used to establish the trend of area growth/decline. The crop categories have been selected based on the availability of data.

This timeframe has been chosen because from 2022 onwards, the agricultural area has been impacted by the ongoing full-scale invasion, and the data hasn't been updated.

Table 1: Crops grown in 2021 in Ukraine, before the full-scale invasion. Pumpkin and squash have been merged into one group of vegetables

Crop	Area (1000s ha)	% of total area	Trend
Grain	15995	56%	Growth
Legumes (mainly pea)	314	1%	Decline
Sugar beets	227	0,8%	Decline
Sunflower	6622	23%	Growth
Rapeseed & colza	1311	4,6%	Growth
Soy	1006	3,5%	Growth
Open field vegetables - Tomatoes - Cabbage - Pumpkin & Squash - Cucumbers - Onions - Carrots - Beetroot	454 75 69 64 53 53 43 39	1,6%	Decline
Fodder crops	1535	5,3%	Decline

Most of the agricultural land is used to produce cereals and commodity crops, both being crop categories of relatively low economic value. Considering the favorable circumstances for cultivation and the large amount of arable land, there is a high economic potential for Ukraine in exploring the options for cultivation of more diverse and high value crops, both for export and domestic consumption. Certain crops will have a high value directly after the harvest, while others require processing before obtaining a high value. This can be done within the country or specifically within regions themselves to stimulate (local) economic growth and food security.

3 Objectives and outputs

The study's objectives are to determine:

- Which specific crops and supply chains can benefit the most from collaboration between the Netherlands and Ukraine.

- How the cultivation and processing of agricultural products in Ukraine can be matched with expertise and potentially the demand from the Netherlands.

- The role that government and sector organizations can play in supporting and promoting this collaboration.

- By focusing on these areas, the research seeks to uncover ways to enhance agricultural productivity and economic growth through strategic collaboration between (semi-)governments, companies and organizations of the two nations.

The audience for this study and its deliverables is diverse: i) entrepreneurs that are directly or indirectly involved in open field farming in Ukraine and the Netherlands, ii) agricultural cooperatives, iii) sector organizations, iv) government organizations and other decision makers in Ukraine, varying from regional development agencies to municipalities, v) knowledge institutions and vi) consultants or project managers.

4 Scope

This project targets a selection of crop types. This study aims to provide a general overview of collaboration opportunities in crops and chains, but it is important to note that it is not possible to analyze the opportunities for every crop. The crop types considered interesting for this collaboration are:

Fiber crops: Fiber hemp, fiber flax, and straw as a residual stream after grain cultivation. These crops offer opportunities for the cultivation and processing of e.g. biobased building materials. This can be used for reconstruction purposes of houses and other buildings in Ukraine and potentially abroad (export potential).

Oil crops: Such as rapeseed, suitable for processing and private use in Ukraine, and linseed, derived from oil flax, with applications in both food and the industrial sector.

Vegetables: Fresh and processed vegetables for both domestic consumption and the export market. This includes crops such as onions (for international trade) and vegetables like carrots, beans, and cabbages, which are mainly grown for regional consumption. For canned goods and vegetarian products, various beans (for canning) and protein-rich crops are suitable such as field beans and soybeans.

5 Research questions

The main question to be answered by this research study is:

"For which crops and chains is the collaboration between the Netherlands and Ukraine of added value, and how can the demand, supply and possibilities in Ukraine best be matched with the expertise and possibly the demand from the Netherlands?"

This research question will be answered using the following sub-questions:

1. Which crops and chains have the most potential for collaboration between the Netherlands and Ukraine?

2. What are the main challenges and needs of Ukrainian growers and processors within these crops? What cultivation possibilities are there in (regions of) Ukraine, also given the soil type and climate.

3. Which Dutch products, technologies and knowledge can contribute to fulfilling these needs?

4. What is the demand from the Netherlands and European Union for these crops and processing, also given the Dutch and European commitment to, among other things, the protein strategy and the social debate on food security or food sovereignty.

5. What are the possibilities and challenges for the export of Dutch products to Ukraine and vice versa within the mentioned crops and chains?

6. What support from the Dutch government can contribute to a successful collaboration?

7. How can government organizations and sector organizations in the Netherlands and Ukraine work together to strengthen the agricultural chains in both countries?

3 Methodology

To uncover the full potential of agricultural collaboration between the Netherlands and Ukraine, this research employs a multifaceted approach. We will conduct a compact **desk study**. By analyzing existing data and reports on the agricultural sectors of both countries, we gain a comprehensive understanding of the current landscape and identify key areas for improvement. By engaging with relevant stakeholders from both the business and government sectors in the Netherlands and Ukraine by **performing in-depth interviews**, we will gain valuable insights and firsthand perspectives on the opportunities and challenges of possible collaboration. An **exploring market analysis** will present the inventory of demand and supply within the targeted crops and supply chains and will help pinpoint where the greatest potential for synergy lies.

By examining examples of successful collaborations (case studies) in similar contexts we will present practical lessons and strategies that can be applied to enhance the partnership between the two countries. By combining these methods, the research aims to create a robust framework for fostering effective and mutually beneficial agricultural collaboration.

1 Desk study

A compact desk study will map the cultivation characteristics of both countries and describe the effects of the war on the agricultural landscape of Ukraine. Characteristics such as soil type, local climate, growing season, water supply and infrastructure will be considered, but also cultural standards and customs will be considered. The potential success of future collaborations is expected to be higher when both cultures are respected.

2 Conducting in-depth interviews

Stakeholder identification

Relevant stakeholders are identified within our own network, and together with the Netherlands Enterprise Agency (RVO) and the Netherlands Embassy in Kyiv. Important stakeholders will be breeding companies, suppliers of inputs, advice companies, processing companies, trading companies, logistics experts and agrarian associations.

Selected stakeholders were invited for an online interview for a maximum of one hour (MS Teams). We selected entrepreneurs and consultants with extensive experience with growing seasons in Ukraine, within different regions. During the interview process, we identified extra key stakeholders to include in the study.

Figure 2: Interview method

Interview guidelines

The interviews with different stakeholders focused on a general impression of Ukraine's open field vegetable sector and on possibilities and challenges that are recognized for future development. The interviews were structured by discussing possibilities and challenges for new crops in terms of production, processing, storage, logistics, and market opportunities.

We made a longlist of crops which might be interesting for collaboration between Ukraine and the Netherlands. This list was further examined together with Ukrainian and Dutch stakeholders and categories of crops were identified that seem to have potential, based on the current circumstances in Ukraine. This resulted in a shortlist of crops that was looked at more closely by visualizing the value chain per crop group.

3 Survey

Based on the advice of the Netherlands Embassy in Kyiv, a survey was used to obtain information of Ukrainian organizations on their opportunities, challenges and possibilities in the field of open field crops. This provided the opportunity to reach more local representatives of companies and knowledge institutes than only with interviews. The survey was written in English and asked for a time investment of about ten minutes. It was completed 20 times, of which 10 were companies, and 10 were researchers and students at knowledge institutions. In our analysis, we primarily used the responses of companies when the topics were cultivation or market related. The full survey can be found in Annex B.

4 Exploring market analysis

The cultivation market in Ukraine and the Netherlands and the associated market demand and processing industry will be described. What challenges are identified for Ukrainian and Dutch growers and processors. And how can Dutch products, technologies and knowledge contribute to fulfilling these

needs? To answer these questions, results from the interviews and survey were used, combined with our sector specific and country specific expertise.

The associated chain perspective will be described as well as in how far the crop and chain adheres to the European agricultural vision.

5 Case studies

During our research study we will map out examples of collaborations in similar contexts. These could include case studies in Ukraine, pilots in the Netherlands or countries that are similar to Ukraine in terms of climate, culture, types of crops or war situation. Take aways from these case studies can help future cultivation projects and collaborations to be more successful.

4 General findings

The following general findings from the interviews, literature and survey results, were found to impact the potential interest, acceptance and success of 'novel' crops in Ukraine, as well as the added value of collaboration with Dutch partners.

Novel crops: crops that are not widely grown in Ukraine yet.

1 Effects of the war on the agricultural landscape of Ukraine

Due to Russia's ongoing war in Ukraine, there are specific challenges that agricultural entrepreneurs are facing. Due to occupation, complete areas have become inaccessible for Ukrainians and everything they had built up here on a personal and professional level was destroyed. For agriculture in specific, we will briefly elaborate on four topics: Access to land, labour shortage, loss of irrigation and infrastructure for storage, processing and logistics. In addition, landmines scattered across agricultural and other areas have rendered parts of the land unusable.

1.1 Disruption of access to agricultural land

As a result of the ongoing Russian aggression against Ukraine, significant areas of highly fertile agricultural land have been occupied, are continuously bombed and/or mined or have become infertile to the destruction of the Kakhovka dam. Regions in the south surrounding the Dnipro River delta such as Kherson – historically known for its favourable climate and productive soil – have been severely affected and are now unsuitable for agricultural activities.

Since the start of the full-scale invasion of Russia into Ukraine in February 2022, many farmers and land operators have relocated their agricultural activities to other regions. Cultivation has increasingly shifted towards the north, west, and central parts of Ukraine.

1.2. Labour shortage

The agricultural sector is facing significant labour shortages due to the war. A considerable portion of the workforce is currently enrolled in mandatory military service, and many have been affected by the broader humanitarian impact of the Russian aggression against Ukraine, including damage to civilian areas, infrastructure and farms. As a result, the available labour pool for essential agricultural activities – such as cultivation, harvesting, processing, and logistics – has been greatly reduced.

It is unlikely that this shortage will be resolved in the short term. Labour availability is expected to be a critical bottleneck in terms of crop choice and development. Labour-intensive crops will be difficult to set up and scale.

Possibilities for collaboration with Dutch partners

The Netherlands is currently facing a significant labour shortage when it comes to labour-intensive work. Next to this, salaries in the Netherlands are relatively high and there can be problems to keep employees longer in the company. Currently there are simply not enough people to fill available positions, which calls for the implementation of smart technologies and automation. These solutions can also be applied to the situation in Ukraine.

1.3. Loss of irrigation

Water availability is the most critical factor in achieving a stable cultivation and harvest cycle. The Dnipro delta not only provided fertile conditions for crop cultivation but also benefited from a well-established irrigation network. This infrastructure enabled consistent agricultural production even under dry conditions. Now many irrigation systems have been damaged, rendered inoperable, or destroyed, with the destruction of the Kakhovka dam being the most infamous example. Since the beginning of the full-scale invasion, one-third of Ukraine's freshwater storage has been destroyed, causing major ecological and economic consequences for water bodies and infrastructure (Hapich et al., 2024). Given the age and condition of the water infrastructure, restoration is no longer a viable option. To restore these agricultural grounds in the future, entirely new irrigation systems will need to be constructed from the ground up.

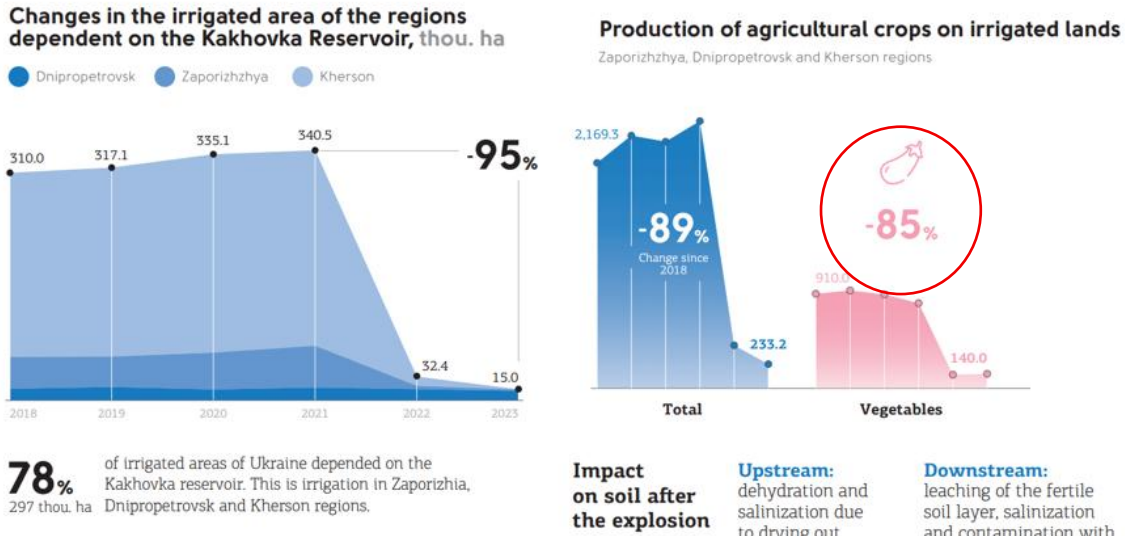

Figure 3: Impact of the destruction of the Kakhovka dam on vegetable production. Infographics obtained from Latifundist, 2025, and adapted for own usage.

Many crops – particularly those newly introduced – require reliable irrigation, which is currently insufficient or unavailable in many areas. In locations where irrigation is not feasible, optimizing soil health and water retention becomes essential to reduce vulnerability to abiotic stress factors such as drought or salinity. Soil health being a determining aspect in selecting a crop was further confirmed by results from the survey, with preventing soil depletion and climate resilience being mentioned as important factors.

Possibilities for collaboration with Dutch partners

Modern irrigation strategies from the Netherlands can assist in optimizing water use efficiency, such as sensor-based drip systems and data-driven water management platforms, especially in regions prone to drought or where systems have been damaged. These technologies can be integrated with monitoring systems to improve resilience to climate variability while minimizing water waste and reducing environmental impact. It is likely that such technologies will only be cost-efficient when used for high value crops.

The Dutch Ukraine Water Public-Private-Partnership Platform (UWP), also a platform of the Netherlands Enterprise Agency (RVO), acts as a bridge between the Ukrainian and Dutch water sectors. It provides a central point for its participants – Dutch and Ukrainian organisations – to come together, facilitating connections and resources, and bringing forward opportunities for designing collaboration strategies and joint actions. Interested parties can join this platform.

1.4 Infrastructure for storage, processing and logistics

In general, logistical challenges appeared less significant than those related to storage or energy infrastructure. Basic transport and logistics infrastructure is already in place, however, a shortage of truckdrivers was mentioned as the most pressing logistical concern.

In Ukraine, many facilities for storage and processing were occupied and destroyed. Now some storages are still available, mostly cold rooms for vegetables. Gas controlled atmosphere is available in some of them. It is good to note for readers that are not very familiar yet with Ukraine's agricultural landscape, that Ukraine had many high-level and basic storage facilities before the full-scale invasion of Russia into Ukraine.

Investment in post-harvest infrastructure is crucial to rebuild Ukraine's agricultural sector. Since most harvests occur only once per year and fresh produce has a limited shelf life under non-conditioned conditions, effective storage is essential. Building back storage capacity is a main priority for the Ukrainian government, prompting them to recently adopt a decision that will

expand farmers' possibilities to finance new storage facilities[1]. This supports possible further steps towards processing crops within the country, increasing the product value and contributing to domestic food security.

Access to energy has been severely compromised due to the war and poses a main challenge in the agricultural sector. Without improvements in energy access and reliability, value chain development will remain hindered. This vulnerability was a recurring concern in nearly all interviews conducted.

Possibilities for collaboration with Dutch partners

Dutch technology in cold chains, humidity control systems and smart monitoring tools can support storage reconstruction. Additionally, novel processing technologies can add significant value to agricultural output. Dutch companies, for example, offer advanced sorting, grading, peeling, and packaging technologies tailored to specific crops. These can enable Ukraine not only to process produce for domestic use but also to target high value export markets through compliance with EU quality and safety standards. Multiple Dutch organizations such as Tolsma Grisnich, Van Dijk Technieks, Royal Haskoning DHV, VDL and Marcellisen Venlo B.V. have been active in Ukraine for a long time or would like to become more active, also on processing and packaging.

Since storage facilities are one of the top priorities of the Ukrainian government, due to its direct link to food security and value creation, the way must be paved towards financial support by International Financial Institutions such as the European Bank for Reconstruction and Development (EBRD). This is a work in progress with a role for different stakeholders such as the Netherlands Enterprise Agency (RVO) and the Dutch Agriculture & Food Security platform Ukraine. The EBRD is supporting the Ukrainian government in strategic development of different sectors.

Regarding access to electricity, collaborations with Dutch or other European companies could support the integration of renewable and off-grid energy sources into agricultural systems, such as solar, wind, and biogas. This makes Ukrainian entrepreneurs less dependent on centralized electricity suppliers such as fossil and nuclear fuels, making them more resilient in the current landscape of blackouts and power cuts.

[1] AgroberichtenBuitenland (2025) Ukraine: state support program for building vegetables storages

2 Cultural aspects

In both the Netherlands and Ukraine, local cultural practices and community acceptance must be considered before starting up collaboration on novel crops. Ukraine should be placed in the lead, with Dutch actors supporting rather than directing. This requires genuine dialogue with local knowledge holders in Ukraine, listening carefully and engaging in co-creation rather than imposing Dutch perspectives.

In the Netherlands, there is a saying '*wat de boer niet kent, eet hij niet*', meaning that a farmer won't eat what he or she does not know. In the Netherlands, farmers look at other farmers and compare this with their business model to see if it adds value to their company. When specific (local) knowledge and expertise is required, farmers form study groups, sometimes started up by a farmers' association. In Ukraine, experimenting with the cultivation of a new crop can easily be done on a smaller portion of the land, given the extensive areas of agricultural land available. If a cultivation proves successful, the farmer can further develop their skills in that specific crop type, and if it does not succeed, the loss is minimal. Usually a farmer will focus on export, while directing lower-quality produce to the local market, gradually building local demand as consumers get accustomed to the product. What is evident is that in both countries, cultivating new types of crops presents challenges, and farmers can benefit from sharing their experiences with each other.

Another cultural aspect we encountered in our research on open field vegetable farming is that vegetables that are used in the traditional kitchen are grown with the most enthusiasm and confidence. This almost guarantees a secure domestic market to produce for, whereas products grown for export come with a lot of insecurities concerning market and logistics.

3 Strengthening the Market Interface

To scale the supply chain and unlock market potential, Ukrainian producers can benefit from stronger commercial ties with European retailers and processors. Especially in the current circumstances in Ukraine, where traditional markets such as Russia have vanished and new markets are yet to be found. The European Union can become a valuable partner to Ukraine, with the EU's Green Deal, Farm to Fork strategy, protein strategy and vision on circular building creating opportunities for novel crops. This could open up an export market for protein rich vegetables and circular building materials.

Possibilities for collaboration with Dutch partners

Dutch expertise in cooperative marketing, digital traceability platforms, and sustainable branding can help Ukrainian products enter premium market segments within Europe with a transparent, high-quality offering. These collaborative efforts not only enhance market access but also encourage adherence to sustainability standards demanded by modern consumers. The Centre for the Promotion of Imports from developing countries (CBI) is a Dutch government agency that supports small and medium-sized enterprises (SMEs) in developing countries in exporting to Europe. Rather than offering direct export advice or trade services, CBI focuses on strengthening entrepreneurs' export-related knowledge and skills and could play a role in strengthening collaboration. At the moment, there are no active CBI programs for Ukraine.

4 Mechanisation and precision agriculture

A key opportunity lies in the adoption of modern mechanization and precision agriculture technologies. These technologies have a particular potential for the Ukrainian agricultural situation, where farm sizes are generally large and the labour force is under pressure due to the ongoing conflict. Precision farming not only improves efficiency but also contributes to sustainable practices by reducing fertilizer and pesticide runoff, promoting integrated pest management, and optimizing the use of resources. This supports both productivity and environmental stewardship.

Possibilities for collaboration with Dutch partners

Regarding precision agriculture, Dutch-developed knowledge and products can play a key role. Due to the limitation of agricultural land and labour availability for intensive agricultural activities in the Netherlands, the country has become a progressive developer of precision technologies and automation. Integrating such technologies can be both high- and low-cost, including autonomous machinery, drone-based crop monitoring, variable rate application of inputs, and GPS guided seeding and harvesting.

5 Sustainable agricultural practices

Sustainability is an integral component of modern agricultural production. Both survey respondents and interviewed stakeholders mentioned the importance of soil health and climate resilience for successful agriculture. Optimizing soil biodiversity, organic matter and water retention makes crops more resilient to pests, droughts and heavy precipitation.

- **Conservation Agriculture:** Implementing minimal or no tillage, crop rotation, and cover cropping to enhance soil health and reduce erosion. This stimulates organic matter in the soil, improving water retention, soil fertility and carbon sequestration.
- **Integrated Pest Management (IPM):** Utilizing biological control measures, organic pesticides, and precision monitoring to reduce chemical inputs, protect biodiversity, and maintain ecological balance.
- **Integrated Crop Management:** Optimizing the use of water and inputs through precision agriculture, smart irrigation, and renewable energy solutions.

During the interviews with experts, it became clear that physical soil analysis can be conducted in Ukraine, but biological analysis (pathogenic but also beneficial nematodes, fungi, bacteria) is still done abroad, e.g. in the Netherlands.

Possibilities for collaboration with Dutch partners

Collaboration and knowledge exchange between the Ukrainian agricultural sector and Dutch or European agricultural research institutions and companies can support the adoption of sustainable technologies, relatively new crops and practices. This includes leveraging pilot projects, training programs, and joint research initiatives (e.g. through LIFE or Horizon Europe) to spread sustainable innovations across the country.

6 Current regions for open field vegetables

Because of rapid local changes and developments, the circumstances per region can change rather quickly. At the time of this study, several regions were mentioned during interviews where open field cultivation is situated. There is either existing or potential irrigation and good soil quality. The western and central parts of Ukraine are relatively calm in terms of military aggression.

At the moment, **open field crop cultivation** was mentioned to be mainly situated in Volyn (W), Zakarpattia (W) and the Central region. A recent report by Latifundist[2] further refers to Dnipropetrovsk (E), Lviv (W) and Kyiv (N) as major vegetable producing oblasts, followed by Poltava (C), Vinnytsia (C), Mykolaiv (S), Cherkasy (C), Zhytomyr (N), Kharkiv (E) and Ternopil (W). Interviewees mentioned that **plastic tunnels with vegetable production** are

[2] Latifundist, 2025 https://www.agroberichtenbuitenland.nl/landeninformatie/oekraine/documenten/publicaties/2025/02/17/agribusiness-of-ukraine-2023-2024

mainly situated in Volyn (W), Ternopil (W), Zakarpattia (W), and parts of Dnipropetrovsk (E) and Odesa (S).

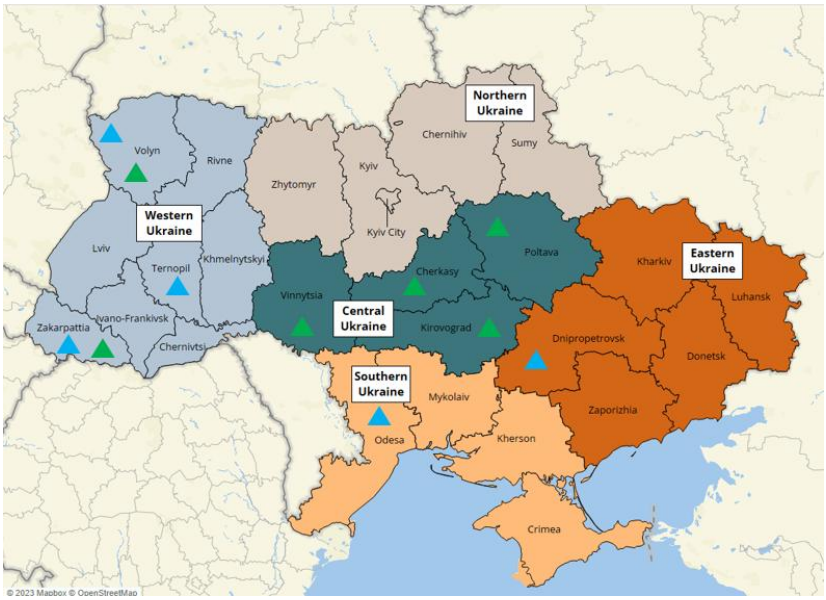

Figure 4: Original map of Ukraine's regions and oblasts obtained from Acleddata (2023), adapted for own use. Green triangles refer to the oblasts mentioned that cultivate most open field crops, blue triangles refer to the oblasts where most cultivation with plastic tunnels is practiced.

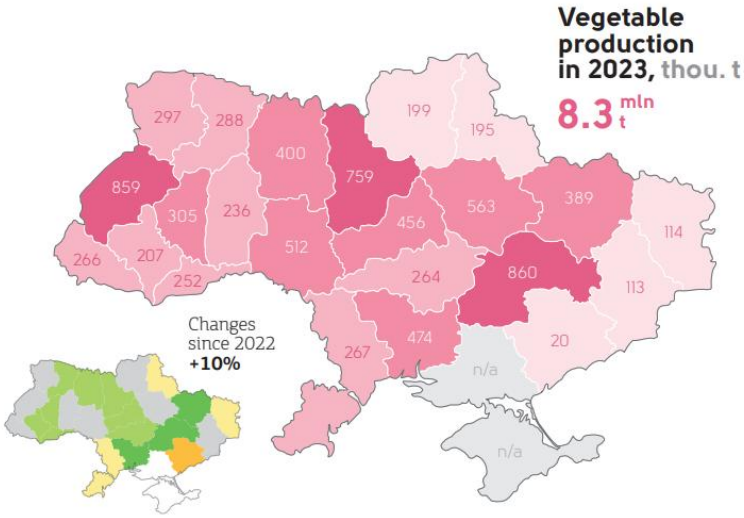

Figure 5: Vegetable production per oblast in 2025. Source: Latifundist, 2025

During the interviews mainly the western and central part of Ukraine were mentioned as regions to focus on for short term development. However, it is clear that the Ukrainian soil and climate in combination with the resourcefulness and extensive experience of farmers make every non

occupied region a good candidate for open field vegetable farming. This was confirmed by the survey respondents.

7 Risk mitigation

In the current challenging situation in Ukraine, ensuring safety of personnel and property is crucial when doing business. Appropriate insurance coverage is available for both Dutch and Ukrainian entrepreneurs through providers such as Atradius Dutch State Business (Atradius, 2025). Travel advisories may change but for now, Ukraine is subject to red travel warnings as advised by the Dutch government. The security situation can vary significantly. The western regions of Ukraine have remained relatively stable with limited military activity.

Cross-border movement of materials, seeds, and project managers remains complex due to customs procedures, phytosanitary regulations, and geopolitical sensitivities. Identifying reliable local partners on both sides is essential for sustainable collaboration, yet often time-consuming and dependent on strong networks. For Ukrainian exports to the Netherlands or the broader EU, compliance with certification standards, ensuring product protection during transport, and conducting thorough value assessments are critical. These efforts hinge on clear market agreements and predictable trade conditions.

To mitigate the risk of corruption or theft, cargo trucks must be thoroughly checked and sealed prior to departure and upon arrival. Shipping documents should be prepared without mistakes to reduce corruption risks. Border crossings may experience delays and are occasionally subject to trade restrictions. It is essential to plan for potential disruptions.

In terms of regulatory challenges, the Ukrainian government currently has limited administrative capacity. For new entrepreneurs, obtaining the necessary permits and licenses can be particularly challenging and time-consuming.

5 Survey results

The survey had a total of 20 respondents. Among the survey respondents, there was considerable variation in organization type, including farmers, processors, sector associations, and researchers. Different crops were cultivated or processed such as grains, oil seeds (a.o. sunflower, rapeseed, soy), fiber crops (hemp and flax), sugar beets, vegetables (beans, peas, carrot, potato) and fruits (berries, apples, strawberries). The entrepreneurs that filled out the survey indicate that oil crops for diversification would suit best in their rotation plan, with protein rich vegetables as a second option and fiber and vegetables as a shared third option (see Figure 6). One of the survey respondents describes that pea cultivation was stopped because of unstable prices and yield.

Most respondents have their own storage facilities, but power outages, drying capacity and labour shortages pose challenges. The warehouse equipment needs to be updated to control humidity, temperature and moisture conditions to preserve the products from decay.

Only a few respondents also have their own processing facilities, which are used for seed production. Such processing lines are used to retrieve seed material from e.g. carrot and potato, to clean, dry and calibrate the seeds.

The three most important factors in selecting a new crop were stated to be market potential (both local and export market), climate resilience and preventing soil depletion, respectively (see Figure 6).

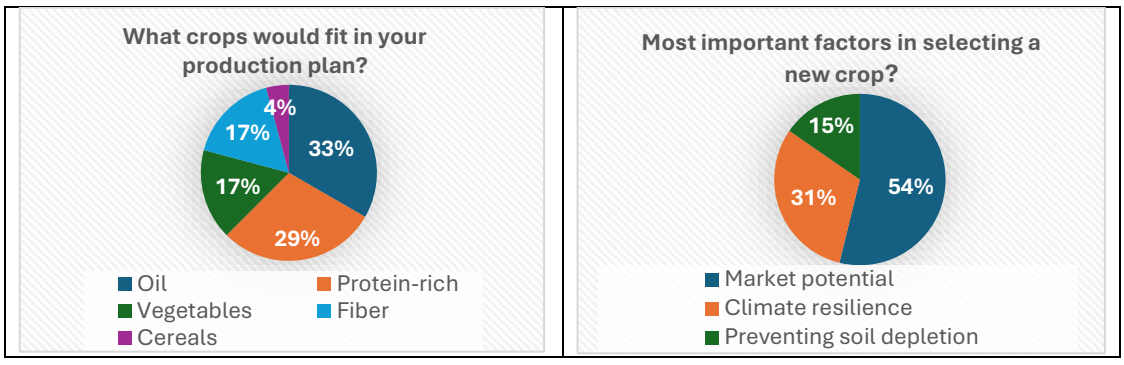

Figure 6: Survey results on suitability of crops in existing rotation plans and factors on selecting new crops to cultivate.

A variety of challenges were identified for introducing new crops, among which environmental factors such as water availability, new diseases and temperature, but also socio-economic factors such as market development and the absence of labour. The lack of stable markets and small capacity or

even absence of primary and secondary processing facilities in Ukraine were also mentioned as challenges.

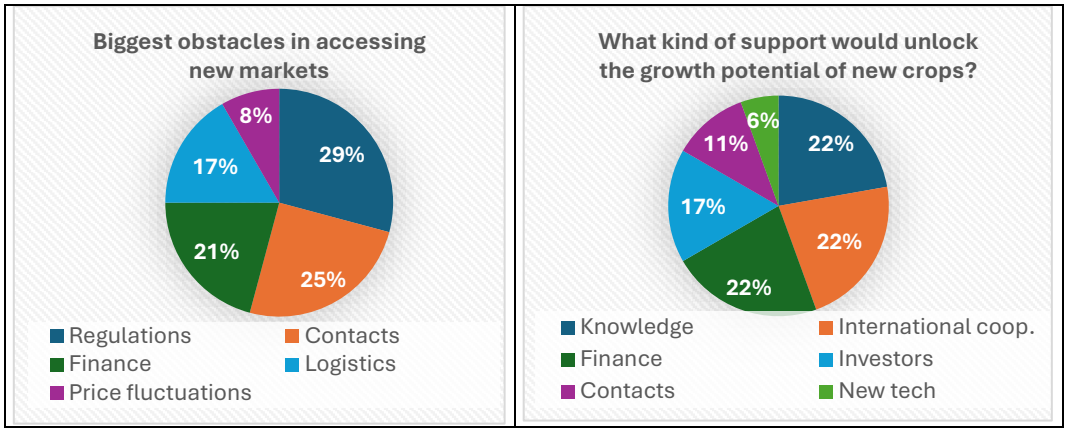

Figure 7: Survey results on the biggest obstacles in accessing new markets, and on the question of what kind of support or partnerships would help unlock the growth potential of new crops

Upon entering new markets, various obstacles were mentioned, but most notably the presence of (export) regulations and lack of contacts and finance. On the question of what kind of support would help unlock the growth potential of new crops, knowledge sharing, finance and international collaboration was mentioned.

Possibilities for collaboration with Dutch partners

The challenges described can be addressed by working together with partners from the EU in knowledge, technology and products, the respondents indicate. Practical research, experience and technology in e.g. precision agriculture, minimum tillage and cover crops applied to the Ukrainian regions were mentioned, as well as European experience in protein- and fiber crops. Knowledge was recognized to assist in managing labour, water and financial resources in a more optimized way. New technologies in processing, digitalization and traceability of products were also mentioned to be of importance. Simultaneously European partners could help in expanding the market and trading. On export, the respondents see potential for oil crops such as sunflower, rapeseed and soy for the European market, and novel crops for the local or domestic market. Generally, the value of the processing industry was considered to be underestimated.

6 Crops and chains

1 Longlist of crops

To identify promising novel crops for cultivation in Ukraine where collaboration with the Netherlands can be of added value, we will start with a longlist of crops within the scope of our study (fiber crops, diversification of oil crops, and vegetables). This list will be compiled based on several criteria:

- Crops with which the Netherlands has extensive experience or plays an important role in the global/European market (indirect market potential)
- Crops that can contribute to the European Union's protein and circular building strategy. This involves cultivating and processing crops in Ukraine and exporting the products to the European Union or specifically the Netherlands.
- Crops that match traditional markets and cuisine, making them a good candidate for domestic market consumption.

The longlist was set up from our open field vegetables knowledge and supplemented based on the additions of survey participants and interviewed experts, see Table 2. The focus will be on products that can be grown by farmers under the short and middle term circumstances. Some of the longlist crops are already grown in Ukraine. During the in-depth interviews with stakeholders, we found out where experts see the most potential for development of crops and what is needed to stimulate this. We will describe this per crop or crop group.

In this study we will also discuss several niche products that were found or mentioned, exploring some crops that may have potential but are not yet widely grown. It must be noted that Ukraine's domestic market is not very big for these kinds of products. A risk of stimulating niche products can be that many farmers start with the same crop type which devalues the product and plummets prices. Exporting a niche product requires extensive preparation to determine the specific market that is targeted and to calculate whether the costs of storage, processing and transport across the border are worthwhile for the farmer. This study will not focus on these niche products because they provide too little potential for local impact and international collaboration but observations that were made will be noted per crop.

Table 2: Longlist of crops

Fiber crops	**Flax** **Hemp** **Miscanthus**
Oil crop diversification	Essential oils Pumpkin seed
Vegetables, fresh and preserved	Artichoke Asparagus Beetroot Broccoli Brussels sprouts Cauliflower Carrot (Chanteney) Chickpeas Cichory Faba beans Garlic Gurkin Leek Lentils Lettuce Lupine Napa cabbage Onion Pea Pepper Radish Soybeans Squash Sweet potato Tomato White cabbage

2 Longlist - observations per crop group

Fiber crops

The decision of Ukrainian farmers to grow fiber crops in Ukraine is influenced by the uncertainty of stable markets and the relatively small capacities of primary and secondary processing enterprises. Challenges can be found in technological re-equipment necessary for growing fiber crops, organizing primary processing and finding partners in EU countries. Additionally, attracting best (European) experiences in stimulating the use of fiber crops is crucial for increasing the market. To address these challenges, several forms of collaboration with the Netherlands could have added value.

Oil crops (diversification)

Oil crops are widely cultivated in Ukraine (Latifundist, 2025; ABB, 2025), which means there is a lot of experience and expertise on this topic. In our survey, entrepreneurs were asked which type of crops would fit best into their rotation plan (fiber, oil, vegetables). 8 out of 12 entrepreneurs selected 'oil crop diversification' and mentioned sunflower oil as a possible product to produce. For collaboration with the Netherlands, an opportunity may lie in upgrading and diversifying the existing value chains to create more value-added products. However, the Netherlands does not have the extensive experience in this field that Ukrainian farmers have and, in our study, we did not encounter oil crops for diversification purposes that provide a market aside from niche products.

Vegetables

Vegetables represent varying opportunities for collaboration and can be produced for fresh consumption or for processing. Canning and freezing of vegetables such as green peas offer considerable potential, provided that adequate processing facilities are in place and can function despite the current energy outages. This potential applies to both existing and new varieties of vegetables. Legumes, especially those suited for dry harvesting, are another promising category. While they can be used for animal feed, the growing trend in Western Europe towards plant-based diets presents a significant market opportunity for human consumption.

3 Longlist and shortlist– observations per crop

The successful implementation of novel crops requires careful consideration of local conditions. Key factors include soil type and land characteristics, local knowledge and expertise, and infrastructure, such as storage, logistics, and energy supply. As stated before, Ukrainian farmers have extensive experience with the local conditions and different types of crops.

The long list contains four types of crops:

1) **Novel crops** (not widely produced in Ukraine yet)
   Faba beans, Sweet potato, Leek.
2) **Existing crops with potential for novel applications**
   Flax, Hemp, Peas for starch, Soybeans for human consumption.
3) **Existing crops suitable for expansion under current circumstances**
   Beetroot (Red beet), Carrot, Onion, White cabbage.

4) **Crops** we consider having **low potential** for now

1) Novel crops

- **a. Faba beans**
- **b. Leek**
- **c. Sweet potato**

Faba beans

Faba beans are well-suited for cultivation in Ukraine's climate and align with sustainability goals by increasing the human consumption of plant-based protein. They fit well into crop rotation plans and offer opportunities in various markets. Extracting protein isolates and producing meat substitutes can create added value, beyond being a bulk commodity. Field beans for human consumption are still relatively unknown, but with the right partners and the establishment of value chains, this crop has definite potential. However, extensive research and pilot projects will be necessary to realize this potential (variety selection, cultivation optimization, etc.).

In the survey output it was mentioned that for protein-rich crops for human consumption traceability is essential. This goes for field beans but also peas and soy. Separating and cleaning technologies were mentioned regarding processing technology, allowing farmers to clean goods at the farm and be sure all quality standards are met before the products enter the market.

No data was found on the production yield and market of faba beans in Ukraine, and as such, no realistic indication could be made on the financial aspect of these crops. For Dutch circumstances a yield of 5,5 tons faba beans per hectare is possible. Depending on market prices, this corresponds with a gross value of € 1.500, - per hectare. This value provides an indication, bearing in mind that the yield in Ukraine is expected to be different due to factors such as climate, soil and experience.

Leek

In the Netherlands, it is possible to grow and harvest leek almost year-round because of the soft winters. Leek can tolerate frost, but the harder it freezes, the more it becomes damaged. In Ukraine, year-round cultivation would be more challenging using open-field cultivation, due to the cold winters. Supportive cultivation methods such as plastic covers or tunnels could be employed in winter, but these would increase production costs.

Once harvested, leeks have a limited shelf life and can only be stored for a few weeks. This requires immediate transportation for consumption

following harvest. Due to the crop's poor storability, end users must be prepared in advance, and logistics should be arranged without delay. A comparable crop is celeriac, which shares some similarities with leek but offers significantly better storage potential.

Leek is not a traditional crop in Ukraine, where the focus is more on onions and garlic as seasoning. Nevertheless, with a proper introduction, leeks could find a place as a seasonal vegetable, although it would require time for adaptation and acceptance. Ukraine is already exporting some leek, mainly to Poland, Lithuania and Italy (Tridge, 2025).

Since the production of leek is relatively small in Ukraine, no data on the financial yield of leek production in the country could be found. For the Netherlands, leek grown on sandy soils has a total yield of €36.198,-/ha (summer), €28.519,-/ha (autumn) and €18.186,-/ha (winter), excluding inputs and labour (estimated to be €8.000-11.000,-/ha) (KWIN, 2022). This value provides a mere indication, with the yield in Ukraine expected to be different due to factors such as climate, experience and labour costs.

Sweet potato

Sweet potato is a relatively unknown crop in Ukraine. In the Netherlands, sweet potatoes are grown on a small scale. There is still much to learn about its cultivation in the Netherlands, which will also be necessary for the specific circumstances in Ukraine. Because of an increasing market demand, this could be a crop with potential, but much remains to be discovered about its cultivation, and the market still needs to be fully developed.

Sweet potato cultivation can be done best in the Ssouthern region, due to its milder climate, although cultivation in the central and eastern regions is expected to be possible as well (East-fruit, 2024). During the cultivation phase, irrigation management is critical to growing sweet potatoes, as the crop requires adequate moisture throughout the growing season. NAAS Institute studied the cultivation of sweet potato in Ukraine and is ready to provide knowledge and technology on further developing this crop within the country.

Sweet potato has high-margin domestic markets and export potential. Although sweet potato in Ukraine is still grown on a small area, really being a novel crop, production rose significantly in the last decade (Agronomist, 2019). Demand for sweet potatoes is growing under consumers and producers, and sweet potatoes are becoming more popular in the food service industry. Additionally, sweet potato from Ukraine was mentioned to have a major export potential for both fresh and processed markets (East-

fruit, 2024). The import of sweet potatoes into the EU keeps growing, with the Netherlands being the largest importing member state, accounting for a total sum of €146.691.000,- of sweet potatoes (both EU and non-EU) (CBI, 2023).

On the long term, the European demand will continue to grow but challenges remain. Rising production costs could influence the enthusiasm of producers, good returns on investments may be problematic on the short-term, and farmers may favour more familiar and profitable crops such as grains.

Since sweet potato is not produced widely in Ukraine yet, no data on the financial yield of sweet potato production in the country could be found. For the Netherlands, sweet potato cultivation in 2018 had a total yield of €72.000,-/ha, excluding inputs and labour (estimated to be around €23.000,-/ha) (Peteroff, 2018). This value provides a mere indication, with the yield in Ukraine expected to be different due to factors such as climate, experience and labour costs.

2) **Existing crops with potential for novel applications**
    a. **Hemp**
    b. **Flax**
    c. **Peas for starch**
    d. **Potato**
    e. **Soybeans for direct human food**

Hemp

Historically, Ukraine was one of the global leaders in hemp production until a sharp decline in the 20th century due to the rise of synthetic materials and classification of hemp as a narcotic plant. Since the last decade, the cultivation of hemp started growing again in Ukraine, mainly due to the cancellation of special permits for its cultivation. By 2024, the total area dedicated to industrial hemp production in Ukraine had expanded to between 2,600 and 3,000 hectares, surpassing the total hemp cultivation area in the European Union (KSE, 2025).

Using different varieties and technologies, hemp can be grown anywhere in Ukraine, but it particularly thrives in regions of the country where there is a high humidity in the plant's early life stage (ABB, 2025). Industrial hemp is currently cultivated fragmentarily in the Poltava (C), Vinnytsia (C), Zhytomyr (N), Volyn (W), Rivne (W), Chernihiv (N), Kyiv (N), Sumy (N), Kharkiv (E) and Cherkasy (C), Dnipropetrovsk (E) oblasts. It was also mentioned that hemp cultivation could play a role in purifying the soil of (former) frontlines, often

polluted with heavy metals. Hemp has purifying features and can be of added value in making soil suitable again for other crops.

Hemp is labour efficient and relatively insensitive to abiotic stress due to its low water requirements. However, establishing a well-functioning value chain remains essential. In the survey it was also expressed that there is a need for highly efficient harvesting equipment and modern sorting equipment for fiber crops to improve the quality of seed material. Methods and areas of processing, along with the integration of digital technologies and technical support of the technological process are required to further improve the quality of the value chain.

Hemp is used to produce a variety of products, among which are biobased construction materials, textiles and cellulose for paper, gunpowder and the automotive industry. On a global scale, the Netherlands stands as the largest exporter of unprocessed hemp, a position it maintains not only through domestic production but mainly by serving as a hub for raw hemp trade from and into the EU. This makes a collaboration between Ukraine and the Netherlands in the hemp industry particularly relevant. Since you cannot transport hemp straw in large volumes, at least some primary processing is important. This will allow Ukraine not only to supply raw materials, but also to produce products with some added value. From Ukraine's perspective, exporting processed hemp would be more lucrative: selling raw Ukrainian hemp yields approximately €120-130 per ton, whereas primary processed products command higher prices, hemp straw at €300 per ton and hemp fiber at €600-650 per ton (ABB, 2025). The EU, particularly Lithuania, Belgium, Germany, and the Netherlands, has a strong interest in these primary processed hemp products. Additionally, hemp benefits from the absence of EU import quotas, further enhancing its market potential.

To transform raw hemp into a higher value product, a domestic processing industry for drying, pressing and packaging is needed, further confirmed by the output of the survey. Now there are five hemp processing facilities for fiber material, mostly clustered in the northern region. A newly constructed factory of the Ma'rijany Hemp Company is located in the Zjytomyr oblast (N) and will be the largest in Europe, with a much higher capacity than the current hemp supply of Ukraine, anticipating on a growth in total production. Additionally, Ukraine has a variety of novel companies using processed hemp for novel applications, such as Hempire (see: Case studies), further increasing the output value of processed hemp.

In both the Netherlands and Ukraine, initiatives in the field of circular construction are emerging, presenting strong potential for market growth. This is recognized in Ukraine and supported by the Ukrainian Hemp Building Association (UHBA). In the Netherlands, the 'Building Balance' program aims to accelerate circular building practices, particularly by using fiber crops.

Dutch companies collaborate closely within the country, and there is promising potential to extend this collaboration to Ukraine. Some Dutch companies active in the circular construction sector are already engaged in projects in Ukraine. Circular construction is also a focus area for the Netherlands Enterprise Agency (RVO) and the Netherlands Embassy in Ukraine.

International regulations are the biggest obstacle in accessing new markets, according to the survey participants, followed by finding financing and valuable contacts. Collaboration between Ukrainian and Dutch governmental and sectoral organizations could contribute by starting up collaborations in the field of cultivation, processing and supply, or market development. Ukrainian agricultural universities that took part in the survey are open for collaboration with Dutch universities. A knowledge institute that is recommended to cooperate with is the Institute of Bast Crops of the National Academy of Agrarian Sciences of Ukraine (NAAS), a leading research institute conducting research on breeding, growing, harvesting and processing of fiber flax and industrial hemp. One very concrete point of collaboration mentioned in the survey could be the industrial hemp varieties developed by NAAS. The varieties YuSO-31, Glyana and Glesiya are already included in the EU variety register and are known internationally. Cultivation expanding to EU countries could be possible. To provide European farmers with access to the Ukrainian industrial hemp varieties, their seed production can be organized in an EU country like the Netherlands, which would comply with the EU legislation. Experience of European entrepreneurs is relevant for re-equipping seed production, organizing a 'mini seed factory' for the European market.

Flax

Currently, most flax production takes place in France and Belgium, with China being the largest export market (mainly for textile). In the Netherlands, high-quality seed material is produced. In the Soviet era, Ukraine had an extensive flax industry, including cultivation and processing. The Ukrainian flax sector largely collapsed after the dissolution of the USSR, and the global market for flax has significantly decreased since the availability of inexpensive synthetic fibers. Currently, flax covers only a very small portion of Ukraine's agricultural area, mainly in the Zhytomyr (N), Sumy (N) and Chernihiv (N) oblasts. Like hemp, flax can be used to purify the soil of (former) frontlines, preparing the soil for other crops.

The profitability of flax is highly dependent on the availability of storage- and processing chains. Barely anything of the supply chain that was so big in the 20th century still exists today, so stimulating a profitable flax sector would

require reconstructing the chain almost from the start. Flax certainly has potential, but a key challenge will be market certainty. Using flax for biobased insulation and construction material could play a role in this, linking it with a rapid reconstruction of Ukraine and European demand of biobased construction materials. This, however, will require consistent quality and supply to replace conventional construction material. A steady number of state orders would be a way to set up a stable market, along with pilot projects to set up the required facilities. Dutch-Ukrainian collaboration in providing the equipment would be of value, similar to the Build Back Bio initiative (see: Chapter 9, Case Studies). Regarding seed varieties, the Netherlands-based Van de Bilt Zaden en Vlas and Ukrainian Institute of Bast Crops of NAAS could be logical partners.

For the Netherlands, flax cultivation had an average financial yield of €4.397,-/ha, excluding inputs and labour (estimated to be around €2.119,-/ha) (KWIN, 2022). The average flax fiber production per hectare in Ukraine is 630 kg fiber (Pryimachuk et al., 2017). This is significantly lower than the average in the Netherlands (2.130 kg fiber/ha) (KWIN, 2022), meaning that revenue for Ukrainian flax producers is much more limited.

Peas for starch

Pea cultivation is increasing rapidly in Ukraine and can be seen as an upcoming crop, unlike the declining trend before the full-scale invasion (see Table 1). Like faba beans, the cultivation of peas is quite promising. In 2024, the Ministry of Agrarian Policy reported that 162.100 ha of peas were cultivated (Open4Business, 2025) and for the spring of 2025, it was predicted that pea cultivation (yellow/grean) would occupy 243.000 ha in Ukraine (UPSA, 2024). As a comparison, the Netherlands had a total open field vegetable areal in 2024 of just over 26.000 ha (Agrimatie, 2025).

For the Netherlands, pea cultivation had an average financial yield of €2.710,-/ha, excluding inputs and labour (estimated to be around €1.635,-/ha) (KWIN, 2022). This value provides a mere indication, with the yield in Ukraine expected to be different. Average production per hectare in the Netherlands is 7 tons, whereas the Ukrainian average lies lower, around 2,2 tons per hectare (UkrAgroConsult, 2025). Challenges in the cultivation remain: due to low moisture levels, stimulated by an increase in drier climatological circumstances in Ukraine, farmers risk uneven crop development. To cultivate peas successfully, agricultural practices need to be adapted, such as adjusting sowing schedules to periods of optimal moisture availability.

The range of applications is broad, as peas can be used for the canning industry as well as for dried harvest. Another possibility is extracting pea proteins, like in the case of Blue Bean (Chapter Case studies), to used for the production of high-protein products or vegetarian food. A major opportunity is processing peas for the starch industry, with the global pea starch market projected to grow for almost 50% in the next five years (Marketsandmarkets, 2024). Starch is purely an ingredient, but it is used in many products, with the positive trend being primarily attributed to a rising demand in plant-based ingredients and bio-based packaging materials (such as single-use food containers). Pea starch specifically is gaining popularity due to a greater demand for low-calorie, nutritious food. Processing facilities can combine pea and potato processing for starch production.

Another important recent development for cultivating peas in Ukraine regards the merge of previously separate pulse and soybean organisations, now called the Ukrainian Pulse and Soybean Association (UPSA). This allows for bundling of efforts on increasing competition in international markets, adhering to European regulations and standards and implementing innovations in production.

Potato

Traditionally cultivation of potatoes has been largely present in Ukraine, especially in the northern and central regions. The market was and is mainly focused on potatoes for direct consumption. Industrial processing of potatoes, for instance for fries and chips, is limited. Developing the potato sector is already one of the priorities of the Netherlands Embassy in Ukraine, working on stimulation of the country's potato processing industry. Several new projects in the sector are running, with and as such there is no additional value for including this crop in this study on novel crops.

Soybeans for direct human food

In Ukraine, soy is mainly grown in the western, northern and central regions. Both the total production area of soy and the yield per hectare has been growing significantly in the country during the last decade. Currently, Ukraine is the largest soy producer on the European continent.

The EU is only self-sufficient for 3% of its total soy consumption, including for direct human food and animal feed (European Parliament, 2023). Most of the soy is imported from Brazil, the United States and Argentina, but Ukraine could play a vital role in providing more locally sourced soy, ensuring food

security and decreasing emissions related to transportation and land use change. The soybean market, especially for animal feed, is a global market, driven by cost rather than added value. Ukraine's potential is further increased if the lower carbon footprint, sustainability and regional (European) food security is part of the market strategy and are ensured.

Globally, soybeans are primarily used in the animal feed industry (76%) (Ourworldindata, 2024). However, soybeans are also used for direct human food (20%), mostly for soy oil (13%). In the European Union there is a growing demand for plant-based proteins in e.g. tofu, soymilk and meat replacements, which can create added value to the product. In the EU, soy directly used in human food as a plant-based protein source, is mandatory to be free of GMO. Non-GMO soy is mostly originating from the EU, Canada and African countries, with the EU only being self-sufficient for 40% on non-GMO soy. This provides opportunities for Ukraine: Ukraine is already the largest soy producer of Europe, and it can provide a crucial role in the EU's demand for (non-GMO) soy protein for human consumption.

The gross yield, according to consulted experts, is approximately 2.5 to 3 tons per hectare. Based on European prices, the gross yield is then approximately €1.500,-/ha. Bear in mind that this is a price indication, with the yield being dependent on factors like local soil, climate and the presence of

3) **Existing crops suitable for expansion under current circumstances**
    a. **Beetroot (Red beet)**
    b. **Carrot**
    c. **Onion**
    d. **White cabbage**

There are multiple open field vegetable crops that Ukraine has extensive experience in and that have good potential for expansion. As described earlier in the chapter introduction and background, a lot of vegetable production has been forced to move to other areas because of complete destruction.

Beetroot, carrot, onion and white cabbage:

- **Are well suited for mechanical cultivation and harvest**, which makes them suitable for a situation with labour shortage.
- **Do not require excessive amounts of water**.
- **Present opportunities for both fresh products and processed products**

- **Present opportunities for the domestic market and the export market**.

Possibilities for collaboration between Ukraine and the Netherlands

General possibilities for collaboration include reconstructing storage facilities, sorting and packaging lines and collaboration on the further development of sustainable agricultural techniques. Dutch companies and the Netherlands in general have a lot of experience with these kind of market solutions. Several of these Dutch companies are already active in the Ukrainian market.

Beetroot/Red beets

Red beets (not sugar beets or fodder beets) are well-suited for borscht soup and other local consumption. They are relatively easy to grow and mechanize in terms of sowing and harvesting. In Ukraine, red beets were traditionally grown particularly in the Kherson region where many vegetables were cultivated before the start of the full-scale invasion. They are also grown in household plots and family farms. In the Netherlands, a few companies specialize in this crop. Both fresh and processed products are available. For fresh products, washing and cleaning is necessary.

Red beets can be stored for months, if they are kept in cool storages. It is important that these storages are high in quality, so the quality of the product does not go down. Before the start of the full-scale invasion, beetroot cultivation had a yield of approximately 37 tons per hectare in Ukraine (Vdovenko, 2018). As of 2022, an average of 22 tons per hectare is mentioned as yield (UkrStat, 2022).

There are no hard figures available about the gross yield of red beets in Ukraine. Based on expert judgement a yield between €1.500,- and € 4.000,- per hectare should be possible. This, however, is an indication, with yield depending on factors such as local soil, climate and experience.

Carrot (Chanteney)

Carrots are a well-known vegetable in Ukraine, though there is a difference between the carrots that are grown and consumed the Netherlands and in Ukraine. In the Netherlands, carrots are cylindrical, while in Ukraine they are pointed and triangular. This originates from a difference in breed and market differences. In the Netherlands carrots are a relatively large crop, it is easy to mechanize and can be stored year-round. They are also grown organically.

Carrots can be produced for the fresh market and can also be processed, for example by washing and slicing them. Many carrots are included in pre-cut vegetable packages to add colour, in the Netherlands. Storage of fresh products needs to be done in crates with soil to regulate moisture during storage, under a low temperature.

There are no hard figures available about the gross yield of chanteney in Ukraine. Based on expert judgement it should be possible to achieve at least a yield of 35 tons per hectare. Corresponding to at least €20.000,- per hectare. This, however, is an indication, with yield depending on factors such as local soil, climate and experience.

Onion

Onions are grown both in Ukraine and the Netherlands and can be stored well. Because of the long storage possibility, onions offer more flexibility and allow for longer logistical lines. Because of the full-scale invasion, many farmers had to relocate and had to find the best ways of cultivating onions in new areas, taking the local climate, soil conditions and breed considerations into account. Despite the circumstances, Ukraine is still exporting onions that currently have a price advantage over for example Polish and Dutch onions (Freshplaza, 2025).

The climatic conditions, light intensity, and soil types in Ukraine provide good cultivation opportunities. Onion cultivation includes various types and varieties (seed onions, both red and yellow, planting onions, shallots, etc.). The cultivation can be well mechanized, and there is sufficient knowledge and expertise available for storage and processing. There are many different varieties and characteristics, so careful consideration must be given to the right choices based on regional and climatic conditions. The Netherlands is a big exporter of onions but also a big importer of onions. This creates export opportunities for Ukraine.

For the Netherlands, onion cultivation had an average yield of 40 tons and €18.113,- per hectare (KWIN, 2022). It is likely that yields in Ukraine will be somewhat lower because of the relocation of many farmers, that now have to produce in new areas.

White cabbage

White cabbage has traditionally been a well-known crop in Ukraine and offers opportunities for scaling up. White cabbage has potential both as a fresh product and as a processed product (sauerkraut). Challenges for cultivation can be consequences of climate change and processing

capacity. Furthermore, to harvest cabbage for long-term storage, the crop cannot be damaged and requires manual harvest, making the harvest process labour-intensive. This makes cultivation difficult under the current conditions. Harvest for short term storage, or fermented cabbage, is possible to do mechanically. Planting the crop is often done by semi-automatic machines, and can be mechanised, requiring an investment of the farmer.

Yields vary, but early varieties typically produce 25-30 tons per hectare, while later types produce 40-60 tons per hectare. Prices for cabbage currently lay around 24.000,- to 32.000,- UAH/ton (Agroreview, 2025), meaning that the revenue of a hectare of white cabbage varies between €12.300,- to €19.800,- /ha (early) and €19.800,- to €39.500,- /ha (later). This excludes cost related to inputs and labour.

4) **Crops we consider having low potential for now**
    a. **Crops that did not make it to the shortlist:**
        i. **Broccoli**
        ii. **Brussels sprouts**
        iii. **Cauliflower**
        iv. **Chickpeas**
        v. **Lentils**
        vi. **Lettuce**
        vii. **Lupine**
        viii. **Miscanthus**
        ix. **Radish**
        x. **Squash and Pumpkin**

    b. **Crops that could be niche products:**
        i. **Artichoke & asparagus**
        ii. **Asparagus**
        iii. **Essential oils**
        iv. **Pumpkin seed**
        v. **Chicory**
        vi. **Garlic**
        vii. **Napa cabbage**
        viii. **Pepper**

a) Crops that did not make it to the shortlist

We will provide a short explanation of why these crops were considered unsuitable for collaboration now. We would like to stress that the longlist of crops was not set up to be complete.

Water and climate

For **broccoli and cauliflower**, the Ukrainian climate is expected to be too hot. Both crops are relatively vulnerable to environmental changes and do not like high temperatures. In the Netherlands cauliflower is mainly grown in the coastal areas for this reason. We have spoken to one experienced farmer that tried to grow cauliflower in the center of Ukraine but was unsuccessful because of this.

Brussel sprouts are a crop that are harvested in wintertime in the Netherlands. The Ukrainian winters are too cold for mechanization activities. In the south or west of Ukraine, if it would get warmer because of climate change, this could be an option in the future.

Limited market expectations

For **lentils**, it seems the demand is lower than for other beans or other fabacea, although the Ukrainian Pulse and Soybean Association predicts that lentil cultivation will expand. In the Netherlands, lentils are an experimental crop that organic and nature inclusive farmers grow. The same goes for **chickpeas**, this is not a crop that the Netherlands has extensive experience with.

Another crop that is not regarded as high in potential for different markets is **lupine**. This is now used for animal feed and is known for its bitter taste, making it less attractive for processing in products for human consumption.

For **miscanthus**, a fiber crop, the complete value chain must be set up from the start. The current development of a supply chain and market for the hemp (and flax) biobased construction materials might create room for miscanthus to co-develop, but for now, setting up a value chain for miscanthus in Ukraine is not expected to have much potential.

Labour intensive crops

Crops such as **lettuce**, **radish**, **squash and pumpkin**, require relatively intensive manual labour. Lettuce is produced for the fresh market which makes it vulnerable to market changes. Agreements with buyers are a good way to take some of this risk away from the grower. Radish is used a lot in salads and is grown locally on family farms. This product also has a relatively short shelf-life and is susceptible to diseases and pests which make short sales lines very important. Squash and pumpkin are vulnerable crops and mechanization is possible but not easy or straightforward. This is a crop that is already grown in Ukraine which means there will be knowledge and expertise present. However, growing these crops requires additional investments in the processing chain because seeds need to be dried. Creating a uniform quality of seeds and sorting the seeds can both be tricky.

As we understand it, the market for products is relatively small. In saying this, with the right investors to create appropriate sales channels, this vegetable could grow again in the future. This requires a long-term vision and commitment.

Existing crops where we don't see connections for collaboration

In Ukraine, there is extensive experience with growing **gurkins** and **open field tomatoes**. For open field tomatoes there is potential for large-scale growing, especially for processed products. However, processing logistics and market potential will have to connect seamlessly. Also, the availability of water is uncertain now. Dutch seeds are used for open field tomato production, for now we don't see any further links for collaboration with the Netherlands, next to the general themes such as irrigation, storage and processing/packaging solutions. Gurkins have potential for the domestic market but must be processed and pickled, this can be labour and cost intensive. The question is if there is enough market potential. This is a specific crop that must be specifically matched with the existing cultivation plan.

b) Crops that could be niche products

Luxury crops

Artichokes and **asparagus** can have a potential for a niche market as luxury products, but very limited now. Climatologically, artichokes could fit in Ukraine but a collaboration with the Netherlands would not be of added value as the artichoke production and demand in the Netherlands is stable but relatively small. Collaboration with countries like Italy, Spain and France could have more value.

Asparagus is a crop not traditionally used in the Ukrainian cuisine and relatively unknown to Ukrainian farmers. Before the full-scale invasion there was production in the Kherson region and cultivation is now largely situated in Volyn. The cultivation is very labour-intensive, and it requires a lot of investment before it can be harvested, as the crop can only be harvested after 3 years. Asparagus can be possible as a luxury niche product. In the Netherlands, asparagus is a culturally appreciated product grown on 3.000 ha and often sold locally on the farm, providing direct income.

Essential oils – sourced from a diversity of (oil) crops - have been mentioned in the survey and interviews as a potential market generating high-value products. This can be considered a niche product that fits in with the growing interest for natural medicine alternatives and aroma therapy. For now we do not see added value of collaboration with the Netherlands.

Limited market expectations

Chicory is a crop that is considered a craft product. In the North-Sumy region chicory is traditionally grown on a small scale Chicory is nowadays also imported from India which means import substitution can be considered. It is a two-year crop which means that harvesting takes place in the second year. The Netherlands has extensive experience in cultivating chicory, but the domestic market is saturated, and yields can disappoint sometimes.

Napa cabbage, also referred to as 'Chinese cabbage' in the Netherlands, requires a moderate temperature for cultivation and has a short growing period. Because of the moderate temperature throughout the season in Ukraine, it is a viable crop. However, it is highly susceptible to diseases and pests, making it more suitable for a niche market. Originally, in Ukraine it was mainly cultivated for the Russian market, but the war disturbed that demand making it more suitable for a niche product.

Ukraine is a main producer of **pumpkin and squash**, having suitable soil and climatologic features for its cultivation. Butternut squash for example is resistant against drought and can survive different climate types. It can be grown on a large and small scale and can be grown organic. Butternut squash can be kept fresh for months without cooling. Since Ukraine is already a producer of pumpkin and squash, selling pumpkin seeds for consumption or oil can increase value to redundant biomass from the product. However, the limited market makes this a niche product for a specific market. More generally on the future potential for pumpkin, the Centre for the Promotion of Import from developing countries describes an expected growth in pumpkin consumption for the coming years, driven by trends involving health and sustainability (CBI, 2024). Pumpkins and squash can also be used as an ingredient in vegetarian products, which could offer opportunities as the number of people on a vegetarian or vegan diet is growing in the EU.

Labour intensive crops

The cultivation of **garlic** fits in the Ukrainian climate and domestic cuisine but requires relatively labour-intensive cultivation and has a limited market. It can be considered a niche product. The Netherlands doesn't have an extensive garlic production, so Ukrainian Dutch collaboration in garlic is not expected to have an added value.

The cultivation of (sweet) **pepper** in the open soil is possible in Ukraine, but the crop is very sensitive to frost. Changes in temperature and stress factors have a major impact, so cultivation in plastic tunnels or greenhouses has a bigger chance of success. Furthermore, cultivating peppers is relatively labour intensive. Collaborations with the Netherlands are not considered suitable for the moment.

4 Value chain observations and possibilities for collaboration

In this study, we have described possibilities for collaboration between Ukraine and the Netherlands per crop and crop group. Because fiber crops and vegetable crops present the most potential, the added value of collaboration to value chains is summarized and depicted below.

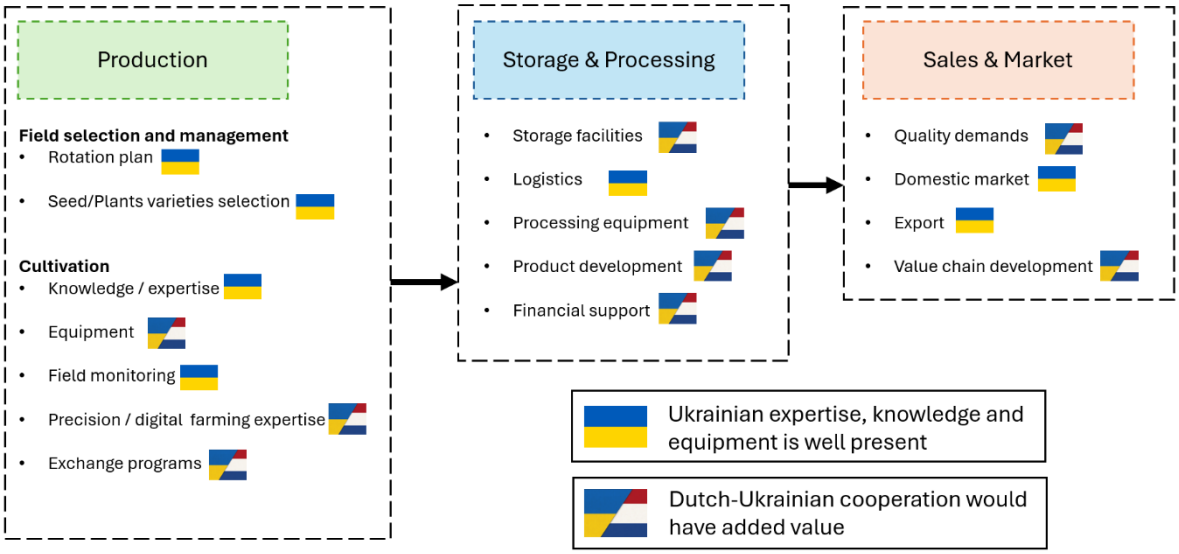

Figure 8: Opportunity to create added value in value chain development for fiber crops by collaboration of Ukraine and the Netherlands

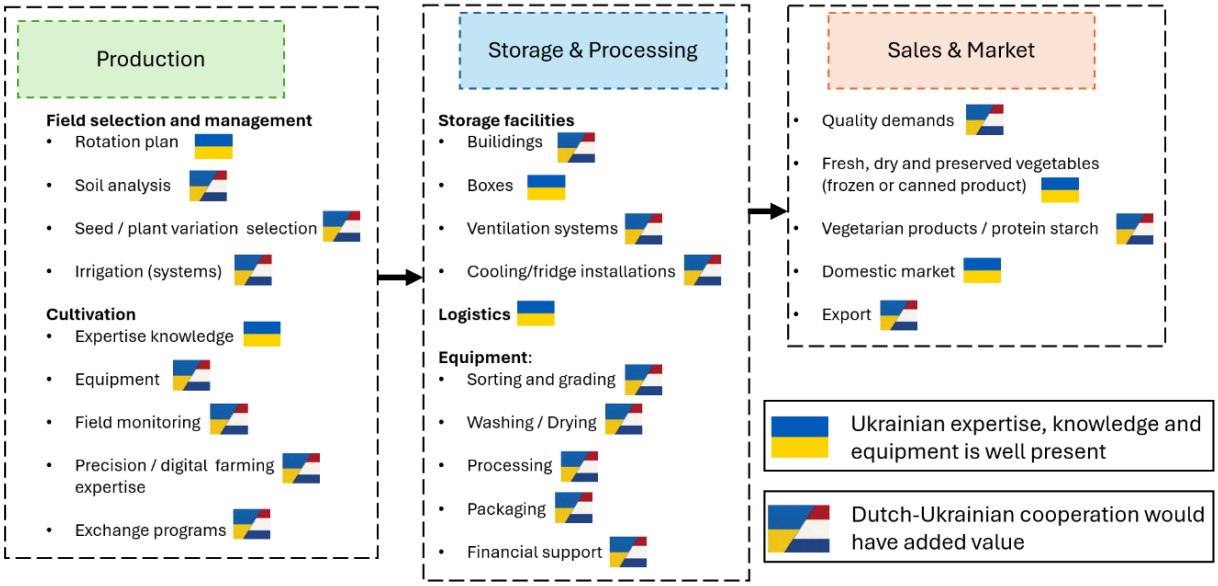

Figure 9: Opportunity to create added value in value chain development for vegetable crops by collaboration of Ukraine and the Netherlands

7 Government and sector organizations

Both in the interview and the survey, participants are clear that to foster successful collaboration in the cultivation and development of (novel) agricultural supply chains, the Dutch government can play a vital role by providing access to relevant information, mitigating risks in cooperation with Atradius and facilitating knowledge sharing between stakeholders. Appointing dedicated contact persons would help streamline communication and coordination efforts. In addition, offering technical support and promoting collaboration through joint initiatives can significantly enhance the effectiveness of these partnerships.

The introduction of novel, innovative technologies, particularly those related to new plant species, along with comprehensive training on how to work with them, would further strengthen development. Organizing training programs to share European agricultural expertise would also contribute to building capacity and aligning practices. For this, European programs should be utilized like for example Horizon Europe.

Financial support remains a key enabler, whether through direct funding, subsidies, or investment incentives. Private investments, bilateral programs and International Financial Institutions such as the EBRD play a key role in financing. Dutch instruments such as Impact Clusters and the Ukraine Partnership Facility can be utilized, next to instruments like the Private Sector Development (PSD) Toolkit that is based on initiative from the Netherlands Embassy, and cluster budget that is allocated to the five different platforms of the Netherlands Enterprise Agency (RVO), of which the Dutch Agriculture & Food Security platform Ukraine is one of them.

Enhancing logistics infrastructure for the transport and storage of agricultural products, along with simplifying certification processes, would facilitate easier access to European markets.

Supporting Ukraine's EU membership aspirations and facilitating the export of Ukrainian agricultural products is also important. Discussions on import quotas and the future of Ukraine in Europe are of course discussions on a European level.

Establishing collaborations in cultivation, processing, and supply would create long-term business opportunities. Active participation of farm enterprises, other companies, associations and governments in conferences and seminars would allow organizations to engage directly with growers, better understand their specific needs, and tailor support accordingly.

8 Case studies

1 Hempire

This case was valuable to our study because it illustrates the opportunities that are present on the topic of fiber crops and collaboration between Ukraine and the Netherlands.

Hempire is a Ukrainian company founded in 2015, active in the production of hemp-based construction materials. It processes dried hemp into prefab walls, floors, roofs, insulation material, plaster and lime binder. In the efforts of Ukraine's early reconstruction, Hempire started a consortium with two Dutch partners: ODU and Rawblox. The Netherlands-based Open Door Ukraine (ODU) Foundation is active in humanitarian and early recovery activities to help the affected Ukrainian population and repair damage caused by the war. Rawblox is a Dutch startup providing equipment to make biobased construction materials of straw.

The consortium has been granted support from the Ukraine Partnership Facility (UPF), a program from the Netherlands Enterprise Agency commissioned by the Netherlands Ministry of Foreign Affairs. UPF supports damage repair and reconstruction projects for the public and private sectors. UPF aims to help the recovery and sustainable reconstruction activities of the Ukrainian economy and society in the water, healthcare, circular reconstruction, sustainable energy and agricultural sectors.

This UPF will be used by Hempire, ODU and Rawblox to jointly construct buildings made of biobased prefab materials, where straw is used for the walls and hemp for the floors and roofs. By operating the equipment locally, using the local available straw and hemp, production capacity can be significantly strengthened. With the local facility, dozens of houses can be produced per month. This makes it possible to respond to the acute housing shortage in Ukraine, while also reducing the environmental impact and production costs per house due to economies of scale.

The consortium showcases a successful case of Ukrainian Dutch collaboration in hemp, a 'novel' crop of which the produced area is expected to grow significantly. Although this collaboration is not directly taking place within the agricultural sector but further down the chain, it shows how Dutch technology and funding can help with setting up a chain within Ukraine to increase the value of a product domestically. Simultaneously, Dutch technologies can be tested 'in the field', gaining valuable insights to implement it in the Netherlands in the future as well. If the technology of biobased construction would gain track in Ukraine, it would increase the

market value and stimulate the crop value of hemp as well, making it more financially appealing for farmers to grow.

2 Blue Bean

This case was valuable to our study because it illustrates lessons learned from an initiative to set up a plant-based protein factory in Poland.

A few years ago, the set-up of a plant-based protein factory was prepared in Poland, driven by the belief in the strong potential of plant proteins. In collaboration with Wageningen University & Research, the concept and design of the facility were developed. You can read more about this project on the website[3].

The orientation phase involved support from the Netherlands Embassy in Warsaw and local market insights from Blue Bean. This project was initiated with TOP BV in Wageningen to design a facility capable of processing raw protein crops by removing the husk and extracting protein fractions.

Discussions were held with market players but unfortunately, during the preparation phase of the project, market forecasts became less optimistic. The growth of the meat substitute market slowed, and the anticipated shortage in production capacity did not materialize. As a result, the project was put on hold to avoid adding unnecessary capacity.

Key lessons learned include the need to involve the full value chain, collaborate with local stakeholders, and engage with agricultural organizations, universities, and traders who have direct access to growers and storage infrastructure. Continuous production requires strong partnerships with major market players.

Inspired by this, similar opportunities can be explored in Ukraine, processing local crops into protein fractions for distribution across Europe. While there is existing protein concentrate capacity in Europe, the business case for Ukraine remains strong due to relatively lower land, and investment costs, as compared to other European countries.

[3] https://bluebean-proteins.com/.

9 Conclusions and recommendations

The objective of this study was to find out which crops and chains have the most potential for collaboration between the Netherlands and Ukraine, on the topic of novel crops. In this chapter, we will answer the main and sub questions of this research study and provide our recommendations.

Our definition for this study:
Novel crops: crops that are not widely grown in Ukraine yet.

1 Conclusions

There is a wealth of local agronomic knowledge available in Ukraine, which allows for the cultivation of nearly every crop. The Ukrainian soil and climate, combined with the resourcefulness and extensive experience of its farmers, make nearly every non-occupied region a strong candidate for open-field vegetable farming. This creates a solid foundation for international collaboration.

Unfortunately, due to the ongoing full-scale invasion, the security situation in Ukraine can vary significantly. Generally speaking, Ukrainian growers and processors face several challenges. Climatic conditions such as drought, humidity, and heat stress play a critical role in crop performance, particularly due to their influence on pest and disease pressure. Furthermore, there is a limited availability of labour and an urgent need for irrigation infrastructure. Together, these elements can significantly affect the feasibility and long-term sustainability of introducing new crops.

Due to the current labour shortages, there is a clear demand for support in mechanization, particularly in sowing, planting, harvesting, and processing. Irrigation and infrastructure, including storage, processing, and logistics, are top priorities for building both new and existing value chains. For fiber crops, key needs include access to high-quality seeds, modern cultivation techniques, efficient harvesting and processing equipment, and market development strategies. For vegetable crops, challenges often relate to irrigation, crop rotation planning, pest and disease management, post-harvest handling, and meeting the (phyto)sanitary and quality standards required for export.

Dutch products, knowledge, and technologies can play a vital role in addressing these challenges. By collaborating with Ukrainian partners across the entire value chain, from cultivation and soil analysis to storage, processing, and market access, Dutch expertise can help unlock the full potential of these crops. Areas where collaboration is particularly valuable include precision agriculture, irrigation systems, cultivation equipment,

exchange programs focused on agronomic practices and post-harvest techniques, product development, financial support mechanisms, and aligning with quality requirements of end markets.

Among the crops and value chains with the highest potential for collaboration are novel crops such as faba beans, leek, and sweet potatoes. Crops that are already cultivated in Ukraine are also interesting for joint development due to either their potential for novel applications (e.g. producing pea starch, cultivating soy for human consumption or developing biobased materials from fiber crops), or their potential to be scaled up quickly and serve the domestic market (red beets, carrots, onions, white cabbage).

When introducing a novel crop, success depends heavily on local climate conditions, the choice of varieties, crop rotation schemes, logistics, and access to reliable sales channels. These factors must be carefully considered and tailored to regional contexts. It is important to realize that growing new crops without proper sales channels can make prices drop dramatically, by creating a local oversupply. Upon entering new markets, Ukrainian farmers and researchers state that regulations, lack of contacts and lack of finances present the main challenges. Knowledge sharing, finance and international collaboration were mentioned as the most valuable support.

The export of agricultural products, technologies, and expertise offers significant opportunities for both countries, particularly in the context of Ukraine's ambitions to modernize and diversify its agri-food sector. However, realizing this potential requires overcoming several logistical, regulatory, and strategic challenges. Cross-border movement of materials, seeds, and project managers currently remains complex due to customs procedures, phytosanitary regulations, and geopolitical sensitivities. Identifying reliable local partners on both sides is essential for sustainable collaboration, yet often time-consuming and dependent on strong networks. For Ukrainian exports to the Netherlands or the broader EU, compliance with certification standards, ensuring product protection during transport, and conducting thorough value assessments are critical. These efforts rely on clear market agreements and predictable trade conditions.

Support from the Dutch government[4] can play a crucial role in enabling successful collaboration. This includes financial instruments specifically targeting medium-sized enterprises and the stimulation of cluster formation

[4] Governmental bodies such as the Ministry of Foreign Affairs, the Ministry of Agriculture, Fisheries, Food Security and Nature, the Netherlands Embassy in Kyiv, the Netherlands Enterprise Agency (RVO) and Centre for the Promotion of Imports from developing countries (CBI)

among chain actors working with specific crops, helping them to connect more efficiently. Additionally, encouraging and facilitating the formation of long-term partnerships between Dutch and Ukrainian stakeholders is essential. Sector associations, both Dutch and Ukrainian, can play a pivotal role in facilitating connections, sharing best practices, and advocating for supportive policies. To strengthen agricultural chains in both countries, government and sector organizations in the Netherlands and Ukraine should work together based on a shared vision. This requires genuine dialogue with local knowledge holders in Ukraine, listening carefully and engaging in co-creation rather than imposing Dutch perspectives. Ukraine should be placed in the lead, with Dutch actors supporting rather than directing.

The European Union can also become a strategic partner for Ukraine in this transformation. EU policies such as the protein strategy, Horizon Europe and the vision for circular construction create new opportunities for Ukrainian agriculture. These frameworks help to open up export markets for protein-rich crops and sustainable building materials derived from fiber crops, further strengthening the economic and environmental resilience of Ukraine's agri-food sector. It will be key to align regulations and reduce restrictions like corruption to ease trade flows.

If these collaboration strategies are effectively implemented, the remaining challenges will likely center on harmonizing standards, scaling logistics, and building long-term trust between stakeholders.

2 Recommendations

Production

Various crops are expected to be promising for Dutch-Ukrainian cooperation. Legumes such as peas for starch, and soybeans (opportunities for human consumption) offer strong potential due to the rising markets for plant-based proteins and starch. Fiber crops like hemp and flax can be cultivated widely across Ukraine and offer additional benefits such as soil remediation, especially in war-affected areas. Sweet potato, leek and faba beans are promising but will need further agronomic development and adaptation to Ukraine's specific climatic and soil conditions. Successful cultivation of novel crops will require the right variety selection, equipment and practical research in the form of pilot projects. Expansion of existing crops in Ukraine such as beetroot, carrot, onion, and white cabbage is also expected to have significant potential, as these crops are generally well-suited to mechanized farming, resilient under current conditions, there is a lot of experience already and they offer both fresh and processed market opportunities. These vegetables are very well suited for the domestic market.

When considering the introduction of a novel crop or a novel way of processing existing crops, we strongly recommend conducting thorough research tailored to local conditions. This means pilot projects on the cultivation and quality demands of sweet potato, leek and faba beans should be set up. We recommend that the pilots are executed by Ukrainian farmers, and that the project management is a Dutch-Ukrainian partnership. The project leader must be experienced in collaborating with local Ukrainian and/or Dutch farmers. Depending on the crop type, 20 to 100 hectares should be used per pilot project. Oversized pilots may lead to challenges due to the novelty of the crops, limited processing capacity, and potential market disruptions. Pilots smaller than 20 hectares will likely not be taken seriously by Ukrainian entrepreneurs. Preferably, pilots are set up in different regions of Ukraine to assess the effects of local climate and soil conditions on the different crop types.

Peer-to-peer knowledge exchange on cultivation specifics and quality demands is a valuable part of these types of projects. Pilot projects should serve not only as testing grounds but also as platforms for demonstration to, and communication with other farmers in the region. It must be kept in mind that pilots differ in set up, depending on the crop type. It will be important to not only include interested farmers but to create a process where interested stakeholders in the value chain are involved. For seed and variety selection, we advise to include Enza Zaden, Rijk Zwaan and Bejo Zaden. It is good to check what varieties of the crops are already registered in Ukraine and from what breeders (Ukrainian Ministry of Agriculture, 2025). As an example organization that can be used as a starting point for the pilot projects, we recommend including students enrolled in Agrokebety (UCAB). These students may be interested to learn about and collaborate on novel crops and Dutch cultivation technologies. Although this would contribute less directly to ‘farmers learning from farmers’, it familiarizes next generation’s farmers with novel crops and technologies and generates practical knowledge about it in the Ukrainian field. Other relevant organizations to include in pilot projects can be the Wageningen University & Research, the National University of Life and Environmental Sciences of Ukraine, Kyiv School of Economics, Ukrainian and Duch applied studies, the Institute of Bast Crops of the National Academy of Agrarian Sciences of Ukraine (for fiber crops) and Ukrainian Pulse and Soybean Association (for legumes). A research project in which multiple European & Ukrainian organizations are partnering may be eligible to be supported by EU financial schemes, such as Horizon Europe. A first step recommendation is to consult an expert who can build a network and initiate a strong project plan together with all actors involved. Again, it is important that farmers can learn from other farmers and that they are very closely involved in the pilot project. It is not just about acquiring knowledge.

Storage and processing

A bottleneck in realizing the potential of (novel) crops lies in the availability and modernization of storage and processing infrastructure. For crops like leek, beetroot, carrot, onion, and cabbage, high-quality storage is essential to maintain product quality and extend marketability. For legumes, separating- and cleaning technologies contribute to quality standards. In the fiber crop sector, investments in primary processing facilities for hemp and flax are necessary to add value and reduce transport inefficiency. Dutch companies can play a key role in supplying equipment and know-how for drying, pressing, packaging, and sorting. Joint ventures or public-private partnerships could accelerate the development of these facilities.

Dutch technology in cold chains, humidity control systems and smart monitoring tools is well known and appreciated in Ukraine. Multiple Dutch organizations such as Tolsma Grisnich, Van Dijk Technieks, Royal Haskoning DHV, VDL and APH Group have been active in Ukraine for a long time or would like to become more active, also on processing and packaging. Storage facilities are a priority of the Ukrainian government because of the direct link to food security and value creation. The way must be paved towards financial support by private investments, bilateral programs and International Financial Institutions such as the European Bank for Reconstruction and Development (EBRD), which is a work in progress with a role for different stakeholders such as the Netherlands Enterprise Agency (RVO) and the Dutch Agriculture & Food Security platform Ukraine. The EBRD is supporting the Ukrainian government in strategic development of different sectors.

Sales and market

For legumes and soybeans, the growing European demand for plant-based proteins presents a clear opportunity. Ukraine's position as Europe's largest soybean producer can be leveraged to supply the EU with non-GMO soy for human consumption, and more locally sourced soy for cattle feed. Similarly, the rising global demand for pea starch opens up export potential, especially if Ukraine can ensure consistent quality and supply. Fiber crops like hemp and flax can tap into the expanding market for biobased construction materials, where Dutch start-ups and initiatives can offer a platform for collaboration. Joint efforts between Dutch and Ukrainian stakeholders to align standards, promote Ukrainian varieties in the EU, and develop pilot projects can help build trust and market access. For exporting vegetables like sweet potato and processed white cabbage, CBI could possibly assist in export promotion towards the European market.

To assess the demand of the Dutch retail sector for specific Ukrainian products, an explorative inquiry would be necessary, preferably combined

with a physical or hybrid networking event for organizations to introduce and connect. Supermarkets in the Netherlands and Europe typically have purchasing alliances. This means they jointly purchase products at favourable prices and other conditions. In the past, companies from Ukraine tried to sell a product directly to a supermarket, but in practice, this is rarely effective. It is necessary to engage with these purchasing alliances. In this context, the advice is to conduct a separate market scan focused on international traders and purchasing alliances. One should also be aware supermarkets focus on affordable prices and want to be distinctive to their competitors. The inquiry should then target the agreements, product characteristics, and product quality that the purchasing alliances require to reach deals. Institutions like CBI should be contacted for this inquiry. Subsequently, a small event could be organized in collaboration with the Ukrainian Embassy in The Hague and/or the Dutch Agriculture and Food Security Platform Ukraine.

Contact about collaboration

Engaging with relevant Ukrainian sector associations can provide valuable insights and support. For those seeking collaboration with Dutch partners, we advise to connect with the Dutch Agriculture and Food Security platform Ukraine, that facilitates networking and encourages matchmaking, with a focus on possible public-private partnership contributions to the early recovery and reconstruction of Ukraine's agricultural sector. On the webpage of the Netherlands Enterprise Agency (RVO), which supports Dutch entrepreneurs in taking part in the early reconstruction of Ukraine, information about financial support, business events, collaboration and personal advice can be found. The Netherlands Embassy in Kyiv collaborates with the Netherlands Enterprise Agency (RVO) to support Dutch entrepreneurs.

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12 Appendix

A) Interview guidelines

This Appendix consists of the information that is shared prior to the interview and the outline of the interview. The interview minutes are not shared publicly.

A1. Information shared prior to the interview

- Duration of maximum 60 minutes
- Why the interviewee is asked
- Explanation about novel crops and how it is defined in this study
- The question to already think about experiences and network on this topic
- The language that will be used, English.

A2. The outline of the interview

Stakeholders that were invited to participate in a digital interview were asked questions about the production, processing, storage, logistic and market opportunities on the studied crops. The raw data of the interviews and the interview guidelines are available to the Netherlands Enterprise Agency (RVO).

B) Survey

Survey questions

General information about your organization

1. What is the name of your company, and since when have you been active? In which region are you located? T*ext box*

2. What is your primary activity within the agricultural sector? (multiple answers possible):
   - Breeding
   - Cultivation
   - Technology
   - Storage
   - Trade
   - Processing
   - Advocacy
   - Other, namely: *Short text box*

3. Can you describe the current size of your company? (e.g., production volume, hectares, number of employees or members, turnover) T*ext box*

Cultivation (if applicable)

4. What crops are you currently cultivating, or are being cultivated in your business environment (at your clients or suppliers)? *Text box*

5. Have there been any recent changes, and if so, could you elaborate? T*ext box*

6. This study examines the potential of the following crops. Which of these would fit into your crop rotation plan? (multiple answers possible):
   - Fiber crops for bio-based construction materials
   - Protein-rich crops for human consumption
   - Vegetable crops, fresh or processed
   - Oil-bearing crops
   - Other, namely: *Short text box*

7. Which (specific) crops? Please elaborate on your choice. *Long text box*

8. What factors influence your decision to introduce a new crop? (e.g., market potential, soil conditions, soil health, climate resilience, subsidies) *Text box*

9. Which regions in Ukraine would be most suitable for cultivating these crops, and why?
   T*ext box*

10. What are the biggest challenges for cultivating the potential crops mentioned? Think of water availability, pests, diseases, processing, storage, and markets. *Text box*

11. Can knowledge, products, or technology help address these challenges? If so, please specify for each challenge how it can help. *Text box*

12. What factors do you consider essential for the successful cultivation of the mentioned crops? Think of: Precision farming, digitization, traceability, new processing methods, or other factors. *Text box*

Supply Chain

13. Does your company have its own **storage** facilities? If so, what type of facilities and units are used and what is the capacity? *Text box*

14. What are the biggest challenges in storage and conditioning? *Text box*

15. Does your company have its own **processing** facilities? If so, what type of facilities and units are used and what is the capacity? *Text box*

16. What are the biggest challenges in processing and handling? *Text box*

17. How are your products currently marketed? (e.g., local market, export, direct sales) *Text box*

18. In which specific markets or sales channels do you see growth opportunities? *Text box*

19. What are the biggest obstacles for your company in accessing new markets? For example:
    - Regulations
    - Logistics
    - Financing
    - Contacts
    - Price fluctuations
    - Other, namely: *Short text box*

20. Which logistics channels are currently used for the distribution of your products? Please describe the complete logistics flow from production location to consumer. *Text box*

Supply Chain Integration and Partnerships

21. What kind of support or partnerships would help you unlock the growth potential of new crops? Think of: knowledge sharing, investors, collaboration with international/Dutch companies, financial resources. *Text box*

22. What are the opportunities and challenges for exporting Dutch products to Ukraine and vice versa within the mentioned crops and supply chains?
    - Fiber crops for bio-based construction materials *Text box*
    - Protein-rich crops for human consumption *Text box*
    - Vegetable crops, fresh or processed *Text box*
    - Oil-bearing crops *Text box*
    - Other crops: T*ext box*
    - Supply chain *Text box*

23. What support from the Dutch government could contribute to successful collaboration in the cultivation and development of these supply chains? *Text box*

24. How can governmental and sectoral organizations in the Netherlands and Ukraine collaborate to strengthen agricultural supply chains in both countries? *Text box*

Final Question

25. Here you have the opportunity to provide any additional comments related to the content of this survey. *Text box*

26. Please leave your contact details (email address and phone number) so we can reach out to you if we consider further clarification or in-depth questions as useful. *Text box*


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