Ministry of Foreign Affairs

Supporting Horticulture Gagauzia

Commissioned by the Netherlands Enterprise Agency

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1. Introduction

In the region Gagauzia in Moldova tomatoes and cucumbers are produced in relatively low-tech conditions. This results in lack of production to meet domestic demand, and in a narrow window for the crops to grow (harvest from April – October).
The Dutch Government, represented by the Agricultural Counsellor wishes to support local farmers in producing tomatoes and cucumbers for the local market in order to become independent from import from Turkey in the long run. At this moment, the horticulture sector is not capable of commercially producing tomatoes and other vegetables to meet local market demands. There is a year-round demand for local produce, though, as the Gagauzian consumers believe this produce to be of higher quality and better flavour than the imported products from Turkey.
The Agricultural Counsellor has requested Delphy to conduct a study, on feasible improvements to make the horticulture tomato sector financially viable in the next coming years. This starts by mapping the current situation, and identifying limiting factors and opportunities for improvement.

The **purpose** of this study it to present a financial and material plan to help increase the production of tomatoes in an viable way in this region, and to prepare an action plan to increase the growing season of tomatoes and cucumbers. Given the hot summers and cold winters, all cultivation is in greenhouses.

This study concluded in a demonstration and seminar for the Gagauzian Chamber of Commerce (CoC), and a selected group of growers in the region. During these two days, the growers, the CoC and the main agricultural bank were informed on the major findings and had the opportunity to practically learn how to implement some of the recommendations of the feasibility study.

Reader's guide

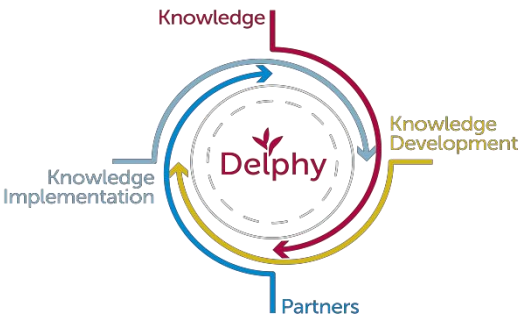
This report is set up as follows: chapter 3 provides an overview of the current state of the horticulture sector in Gagauzia (based on desk study, interviews, surveys and group discussions. Chapter 4 gives an example of a financial plan that was developed by our experts, but also with the help of the growers during a workshop on developing business cases in May. Chapter 5 presents our recommendations for improvement (growing techniques, inputs, post-harvest upgrades, vocational training & value chain cooperation). In chapter 6 the potential for a demonstration greenhouse is explained, and this report concludes in chapter 7. In the annex you can find an overview of the project activities.

2. Partners

2.1 Delphy

Delphy BV is the largest global commercial service provider in the field of cultivation and production related knowledge regarding food & flowers. Based in Wageningen (the Netherlands), Delphy develop and implement knowledge worldwide. More than 230 employees of which 65 foreign employees are 24/7 involved in cultivation and production of food and flowers. Our professionals are a strong team of entrepreneurial, independent advisors with leading global practical knowledge and expertise. Therefore, we can offer each client the best solutions possible on plant production. Delphy is international recognized as a reliable partner with a practical, high knowledge level and the ability to reach the sectors' and farmers' needs with suitable knowledge and technology.

Our services include crop advice, applied research (on-site or at our own research units), trainings and (turnkey) projects to farmers, agricultural companies and investors worldwide. Delphy transfers their expertise and knowledge in TA projects, with the execution of training programs, capacity building, value chain development and agricultural information systems. We always focus on sustainable solutions and are very active in the field of Climate Smart Agriculture. We look for partners worldwide to start up new and innovative agricultural business with a local touch.



Our Experts

Mink Vermeer: Senior expert on open field farming, conducting market studies and setting up investment plans. Speaks Russian and knows the Moldovan context.

Willem Hendriks: Senior Expert on greenhouse cultivation and optimal crop growth. Experience with low- and high-tech greenhouse systems.

Hannah Zevenbergen: program manager, expert on community engagement and horizontal & vertical cooperation across the value-chain.

2.2 Beneficiaries

During the project, we worked together with a core group of growers, that showed an interest in learning and starting up new innovative ways of growing. These 15 growers were present during each field activity. A larger number of growers was included in the surveys, and they will keep in contact with the CoC on learning at a later stage from the demonstration and seminar. Of the leading growers, two were female. The other growers worked together with their wives and family to maintain the greenhouses. One youth participated in the study. The estimate is that through these 15 growers, two partners from the CoC, the agricultural bank, and a horticulture grower's association, at least 60 persons have indirectly benefited from the project. All these people have received the grower's booklet (a summary of the demonstration and seminar, including personalised advice for 6 growers) and can make use of the new experiences of the CoC in supporting them in preparing their business case. In addition to this, all growers in close contact with the CoC now have the opportunity to make use of an EC/pH meter provided by the project. In Table 1 an overview of the direct and indirect beneficiaries is presented.

Table 1. Number of beneficiaries reached.

Nr of people directly reached	Nr of people indirectly reached
20 (2 female, 1 youth) Of which: 15 growers, 2 members of the CoC, 1 director of the agricultural bank, 2 representatives of the horticulture growers association	60
How	How
Through the demonstration & seminar, ad hoc recommendations during the	By association with the core group, the dissemination of the growers booklet, the use of the

field visits, and the growers booklet	EC/pH meter, and by the increased capacity of the CoC to support in the development of business plans and collaboration strategies.

During the study it became apparent that most of the growers do not go to extension service officers, but get most of their knowledge by word of mouth, by local input suppliers and through the internet. They get their knowledge on entrepreneurial skills from the CoC. Two input suppliers from Ceadir-Lunga have been contacted by the study, and the growers have had the opportunity to learn what Dutch supplier best meets their needs for inputs. Furthermore, in the growers booklet the contact information of two main Dutch seed suppliers are shared.

3. Assessment of current situation

In the Republic of Moldova, the northern and central regions are the main agricultural producing regions. In Gagauzia, this sector is underdeveloped as they did not receive the same necessary support the rest of the country received (which results in lack of modern technologies, high operating costs (including exorbitant high tariffs for heating greenhouses in the cold season)). However, within this marginalised region, a number of leading growers have taken the initiative to invest in greenhouses, and many households have their own greenhouse for personal consumption. This implies two important facts:

1. There is a high demand for locally grown produce, and
2. Farmers are open to and have a drive to innovate

According to the bureau of statistics of the Republic of Moldova, 12.7 thousand tons of vegetables were grown in greenhouses. This is an increase of 1.2% compared to 2020. Local produce is only available in three or four months in the year, in the other months Gagauzia is dependent on imports from mainly Turkey, Poland and the Netherlands.

In Gagauzia, there are only 5 registered greenhouse producers. 90% of local production is done without formal registration. As will be mentioned in the section on enabling policies, this makes it difficult for 90% of the growers to secure either a loan or subsidy.

3.1 Climate

Moldova has a temperate continental climate, with hot summers and relatively cold winters. Table 2 below presents an overview of the main climatological characteristics of the country. However, this data is only per month (not per day) and therefor it remains difficult to assess the situation. These cold winters mean, that without heating and lighting systems, tomato and cucumber growers only have one growing season (from May to September). In the other months, these vegetables are imported. The average temperature ranges from -2 in winter, to 23 in the summer. Due to climatic changes rainfall is less and more erratic, and open water bodies are declining in volume.

In the spring, frosty weather is still common. During the third field visit in May, some of the growers had damaged crops because a part of the greenhouse plastic was blown off in a storm and left the young plants vulnerable to low temperatures.

Table 2. Main climatological characteristics of Moldova, per month.

	Average temperature (Celsius)	Average humidity (percentage)	Average cloudy days
January	-1.8	82	13
February	-0.2	78	13
March	4.5	71	16
April	11.0	63	17
May	16.8	60	20
June	20.7	63	21
July	22.9	62	23
August	22.6	60	21
September	17.0	66	18
October	10.8	73	18
November	4.8	81	13
December	-0.2	83	13

3.2 Knowledge & experience of growers

Most of the growers taught themselves how to cultivate in greenhouses, and make use of information on the internet and by the limited amount of local input suppliers. The university of Comrat has an agricultural faculty, and they stimulate graduates to work for agricultural companies. Most knowledge lies in the cultivation of cereals and grapes (for wine), and most graduates will work in this sector, opposed to horticulture.

See Figures 1 and 2 for an example of different input suppliers.

Figure 1. Input supplier with limited knowledge.

Figure 2. Graduate input supplier with a lot of knowledge.

Growers often do not have the knowledge or experience in recognizing specific pests or diseases, and their cultivation techniques are often basic and easy to improve . Some of the growers, however, have put a lot of time and effort in optimising their greenhouse and are good examples for other growers to visit. In addition to these cultivation methods, some of the growers that we met do not monitor their harvests and have no crop registration. They also have limited experience in marketing their produce. They use standardised fertiliser and pesticide quantities, and furthermore have limited knowledge on

crop rotation and the impacts of soil disinfection on the soil quality. During the demonstration day, we discussed several alternative strategies, which can directly be implemented by the growers. Still, a lot of more in-depth training is necessary to bring the knowledge and experience level of these growers to a commercial level.

3.3 Policies

Under certain conditions can the government of Moldova provide subsidies for the construction of greenhouses (only the outer structure, not the technologies inside the greenhouse). For this, the growers would need to be registered, and they would need to pay for the installation in advance. Given the actual inflation rate of 27% this means that the growers end up only having covered part of their investment costs. This means that most growers cannot use the subsidies, as they do not have the seed money, and they cannot afford to lose part of their investment due to inflation. In theory it is possible to secure a loan with 30% own investment, but the interest rate is 10%, and in practice the agricultural bank rarely gives loans to the horticulture sector, as they have more trust in traditional open field cultivation of grapes and cereals. If the growers do not pay taxes, the interest rates are higher than 10%. The growers often do not want to register, because they do not have enough faith in their future revenues to afford to pay the mandatory taxes.

Between 12 and 14 times per year, the growers have the opportunity to meet with national cultivation specialists (extension service officers), provided by the government. The farmers furthermore have the opportunity to request specific expertise, but this knowledge is only limited to cultivation (not post-harvest, or not related to entrepreneurial or economic training). The experts furthermore often lack up-to-date information.

The local government does not get support from the national government to invest in horticulture in the region, so in practice, the growers rarely turn to the government for support (both in terms of financial support and training).

Finally, there are no price regulations (for inputs and for produce), and these are left up to the market. The prices fluctuate between the peak and low season, and the moment the bulk of the harvest is put on the market, the prices drop significantly. During the harvest season, there are also no import bans of tariffs to protect local revenues.

3.4 Cultivation methods

Not all the growers had the same cultivation strategies, or the same infrastructure. This is because most of them are self-taught, and there is no structural collaboration amongst the growers. The cultivation methods are categorised as follows: cultivation infrastructure & technologies, crop management and input strategies.

Technologies

Because of large climatic risks, tomatoes and cucumbers are not grown in open field. Most greenhouses are located in the Ceadir-Lunga district, the Comrat district and the Vulcanesti district.
Most of the greenhouses are constructed by the growers themselves, and are either tunnels or in some cases glass and steel. In some cases the greenhouse is constructed by companies from Transnistria. One particular grower has a former soviet greenhouse construction of 1 ha, but the glass broke and he has

replaced it with plastic sheets. The steel construction is not made to support plastic, as with each heavy storm is blows off. Figure 3 shows this greenhouse construction.

Figure 3. Greenhouse construction from Soviet times, without glass.

The greenhouse tomatoes and cucumbers are grown in the soil, with drip irrigation, limited ventilation and in some cases heating for either the main greenhouse or their nurseries. In some cases, the growers have constructed a greenhouse within another greenhouse to increase the temperature. However, without proper lighting this means that the plants are weak and thin. Figures 4 and 5 are examples of such constructions.

Figure 4. A greenhouse within a greenhouse, with no artificial lighting.

Figure 5. Multiple layer nursery, with no artificial lighting.

Crop management

Most of the growers were aware of all the necessary steps in crop management, but do not execute them in a correct way. For instance, all growers pruned and twisted their crops, but in the way they did disease like botrytis can infest, or it was not done in the cheapest and most efficient way.

Input strategy

Furthermore, the growers rarely rotate their crop, and only in some cases disinfect the soil prior to cultivation. This means that overtime, more pests and diseases will infest the soil, and that harvest quantities and quality will decline. They also do not take regular soil and water samples, as they did not

know of the option to do so at the university of Comrat, and sending it to Chisinau is considered too expensive.

The growers used standardised amount of fertiliser and pesticides, and do not make optimal use of their dripping systems. A lot of inputs come from Ukraine and Russia, and are, given the current crisis, difficult to obtain.

Furthermore, most of the growers (about 95%) produce their own seedlings, and sell the rest to neighbouring growers. There are no large-scale nurseries. The growers that do have heating most often use this heating to grow their seedlings early in the year. There is one growing cycle, and the heating systems aim at maintaining the ground temperature not lower than 20 C, and the relative humidity between 70-80%.

3.5 Yield quality and quantity

In general, the yield quality and quantity is less than optimal. One grower that grows cucumber in a 400 m^2 greenhouse with heating obtains 25 kg/m^2 first class cucumbers. Other greenhouses produce only 10-12 kg/m^2 for tomato or cucumber: due to lack of knowhow less than half that can be achieved.

During the study, there was no harvest yet, so the actual quality of the produce could not be assessed. However, by interviewing the growers and consumers on the markets, everyone expressed their preference to local tomatoes and cucumbers over the imported alternatives.

3.6 Post-harvest systems & value chain collaboration

As briefly mentioned before, the growers do not have experience in marketing their produce, and they do not package it, besides in large plastic bags or crates to be transported to the markets. In some cases does the wholesaler or intermediary have a cold storage and repackages, but most of the produce is sold as shown in Figure 6 below.

Figure 6. Imported produce at local market in Ceadir-Lunga.

No producers have cold storage, and they do not specifically market or package their produce. The produce goes directly to the local markets, and is not transported to the rest of Moldova, or exported.

Most households eat pickled vegetables, but they prefer to make this themselves instead of buying it at the market or supermarket. Therefore, the growers do not see potential in developing processing factories.

Value chain collaboration

Though a lot of the growers know each other, they are reluctant to work together. In interviews and group discussions, this was attributed to the former soviet culture. The growers do not see how they can make small-scale improvements by co-investing, on sharing the costs of for instance transport to Chisinau for soil testing. There seems to be a lack of general trust in one another, and there is no experience in initiating bottom-up collaboration strategies. Large-scale support and planning is perhaps still the norm.

3.7 Key challenges

The paragraphs above highlight what is currently happening in the Gagauz region, in terms of cultivation, knowledge and policies. The literature review, surveys, field visits and the interviews summarise the following key bottlenecks for the development of the horticulture sector in the area:

- Absence of strong commercial relations and collaboration, horizontally and vertically along the value chain. Both locally, nationally and internationally.
- Difficulty producing in the winter months (lack of financial means and know-how to invest)
- Lack of professional training of the growers
- Lack of secondary labour force
- Lack of transparent and fair financing options
- Lack of know-how on how to improve harvest quantity and quality
- Lack of marketing and meeting market demands

Chapter 7 will give recommendations on how to mediate these above mentioned challenges.

4. Investment plan

During the seminar in May, a group of growers learnt how what to take into account when making a business plan, and what calculations are necessary when assessing the financial viability of an investment. Before the workshops, our experts gave a lecture on cost-benefit analysis in order for the growers to understand:

- revenues,
- costs,
- depreciation,
- maintenance,
- insurance,
- payback investment,
- profit & loss, cashflow,
- ROI (return on investment),
- discount rate,
- NPV (nett present value),
- IRR (internal rate of return)

The initial field study showed that the key improvement areas are heating and lighting of the greenhouses. As a preparation for the seminar, we made our own investment plan, based on the greenhouse of Prascovia Torlak. In addition to this, the growers made their own business plans. Though the growers, the bank and the CoC learnt a lot, the seminar showed that more time needs to be invested in understanding the differences between investments and regular costs, and how to make and assess investment plans.

When deciding what kind of investment would make the biggest change in the development of the horticulture sector in Gagauzia, while also taking into account the socio-economic feasibility of it, we came to the conclusion that a joint investment in a heating and lighting system will benefit the growers the most. Only investing in one of them will not result in the desired increase in harvest quantity and quality, as heating and lighting are closely interrelated in influencing the development of a crop.

There is a large variation between the types of greenhouses/tunnels in the area, but the lead farmers have more mid-tech infrastructure and would therefore benefit the most from installing heating and lighting.

In making the investment plan, we concluded that investing in high-tech solutions (constructing a high-tech greenhouse or changing to soilless cultivation for instance) are currently not feasible for the following reasons:

- Currently not economically feasible given the socio-economic situation in Gagauzia
- Would require intensive training to properly manage these greenhouses
- Brings a lot of risks that risk the increase in quality & quantity

The table below presents an overview of the variable & fixed costs, and the investments and revenues for a 1000m^2 greenhouse. The calculations are based on conservative assumptions, and it was used to showcase to the CoC, the growers and the bank what to take into account in making an investment plan, concluding that it can indeed be interesting to investment in heating and lighting systems.

Some important considerations that have not been included in the calculations (to keep it simple) are:

- The current investment plan does not take crop rotation into account. In practice, year round tomato cultivation (every year) can only work in soilless cultivation, or when the soil is disinfected after each cultivation. However, this is detrimental to soil biodiversity.
- In the calculations, we did not consider any increase in product quality and quantity during the earlier summer months, when still occasional frosty weather occurs. This means that, in practice, the increase in revenue might differ.
- The calculations assume that even in the mid-winter months there will be cultivation (year-round). In practice it might be the case that cultivation will be from March-October.

Some of the conclusions that can be derived from the investment plan:

- Total investment costs are € 23.765
- Without investments, the yearly income is €15.000
- With investments in heating and lighting systems, the yearly income can be €50.000
- The ROI after 5 years in 126%, meaning that in less than 4 years the investment is returned
- Payback time of the loan is 4 years, with a grace period of one year

This investment plan is presented as an example to the CoC, the growers, and the bank, to show that it is indeed interesting to invest in greenhouse cultivation (something that the bank was not sure of before the seminar), for the CoC it was a good training on how to make a business plan and support growers in doing so, and for the growers it is an example that thinking in long term revenues is more productive and lucrative than only thinking in terms of initial costs.

The original excel sheet with the detailed calculations can be shared upon request.

Table 3. Overview of costs investment plan.

Year /год	2022	2023	2024
Farmer Income / доход фермера			
ворота фермы €3,00/кг revenues / доходы	€ 25.000	€ 25.000	€ 25.000
Total revenues / Общий доходы	**€ 25.000**	**€ 25.000**	**€ 25.000**
Variable costs / Различные цены			
Различные цены (электричество)	€ 13.080	€ 13.080	€ 13.080
Total variable costs / Общий	**€ 13.080**	**€ 13.080**	**€ 13.080**

Fixed costs / Фиксированные расходы			
labor / рабочая сила	€ 2.400	€ 2.400	€ 2.400
Total labor / Общий	**€ 2.400**	**€ 2.400**	**€ 2.400**
Investment / Инвестиции			
Mid-tech greenhouse 1.000 sq.m.- / теплица	€ 20.165	€ 0	€ 0
инфраструктура и земля 1.200 sq.m.	€ 3.600	€ 0	€ 0
Total investment / Общий инвестиции	**€ 23.765**	**€ 0**	**€ 0**
Амортизация, обслуживание, страхование			
амортизация теплица		€ 2.017	€ 2.017
амортизация инфраструктура и земля		€ 120	€ 120
обслуживание, страхование	€ 475	€ 475	€ 475
Total depreciation, main.,ins. / Общий	**€ 475**	**€ 2.612**	**€ 2.612**

Table 4. Profits overview investment plan.

окупаемость	**2022**	**2023**	**2024**
сумма окупаемости, период (год)	4	€ 11.291	€ 11.291
процент 15,0% (год)---льготный период (год)	1	€ 6.775	€ 5.081
Окупаемость в евро в год	**€ 0**	**€ 18.066**	**€ 16.372**
Profit & loss / Прибыль и убытки			
Gross profit / Валовая прибыль	€ 9.520	€ 7.384	€ 7.384
Nett profit / Чистая прибыль	€ 8.854	€ 6.867	€ 6.867
Cashflow / Поток наличных денег			
Funding +inflow/Финансирование +приток	€ 45.165	€ 25.000	€ 25.000
Outflow / Отток	€ 35.645	€ 33.546	€ 31.852
b.cash / Начальный баланс наличности	€ 0	€ 9.520	€ 974
Increase in cash/Увеличение наличности	€ 9.520	-€ 8.546	-€ 6.852
E.c.b. / Конечный баланс наличности	**€ 9.520**	**€ 974**	**-€ 5.878**
Financial indices / Финансовые показатели		**2023**	**2024**
C.g.(i+d)/Денежные средства получены	€ 8.854	€ 9.003	€ 9.003
i+c+l / инвестиции + стоимость	€ 35.645		
ROI 5y / Возврат Инвестиций ВИ 5r (год)	126%		
ROI 8y / Возврат Инвестиций ВИ 8r (год)	202%		
ADR / Годовая ставка дисконтирования	3,0%		

5. Recommendations

In this chapter an overview of the recommendations are given. A more in-depth version is given in the booklet that each grower has received, and was given during the demonstration and seminar.

5.1 Optimization of growing methods and techniques:

Light

- Increasing potting distance between seedlings to allow for more light: stronger and shorter seedlings
- Picking lower leaves to ensure more light to reach the fruits (especially in the case of tomatoes). Maximum of 12-14 leaves per tomato plant.
- Without heavy investments, the installation of regular lights in the greenhouse will help a lot, especially in the case of growers having one greenhouse inside the other

Air ventilation

- Circulate air (by installing ventilation, option to have two sides of the greenhouse open to stimulate airflow): less temperature differences will lead to less leaf burning, and stimulates pollination for cucumber. Better ventilation furthermore results in less condensation in the greenhouse.

Cucumber specific

- "Umbrella" cultivation system. Check the figure for visualisation
- Correct pruning from the root of the stem: will reduce the open surface where botrytis can occur

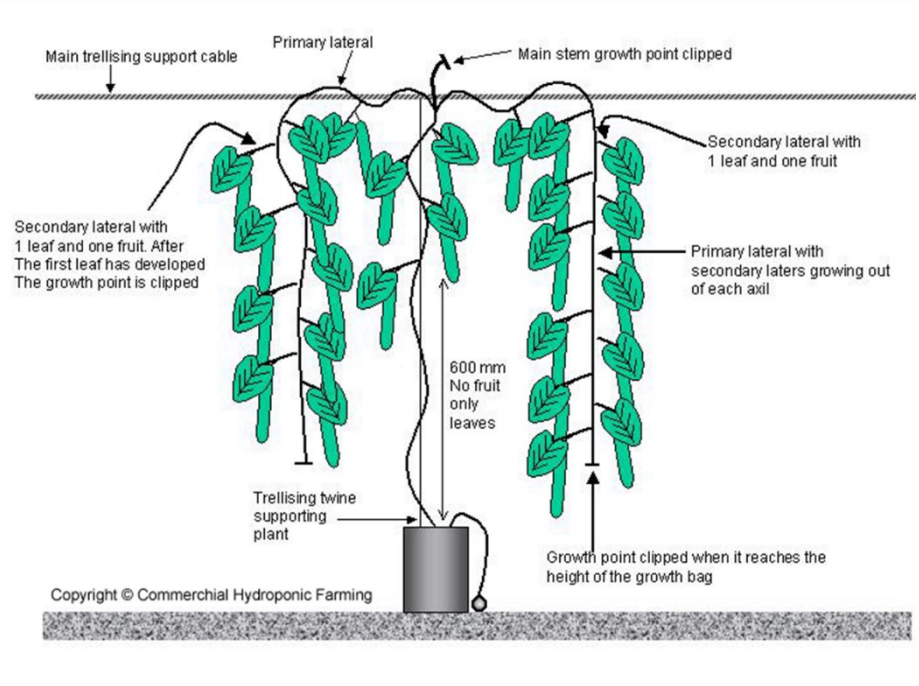


Figure 6. Visualisation of "umbrella" cultivation technique.

Soil & water quality

- Crop rotation to prevent deterioration of soil quality and infestation of disease
  An example was worked out for 1.000 m² greenhouse with 1:5 crop rotation. The greenhouse is divided in 5 parts of 200 m² and on each part vegetables of different plant families are grown. (1)Solanaceae (tomato, capsicum, eggplant), (2)cucurbitaceae (cucumber, gherkin, melon), (3)cruciferae (cabbage, cauliflower, radish), (4)asteraceae (lettuce types iceberg, butterhead, lollo roso), (5)amaryliddaceae (onion, garlic, flowerbulbs). Every year vegetables of different plant family shift to the next part of 200 m². For example tomato will only come back on the same part where it started in the 1st year in the 6th year.
- More frequent testing of soil and water, to be able to adapt fertiliser recipe
- Remove all the plant & harvest leftover from the field before starting new cultivation to prevent spreading of disease

Irrigation

- Irrigate more frequently, in lower quantities (optimise drip use by having a more steady water flow, early in the day)

5.2 Input strategy

Based on the knowledge of the growers, we gave the following advice during the demonstration day, on irrigation quantities, fertilizer and pesticide use. In terms of seeds, the main issue is that the growers to not know if their seeds are really from the Dutch suppliers or if they are packaged incorrectly by illegal traders. Suppliers like RijkZwaan and ENZA are present in the region, and we have suggested to the growers to directly get in contact with their local representatives in Chisinau for more trustworthy branded quality seeds.

Furthermore, the recommendations below are only indications of input quantities, as this will depend on the soil quality and characteristics that vary with each greenhouse. In 5.4, vocational training requirements, we will go deeper into what training is necessary for the growers to better understand their crop needs.

Seeds

Dutch seed is highly appreciated, but is considered too expensive. Rijk Zwaan & Enza are locally present (or the contact person is in Romania & Ukraine). As with the other investments that are required to further develop the horticulture sector in Gagauzia, growers will need to start thinking in terms of market opportunities and potential revenues, opposed to only thinking in terms of input costs. For the right seeds, the grower needs to choose a variety that performs best in his or her greenhouse, but that also suits market demands. We recommend to try new varieties in each season and compare their performances.

Crop protection means

To protect any crop in a good way, more is needed than a scheme with possible pesticides. Good application is really challenging, in the Netherlands only certified persons are allowed to administer pesticides in a greenhouse. Furthermore, integrated pest management (biological control) is preferred over the traditional use of pesticides, to protect the safety of the food and that of the people working in the greenhouse. In addition to this, biological control prevents excessive damage to soil and water quality.

In the growers booklet, growers can find an overview of all the active ingredients per type of pesticide, and for what pest they are used. However, we do not recommend the growers to continuously use these pesticides, as intensive training is required to be able to properly use them. This is further mentioned in 5.4 (vocational training).

Irrigation

Just as is the case for fertiliser and pesticide, the proper amount of irrigation depends on the soil properties (soil type and salinity & pH of the soil and water). Before starting irrigation, every grower must analyse both their water and soil. The water analysis can be done with the EC/pH meter provided by the project.

It is best to irrigate in low quantities, for longer periods of time. Currently some growers only turn their drip system one once every 3 days, but in this way the drip system is not used to its full potential, and these dry periods are detrimental to the crop. Furthermore, we recommend to give nitrogen (N) through the drip system. Depending on the crop stage and soil type (water keeping capacity) frequency and amount have to be determined.

Fertiliser

The amount of fertiliser depends on the initial nutrient content of the soil, therefore it is necessary to test the soil before the start of every cultivation. The types of fertiliser presented below are only a general indication of what nutrients are needed during what growing phase of the crop.

Indicative fertiliser plan **Tomato & cucumber**		
When	**What**	**How (fertigation?)**
Before planting (enough time to be incorporated into rootzone)	Phosphate (P_2O_5), potassium (K_2O), Manure 1-2 months before planting	100% of phosphate and potassium in granulated form are spread before seedbed preparation
During flowering	/	/
After flowering	Nitrogen (N)	Through drip irrigation

5.3 Post-harvest upgrades

As mentioned, the post-harvest value chain is very little developed, as the harvested produce is directly sold on the market in large packaging, and the consumers in Gagauzia prefer to process (mostly pickle) themselves.

The field visits showed that there is so much to improve in harvest quality, that this is a priority before finding ways to improve in post-harvest systems. Furthermore, the harvest quantities are often too high to make local storage feasible, so cultivation diversification and value chain cooperation is more urgent. For this reason, the financial plan does not include investments such as packaging. Keeping this in mind, there are still certain things that can be improved in the short and long term to maintain produce quality from farm to fork.

- Choosing the right time to harvest: less ripe when travel time to market is more, more ripe when the market is close by.
- Packing the tomatoes and cucumbers in smaller boxes, to prevent bruising and to increase accessibility for household consumption. Choose cartons that are easy to stack.
- Grading the harvest to distinguish lower and higher qualities (resulting in a fairer price for high quality produce).
- Branding, with name of product and producer.

5.4 Vocational training

Both the farmers and the Gagauzian extension service officers will benefit from additional vocational training. The demonstration and seminar gave some insights, but more structural (for instance spread over multiple months) training is necessary to effectively innovate cultivation practices and increase crop quality and quantity.

A summary of the required training content is as follows:

1. Preparing for cultivation
    a. Systems to influence climate
    b. Crop rotation design
    c. Basic theory of light/temperature/humidity relations
2. Starting cultivation: nutrient & water management
    a. How to define right fertiliser recipe
    b. How to make solutions to add into drip systems

    c. How to recognize nutrient deficiencies
3. Crop maintenance & protection
    a. Pest management
    b. Disease management
    c. Scouting, spotting & monitoring
4. Harvest & post-harvest management
    a. Crop registration, harvest prediction
    b. Harvesting & packaging techniques
5. Entrepreneurship
    a. Making & evaluating business and investment plans
    b. Long-term thinking in costs and revenues
    c. Marketing and demand driven cultivation
    d. Horizontal and vertical value chain collaboration

5.5 Value chain cooperation

Value chain cooperation can have many benefits, for growers but also for the agricultural value chain as a whole.

Some benefits of collaboration amongst growers are:

- Investments & input purchase become more affordable (e.g. sharing equipment), this can help overcome difficulties in securing bank loans
- Markets can become less flooded if growers communicate and diversify production
- Knowledge exchange can lead to better harvest quality and quantity for all growers
- As a whole, Gagauzian farmers can increase their power position compared to imports

Some benefits of collaboration between growers and the rest of the value chain are:

- Better catering to market demands (opposed to supply driven production)
- More trust in the quality of inputs if there is better communication between growers and input suppliers
- Open communication between growers and financial institutes can unearth bottlenecks for securing loans and subsidies, and can increase grower access to those financial means
- Fewer food losses due to streamlined post-harvest processes

As Gagauzia (and Moldova for that matter) have no history of slowly experimenting with and developing collaboration strategies that work locally like the Netherlands has done for hundreds of years, it is best to start collaboration in little steps, with only a few people at a time. Once there is more trust, and people know what works for them, this collaboration can be up-scaled.

Some examples on how to initiate this are as follows:

- Start small, informal and practical: what is something that 3 or 4 growers need? For instance a leaf blower to stimulate pollination (or collectively buying bumblebees), a trip to Chisinau to deliver soil samples, a representative to voice needs to the government. What can these 3 or 4 growers do to share the costs (time/monetary) of this necessity, that will result in a shared benefit? For instance sharing the costs of a leaf blower, and every grower having the responsibility to take care of the equipment in order to use it.
- If this works, growers can discuss what crops to grow in the coming season: with crop rotation, a plan can be made for a group of farmers. In one season, grower A can produce tomatoes, while grower B grows cucumber or peppers. This will maintain soil quality, and will prevent the markets

to become flooded with one product. The growers can alternate crops, and at a later stage can share the risks of bad harvests or bad market prices.

In the long run, this ad-hoc collaboration can transform into full-fledged cooperatives and contract farming, but for the time being it is most important that growers see the potential of working together on a small scale. More support from for instance the CoC or international organisations is needed to fully develop strong cooperatives, but a demand for this should come from the value chain itself, and not from these organisations. For this, sensitisation and a local initiatives to demonstrate success is necessary.

6. Demonstration greenhouse

Naturally, the growers in Gagauzia are not easily persuaded to invest, or to change their cultivation practices in a way that seems counterintuitive (e.g. our advice to reduce the amount of tomatoes per truss for better quality can seem illogical). Only a one-day demonstration and a one-day seminar are not enough to convince farmers, and are not enough to fully understand how to for instance calculate return on investment rates.

Scepticism is most easily transformed by demonstrating alternatives. For this, a demonstration greenhouse is necessary to showcase all the recommendations mentioned in this report. Here, growers can see the results of innovating cultivation techniques, of early spotting and monitoring pests, and so forth. Furthermore, in such a demonstration greenhouse the financial benefits of investments can be shown, reducing the worries of some growers. These demonstrations can pave the way for upscaling change.

There are certain requirements in selecting a suitable demonstration site. The head grower must of course be interested to share his or her lessons with other growers (and even financial institutions to reduce the bias against investing in horticulture), must have a good quality greenhouse and have the opportunity to invest in heating and lighting. During the field visits, three growers showed a great entrepreneurial mindset, and potential to teach other growers.

Ivan Koltuklu, the grower who offered his location for the initial demonstration day, is willing to open his greenhouse for collective learning, and was eager to implement any recommendations. *Prascovia Torlak* had the best quality greenhouse, including newly installed heating system and lighting. Her willingness to share her harvest quantities with other growers can showcase increased revenues resulting from investments. This can help growers to start thinking in terms of revenues, instead of thinking only in terms of costs. *Pjotr Ratkof* had experience with EU funded projects, and his greenhouse shows he has great knowledge of cultivation, and has a good entrepreneurial mindset. His desire is to invest in a hydroponic system in the coming years, and this alternative cultivation method can be very beneficial for other growers to see.

A combination of regular visits and knowledge exchange sessions with these three growers can be very beneficial to the sector as a whole. These exchange visits can either be informally, or can be organised in collaboration with the CoC and the extension service officers. They can also be part of the vocational training proposed in 5.4.

7. Project conclusions

During the initial phases of the project, it became clear that there is a pressing need for support in developing the horticultural sector in Gagauzia. Both the CoC and the growers did not know how to deal with issues occurring during growing seasons (such as occasional low harvests, differences in produce

quality, just to name a few). In addition to this lack of specific crop cultivation knowledge, the short growing season was one of the main constraint to further developing the horticulture sector.

During the demonstration and seminar at the end of May, both the CoC and the lead growers were very pleased and eager to learn. In those two days, the focus was on easy-to-adopt cultivation methods that could directly improve the quality of the crop and the harvest of tomatoes and cucumbers. Furthermore, the objective was for both the growers and the agricultural bank to assess the feasibility of investing in heating and lighting in the already existing greenhouses. These calculations were to avoid such investments are being treated as a 'black box', but for the growers to understand how long it would take to get a return on investment, and to see the potential revenue instead of only the high investment costs. All the parties did mention that there is much more to learn, and the CoC and some of the main growers are very interested in a more long-term training project.

The director of the agricultural bank showed a lot of interest in the business cases, and presented the requirements for getting either a loan or a subsidy. The main constraint, remains however, as the growers first need to have collateral and an recorded farm before being able to get funding. In addition to this, the growers can only receive a subsidy after they have made the investment. This means that they need to have the costs of the investment beforehand. This is often not the case.

In short, the project partners and beneficiaries were pleased to have this initial feasibility study to kick-off international collaboration in developing the horticulture sector in Gagauzia. The aim is for the growers to directly have a better quality yield in the coming harvest season, and to have more confidence in assessing future investments. The growers booklet and the demonstration & seminar were usefully to change cultivation methods, but in some cases the growers require more convincing. Investing in post-harvest is currently not feasible, as the quality and quantity of the harvest does not make an interesting business case. Once growers start diversifying crop produce (by crop rotation and collaboration between growers) and increase their market potential, the horticulture sector in the region will slowly become ready for further steps.

To realistically increase investments in the area, not only technical training is necessary, but also increased access to finance. For this, the Gagauzian region will need regional or international support.

Annex 1. Project activities

Over the span of 4 months, Mink Vermeer, Willem Hendriks and Hannah Zevenbergen each had two visits to the region, and conducted the following activities:

1. Inception phase
    a. Visit to meet the local partner (Chamber of Commerce), to visit the university in Comrat where agricultural students are trained and where soil samples can be analysed
    b. Meet some of the growers and their greenhouses to get an initial idea of the local context before starting on the desk study
    c. Align objectives of the CoC, growers with the expertise of Delphy and the requirements of the Dutch Embassy
2. Desk study & preparation of field study
    a. We received a list of information from the CoC and we adapted our questionnaires and field interviews to this
    b. Preparation and filling in of surveys
3. Field study
    a. Visiting growers,
    b. Group discussions
    c. Interviewing agricultural bank and wholesalers
4. Demonstration
    a. Good agricultural practices (e.g. pruning & twisting)
    b. Soil preparation & crop rotation
    c. Recognizing & monitoring main pests
    d. Irrigation
    e. Fertiliser & pesticide use
5. Seminar
    a. Presenting business & investment plan (including workshop for the growers to learn how to make one for their own greenhouse)
    b. Keeping track of costs & revenues
    c. Importance of collaboration & strategies
6. Evaluation
    a. With the Delphy experts, the CoC and with some of the head growers

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