CLIMATE-SMART AGRICULTURE

IN THE BLACK SEA BASIN REGION OF BULGARIA

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WASP

Climate-Smart Agriculture

In the Black Sea Basin Region of Bulgaria

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Climate-Smart Agriculture is a feasibility study focused on the Black Sea Basin region of Bulgaria. It aims at outlining the opportunities and challenges in the development of climate-smart agriculture in the region considering the current situation and the existing trends toward sustainability and technological advancement. It provides valuable tools for strategic management and regional development planning for governmental and non-governmental organizations and entities. The book can be used also as an educational resource for teachers, trainers, and students majoring in Agriculture and Food & Science related degrees.

WASP WHISTLEBLOWER AID SUPPORT PROTECTION

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RATIONALE AND AKNOWLEDGEMENTS

This book showcases the opportunities to successfully develop climate-smart agriculture (CSA) in the region of the Black Sea Basin of Bulgaria. It provides a comprehensive analysis of the current situation and a strategic framework for future development on a regional level. The CSA concept is illustrated by relevant business models which can be emulated to match various contexts.

The analysis is based on a study conducted in the framework of AGREEN project (Cross-Border Alliance for Climate-Smart and Green Agriculture in the Black Sea Basin, BSB 1135) project, in the period of 2020–2021.

The methodology of the studies and the layout of the content are elaborated in a series of expert meetings between the author and the AGREEN consortium members.

The primary data was collected via questionnaires and interviews developed and distributed by a large number of contributors: employees and team members of Dobrudzhansko Agrarian Business School (DABS) and Varna University of Management (VUM).

Special gratitude is expressed to all contributors, respondents, and business owners who dedicated their time to share their valuable experience and to provide more insights on the topic.

The contributors' support is limited to data provision and conceptualization. The book content is created solely by the author, Miroslava Gospodinova Dimitrova. No other persons took part in the writing process and no one else by any means could claim co-authorship of the book. The photos and some of the charts are sourced from online repositories as per the regulations of Chapter Five of the Bulgarian Copyright Law. All sources are duly referenced.

The authors grant the copyrights of this book to a Whistleblower Aid Support and Protection Foundation and hope that it will contribute to a better society.

1.1. Definitions and Acronyms

Definition of Climate – Smart Agriculture

Climate-smart agriculture (CSA) is defined by the Food and Agriculture Organization of the United Nations as an approach that "…*helps to guide actions needed to transform and re-orient agricultural systems to effectively support development and ensure food security in a changing climate*" [i] . The concept was first introduced in 2009 as an attempt to provide a globally applicable principle on managing agriculture for food security under climate change and to serve as a basis for policy support.

The three pillars of sustainable climate-smart agriculture outlined by FAO are:

- ✓ **Productivity** and income increase
- ✓ **Adaptation** and building of resilience to climate changes
- ✓ **Reducing**/or **eliminating** if possible greenhouse gas emissions

Climate change refers to the large-scale shifts in weather patterns mainly due to global warming driven by greenhouse gas (GHG) emissions. The primary sources of GHG are energy consumption (fossil fuel burning), agriculture, deforestation, and manufacturing. Climate change is manifested through (1) temperature rising; (2) rising of the sea level; (3) increased snowmelt and change in the water volume; and (4) increased probability of extreme events. Climate changes are impacting the ecosystem, agriculture, forestry, and fisheries. Different regions are affected differently by climate change. For some, the effect might be disastrous while for others (for example, the colder regions), the climate change might be perceived as a "climate improvement". These differences in impacts can lead to diverse response and mitigation activities (Lipper et al, 2018).

Innovations for climate-smart agriculture are approaches, processes, and/or ideas that result in tangible improvements in the agrarian sector's response to climate change. The innovations can be divided into three groups; 1) technological (such as mechanical, biological, and chemical); 2) managerial (land-use, on-farm management etc.), and 3) institutional (trade regulations, insurance, social safety net, mitigating strategies, etc.)

Acronyms

BAS – Bulgarian Academy of Science

BGN – Bulgarian Lev (national currency)

CSA – Climate Smart Agriculture

OA – Organic agriculture

CAP – Common Agricultural Policy

GHG – Greenhouse Gasses

GMO – Genetically Modified Organism

CO2 – Carbon Dioxide

GVA – Gross Value Added

EU – European Union

ERU - Euro

FDI – Foreign Direct Investments

GDP – Gross Domestic Product

ha - Hectare

MAFF – Ministry of Agriculture, Food and Forestry

NGO – Non Governmental Organization

NIHM – National Weather Forecast Institute

NSI – National Statistics Institute

PDO – Protected Designation of Origin

PGI – Protected Geographical Indication

UAA – Utilized Agricultural Area

UPOV – International Union for the Protection of New Varieties of Plants

1.2. Abstract

Climate-smart agriculture as a concept is gaining considerable attention at national and international levels and is considered to be the key toward addressing many of the challenges of agricultural planning under climate change (Lipper et al, 2018)

Climate-smart agriculture is based on the idea that the agricultural sector is fundamental to climate response, not only because of its high vulnerability to climate change but also because it is a main contributor to the problem. CSA is an integrated approach to managing landscapes, crops, livestock, forests, and fishery to adapt in a sustainable way towards climate change, while at the same time ensuring food security for the growing global population.

In Bulgaria, climate-change negative impacts are manifested through weather variability, shifting of agroecosystem boundaries, invasive pests and weed plants, and growing occurrence of extreme weather events. Those factors threaten crop yield and livestock productivity. Farmers are becoming increasingly aware of the problem and are introducing a number of technological advances and innovations in their land-use models and practices. One of obstacle to adopting a CSA-based approach is the high transaction costs for smaller producers and their difficult access to financing schemes. Another stumbling block is the low level of institutionalization of the CSA as a distinctive area for improvement within the policy-making initiatives. The need for raising awareness of the climate change problems on the consumers' level is also evident. In this regard, introducing a CSA brand for food products and presenting CSA crop models, which are the focus of the present study, are essential steps towards achieving sustainable agriculture.

2. Introduction

2.1. The Agricultural Sector in Bulgaria – The case of the North East and South East Regions

Bulgaria is a southeast European country with a diverse relief and mild climate. It encompasses 31% lowlands, 41% hills, 25% highlands, and 3% mountains (of more than 1600 m in height). The Balkan Mountain ridge splits the country into the north and south part and has a strong effect on the temperature regime. The annual mean air temperatures in Bulgaria vary from 3 to 14° C, depending on the location and elevation. The temperature normally reaches a minimum in January (ranging from -11 to +3 ° C), and a maximum in July (up to 25 ° C). Total precipitation depends on circulation patterns, site elevation, and the specificity of local features. Annual mean total precipitation is approximately 500– 650 mm, with an annual variation ranging from 440 to 1020 mm (Alexandrov et al, 2004).

Agriculture is one of the sectors of the Bulgarian economy with historical importance and traditionally a large share of the population was involved in some type of agricultural activity, farming, or husbandry. In the period after the state independence (end of 19th century), agricultural activities were dispersed in smaller family-centered farms with limited output and primitive methods of production. During the communist regime (the period between 1944 - 1989), the land was nationalized and consolidated into larger state-owned agro-industrial complexes with integrated systems of automation, cultivation, and supply. In 1990 the restrictions on private farming were lifted, and almost all agricultural land was restored to private ownership. A new process of consolidation began with the funding of private agricultural cooperatives. Unfortunately, with the progressive urbanization of the country, farming became a less popular career choice for the younger generation. The accession of the country to the European Union, however, provided a number of incentives as various financing schemes and loans were made available. As a result, the agricultural sector is becoming more attractive and the crops are being diversified continuously for achieving optimal gain and productivity.

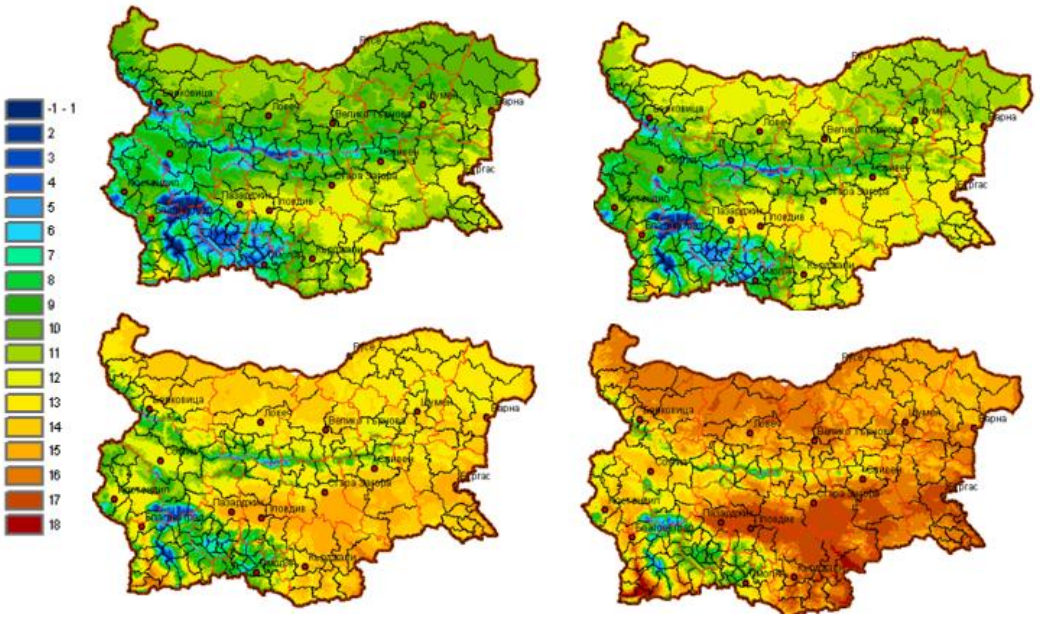
The natural conditions for agricultural development in Bulgaria are excellent. Cultivated agricultural land occupies about 4.9 million hectares or 44% of the total territory of the country (IBG, 2019). The favorable climate and the availability of agricultural land for crop production have resulted in well-developed plant growing and animal breeding.

Today, Agriculture accounts for around one-tenth of the national gross domestic product and 4,4% of the country's total gross value added (GVA). It provides

today, all temperature abnormalities are positive (with 2007 being the warmest year in the records).

The average temperature between 1980-2010 was 1.6 ° C above the average for the period 1961-1990. The Figure below demonstrates the temperature shift trend in a century–long span. The pessimistic forecasts are for the continuous raising of the temperature all over the territory of the country.

Figure 2 *Average annual air temperature during 1961-1990 (a), 2020 (b), 2050 (c), 2080 (d) under pessimistic climate scenario*



Source: *V. Alexandrov (2020), NIHM BAS*

2) low precipitation and snowmelt

The climate in Bulgaria became drier in the last few decades. The annual precipitation however varies considerably from year to year. In some years, low annual precipitation caused droughts of different intensities as during the 1940s and 1980s while in others (1990s), heavy rainfalls caused severe floods and damage (Alexandrov et al, 2004).

In addition to changes in precipitation models, increased temperature cause snowmelt which decrease the possibility to use water stored in snow accumulated during the winter season for irrigation during the warm season (Lipper et al, 2018).

For the period 1931-2000, a widespread fall in winter precipitation was observed. The irregular snowfall and the abrupt change in the temperatures which were experienced in the last five years in the North East region had damaging effects on the newly

2.3. SWOT Analysis of Climate – Smart Agriculture in Bulgaria

Strengths

- ✓ Agricultural land is more than 50% of the territory of the country
- ✓ Diverse and fertile soils
- ✓ Long-term traditions in crops production and animal breeding
- ✓ A number of plant varieties well-suited to the local climate conditions and soils
- ✓ Institutes and universities for agricultural research and development with internationally recognized achievements in biogenetics and plant breeding
- ✓ Network of 80 secondary schools and 5 universities which offer specialization in agriculture and/or food production, thus ensuring the availability of productive and well-educated labour resources for the industry
- ✓ Excellent conditions for organic food production
- ✓ Growing demand (both domestic and international) for bio, organic, and climate-smart food products
- ✓ Established farms of various sizes (large, middle, and small), mostly family-owned which facilitates the preservation of valuable genetic resources and production techniques.
- ✓ Availability of traditional local varieties of fruits, vegetables, essential-oil-bearing plants, herbs, and cereal crops which are appealing to the domestic market and marketable abroad
- ✓ Access to many financial schemes and instruments for organic, bio, and climate-smart agricultural production
- ✓ Existing agricultural policies are aligned with the CAP of the EU, facilitating the exchange of best practices between farmers and producers

Weaknesses

- ✓ Decreased precipitation in recent years leading to fewer options for irrigation, especially for water-intensive crops
- ✓ In the North East regions, despite the abundance of fertile soils, agricultural activities are hindered by the scarcity of natural sweet waters (the region is one of the poorest as per surface river density)
- ✓ The urbanization trend leading to the leakage of resources (including financial, administrative, human, educational, research capacity, etc.) from the rural areas
- ✓ Part of the agricultural land has been abandoned
- ✓ Loss of organic matter and deterioration of soil structure due to wind and water erosion

another expressed doubts about the health benefits of the CSA and its connection to GMO products.

Contents analysis of the interviews:

The interviewees are farmers/producers or representatives of the local authorities and academia. The majority of the farmers are small or medium sized (cultivating up to 50 ha of land), but there are some who are working 2000 ha and more. The smaller farms have up to 5 employees, while the biggest employ 35 workers. There are producers who work on their own not engaging additional farmhands. The main crops grown on their fields are maize, wheat, sunflower, barley legumes (beans), beet, sweet corn, alfalfa, lavender, immortelle, etc. The majority are operating for at least 10 years, but there are some who have just embarked on farming in the last three to five years.

There are also smaller producers who are engaged in greenhouse production of vegetables (such as tomatoes, cucumbers, peppers, herbs, green onion, broccoli,etc.) and some who grow orchards (plums and cherries) and fruit shrubs (such as raspberries).

A great share of the farmers is aware of the CSA concept and are trying to implement it in practice. The CSA measures and techniques they are applied are as follows:

- growing crops and plants with local genetic origin (as those crops are less susceptible and more adaptive to the local climate specificity)
- using greenhouses and windshield nets
- constructing irrigation systems for vegetable and fruit growth.
- laying grass sods around the fruit trees
- no-till or strip-till technology
- avoiding pesticides and chemical fertilizers
- buying and using locally produced seeds (including from agricultural research institutes)

There are however farmers who have no previous knowledge about climate-smart agriculture and for them, participation in the study had an informative and educational value since they were encouraged to research more about this concept.

The respondents are encouraged to further increase their CSA production because they perceive it as a way to meet the market demand for more green and sustainable food products and because they believe that the CSA will play more and more important role in the future. They also regarded CSA as an “intelligent, sustainable and responsible agriculture”.

The biggest advantages of the CSA approach are clean and greener environment, healthy people, high-quality products, greater productivity, less susceptibility to climate changes, and lower costs of production.

Some of the listed challenges of CSA application include limited awareness and thrust among the farmers; dry weather; late spring frosts.
The measurements for CSA development on the local level proposed by the interviewed farmers included:

- proper soil treatment
- clean production
- improved accessibility to the local markets

Some of the farmers are optimistic about CSA development in their regions and share their observation that CSA as a practice is gaining popularity. Others however think that the CSA's feasibility is very limited at this stage and that information and raising awareness campaigns should be carried out in order to enhance its impact.
All of the farmers agree that CSA should be supported on regional and national levels, including via national CSA policy and special financial or other incentives.
They affirm that the CSA brand and label will be beneficial for the market recognition of the CSA products and that the consumers will be encouraged to look for and buy CSA-branded products.
Some respondents believe that a common branding policy will increase the competitiveness of the CSA products and that the producers should try to reunite their efforts in various formal or informal structures for promoting CSA development, but there are others who doubt the feasibility of this approach at the moment and under the present circumstances.

The data received from the interviews with the academia and local authorities' representatives reveal that CSA popularity in the region is low and more information and awareness-raising activities should be scheduled on a local and national level. There is however, an opinion that CSA even though not precisely defined, is being implemented for a long time in the region and the presence of agricultural research institutions (such as "Dobrudja" in the village of General Toshevo) has facilitated the spread of CSA techniques and approaches among the producers. The respondents are rather unsatisfied with the stage of the CSA policy development and urged that a more precise definition of this concept should be outlined. They agree on the need for governmental support (financial, technical, training know-how or information) directed towards CSA farmers and producers and believe that CSA should be encouraged as a prospective and beneficial approach towards sustainable agricultural development. They also encourage the creation of regional alliances and a common CSA brand strategy as a tool to enhance agricultural competitiveness in the BSB region.
When asked about the current state and the future of the CSA, one of the respondent replied:

"The degree of CSA development, both locally and nationally, is very low. The main problem is the lack of expertise in the relevant regulatory bodies and the fact that the appointments there are often on a political and not on an expert basis. Unfortunately, at this stage there is no evidences of change of this negative trend."

The results of the ***Research N 2*** (on the Feasibility of the CSA brand strategy) are as follows:

The majority of the survey participants are young and middle aged people (31-45 (52%), 46-60 (25%), 19-30 (15%)) residing in a city/ urban setting (85%).

Fig. 5: *Age distribution*

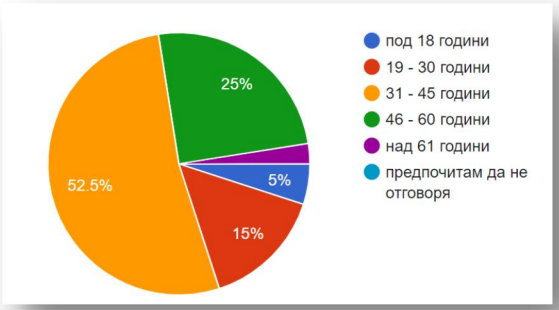
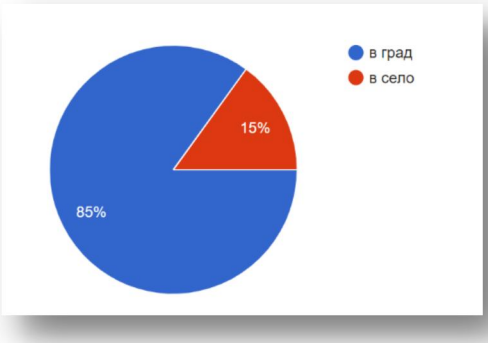


Fig. 6: *Place of residence*



The income of the respondents are mainly within the countries' average (62,5%), 20% are above the average, while 15% are below.

Fig. 7: *Income level*

The analysis of the data about the consumers' buying patterns reveals:

- their preferences to buy from large supermarkets (58%) and smaller local farmers markets (42%) are split.

5. Climate – Smart Agricultural Practices and Crop Models in the Region

Name of Organization: Chudnata gradina ("Wonder Garden"), agricultural social enterprise operated by "Saint Nicholas the Wonderworker" foundation.

Region of Operation: Dobrich

Size of cultivation: 0,4 ha

Number of employees: 22

This company is unique because it is considered to be the biggest and best-developed social enterprise in Bulgaria. The farm was launched less than two years ago in an abandoned lot near Dobrich's main street. The founder is the non-profit organization "Saint Nicholas the Wonderworker" whose CEO Mrs. Maria Metodieva was actively seeking employment opportunities suitable for intellectually challenged adults. The land was provided by the municipality and the noble endeavor soon draw many supporters. As for now, several public institutions, private companies, and individual sponsors are providing assistance in various ways: the water for irrigation is paid for by Dobrich municipality, a local investor donated an automobile for the transportation of produce, etc. Families and friends are also involved in the daily work of the garden as volunteers.

The farm employs 22 men and women with different degrees of intellectual disabilities. For some of them, this is their first job and sole chance towards independence and social acceptance. Unfortunately, in Bulgaria, the degree of inclusion of people with disabilities, especially concerning mentally impaired persons

is very low. In practice, they are shunned from the society. Some of them are deprived of human rights via so-called "guardianship". The mission of the "Wonder Garden" founders is to fight on their behalf by working towards changes in the existing policies and jurisdiction. As a result, several guardianships were removed, enabling people to gain personal independence and social status.

Upon its start, the garden inherited an overgrown plot of land with wild shrubs and hedges, a stony foundation, and scarce soil coverage. The land was cleaned by heavy construction machines and new soil was piled on the empty spot. Thanks to the perseverance and dedication of employees and social workers the plot was miraculously transformed. Today, it has four neatly built greenhouses, 200 sq. m. each which are used for early vegetable production (mostly tomatoes, cucumbers, lettuce, and herbs) and as a nursery for the young seedlings.

In the open areas, three varieties of white cabbage are grown and a specially designed irrigation system is constructed. Bio wastes, grass, and leaves clippings are piled in a large composter intended to be used for enriching the existing soil.

The garden is operating for a very short time, but the success is more than evident. The produce output is growing considerably and the vegetable harvest is abundant each year. The farm has won the trust of the local community, and residents of Dobrich and the nearby towns and villages are loyal clients of the company. They are motivated not only by the noble cause which stays behind the enterprise but also by the excellent qualities of the produce. The farm in practice has ensure the market for its production by repeated customers and gross sales to several bigger institutions (such as Dobrich municipality) and restaurants. Despite this success, the revenues from sales are not sufficient to provide for the

workers' compensation and the managers are constantly applying for participation in programs for state-assisted employment.

The founders admit that their focus is providing social services to disadvantaged groups of people, rather than developing a prosperous agricultural business. They have found that farming is an excellent match for providing opportunities for developing various skills and competencies. The employees have advanced greatly in terms of professional aptitude since their first day of work. Their performance has exceeded even the most optimistic expectation. They have developed expertise in farming, landscaping, and greenhouse construction as well as soft skills for team building, work ethic, responsibility, and discipline. Here, people with intellectual disabilities have found a safe environment that encourages personal growth and social acceptance. As social inclusion is one of the CSA pillars, this farm is an excellent example of CSA best practices by providing numerous benefits and employing innovative approaches in a sustainable way such as:

- ✓ Social inclusion and providing employment opportunities for marginalized people
- ✓ Application of the principles of conservation agriculture (minimum mechanical soil disturbance/ no-tillage; permanent soil organic cover with crop residues, etc.)
- ✓ Careful selection of crop variety and seeds. Various sorts of vegetables and seed providers were tested in order to choose the best match for the particular soil and climate
- ✓ Spare use of fertilizers and minimal use of pesticides. Weeding is done mostly manually since it is a part of the therapeutic activities and helps develop physical stamina
- ✓ crop diversification by including more vegetable varieties, legumes, greeneries, and flowers

- ✓ Ingenious irrigation scheme where water is transported in cisterns from distant natural springs. The water has undergone checks for health safety and environmental cleanness
- ✓ Soil amelioration techniques include usage of natural fertilizers, “lasagna layering” and composting of organic wastes.
- ✓ Protected growth in greenhouses to combat pests without chemicals and maintenance of the optimal temperature and humidity
- ✓ Direct sale to the end consumer and constant communication (via social media or regular PR activities)

Name of Organization: Agroproduct Stoikovi Ltd

Region of Operation: Lukovit Municipality

Size of cultivation: 480 ha (rented and owned)

Years of operation: 9 years

Number of Employees: 7 directly employed (including two executive and administrative managers)

The company produces mainly cereal crops such as wheat, maize, sunflower, barley (for brewing and fodder), alfalfap fodder peas, chickpeas, and rapeseed.

After the changes in the European legislation in 2017 the company is obliged to keep part of the areas with nitrogen-fixing crops in order to be able to obtain the maximum of the European subsidies. Also over the years, the producers have sown a second crop/corn and sunflower /. Average annual crop yields vary depending on the specific weather for a given year. For example, wheat yield fluctuates from 350 kg per decare to 650 kg per decare.

The output of oil-bearing sunflower was increased by diversifying corps with new high-yield hybrids with a richer content of folic acid. The annual sunflower yields vary in the years from 120 kg per decare to 220 kg per decare. Other types of sunflower intended mainly for export include multi-colored sunflowers and the varieties Pioneer and Iregi. Corn is the most profitable plant in grain production. There, too, the yields are very different, starting from 200 kg per decare and reaching 950 kg on average per decare.

The harvested quantity depends mainly on the climate, including temperature regime, rainfalls, unfavorable events such as hailstorms, etc. The weather also enables timely planting which determines whether the crop will have the necessary technological time to develop and reach its maximum capacity for maximum yield.

Some of the CSA approaches applied by the producer include:

- ✓ Innovations in mechanical treatment of the soil. For example, plants are used instead of agricultural machines (radish for example which is planted in 0.30-0.40 m. depth can replace mechanical tillage)
- ✓ Conservative use of invasive chemicals and pesticides which destroy the humus content in the soil
- ✓ Strip-till or no-till techniques with special care for the soil-protection and least disturbance
- ✓ Composting techniques for bio-degradable wastes

Presently the company is cultivating 20% of its land capacity using the above-mentioned CSA techniques. The preliminary estimates show that these methods are effective and economically sound and the farmers will envisage an increase of up to 40% in the nearest future.

The main advantages include low cost of production while maintaining similar yield and financial profits. The main challenges and drawbacks are the need for additional investments in special agricultural equipment (such as precision strip-till planters); financial risks and alternative costs.

6. Conclusions

CSA is a sustainable agricultural approach towards enhancing productivity, maintaining or restoring soil fertility, increasing the efficiency in the management of water and energy resources, conserving genetic resources, strengthening rural communities, and promoting equity and social well-being.

The present Feasibility study reveals that climate-smart agriculture has numerous ecological, economic and social benefits recognized by all stakeholders involved (including producers, consumers, research and local authorities' representatives). Its development should be made a priority and a support scheme should be made available.

Designing and introducing a regional brand of CSA products is encouraged by the existing consumers' preferences (confirmed also by the conducted research as part of this study). Society welcomes foods produced in a natural, environmental-friendly way from the local origin and with excellent nutritional and health benefits. Promoting a CSA brand in the countries of the BSB region will also raise awareness among the community and is likely to instigate institutional engagements towards CSA policy-making and implementation of strategic development plans on the regional and national levels.

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