



AgriTech Solutions: Innovating VET for Sustainable Agriculture
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2024-1-RS01-KA210-VET-000244168

REPORT

From the implementation of an activity for the needs of the project

Field visits

Engaged teachers: Stefanovski Saso, Milosheva Zaklina, Jovanova Kristina, Doncheva Milica, Nikolov Efremcho, Slavkovic Sonja

Location: Kumanovo, Sveti Nikole, Skopje, Strumica, Kavadarci, Valandovo, Veles

Experts/organizations: ZZ "STUBA", TD DZP KLECHOVCE DOOEL, ADUT GVN, AG FUTURA Technologies, "KAV KOMERC AND AGRO KAV KOMERC", COMPANY "STOJCHEVI and WINERY ARBESKA", INDIVIDUAL FARMER MARJAN TANCHEV, LISA - KOM KAVADARCI, INDIVIDUAL FARMER STEFAN STOJCHEV, AGRIJA DOOEL, Individual farmers groups and individuals, IZ Branko Atanasov, Livestock farm, Citizens' Association - Center for Herbalism, Tourism and Sustainable Development BILKILIFE Chucher Sandevo, social enterprise, SUGS "Braka Miladinovci"

Topic/area: Renewable energy sources, Sustainable agricultural practices, Organic agriculture, Precision agriculture, Agricultural technologies

Short description

Several field visits were carried out to various agricultural entities with the aim of directly familiarizing themselves with good practices and modern solutions in the field of sustainable and technologically advanced agriculture.

ZZ "STUBA" (village of Studena Bara, Kumanovo). Within the framework of the topic "Renewable energy sources", it was observed that solar collectors are used for heating water in greenhouses, as well as biomass as an alternative source of heating. A study is being conducted for geothermal sources as a future solution.

In terms of "Agricultural Technologies", the farm uses automated irrigation systems (drip), soil and light sensors, LED growth lighting, as well as digital applications for monitoring and management.

TD DZP "Klechovce" DOOEL was visited with a focus on "Sustainable Agricultural Practices", where crop rotation, composting, organic fertilization, limited use of chemicals, solar panels and efficient irrigation systems with moisture sensors are used. The company plans to expand with agrobiodiversity.

ADUT GVN DOOEL Kumanovo showed an exceptional example of "Organic Agriculture", with its own organic plantations of herbs and vegetables, use of organic seed material, natural fertilizers and biological preparations, as well as ecological



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packaging for their products. The company already exports organic products to several neighboring countries.

"AG FUTURA" Technologies from Skopje presented advanced solutions in the field of "Precision Agriculture", including digital soil mapping (SOIL), RAMAS remote monitoring system, drone NDVI analysis, geolocation sampling, IoT devices and AI for farm management. The company is active in regional initiatives and development of startup platforms for digital agriculture.

These field activities provided direct insight into modern practices and technologies that contribute to more efficient, ecologically and economically sustainable agriculture, and provided a basis for their application and adaptation in the educational process.

Individual farmer. Within the framework of the topic "Renewable Energy Sources", it was established that solar panels are used to heat water in greenhouses. A study is being conducted on geothermal sources as a future solution.

The livestock farm, in terms of "Technologies in Agriculture", uses automated systems for milking cows, soil sensors, on which they produce feed for livestock, and digital applications for monitoring and management.

A group of individual farmers from the Strumica region were visited with a focus on "Sustainable Agricultural Practices", which use crop rotation, composting, organic fertilization, limited use of chemicals, solar panels and efficient

irrigation systems with moisture sensors.

IZ Branko Atanasov showed an exceptional example of "Organic Agriculture", with its own organic strawberry plantations, using organic seed material, natural fertilizers and biological preparations, as well as ecological packaging for packaging their products. This producer already exports organic products to several neighboring countries.

A group of individual greenhouse producers from the Strumica region presented advanced solutions in the field of "Precision Agriculture", including sensors for measuring temperature, humidity, and soil sensors. These farmers plan to increase the use of digital technology in agriculture. .

These field activities provided direct insight into modern practices and technologies that contribute to more efficient, ecologically and economically sustainable agriculture, and provided a basis for their application and adaptation in the educational process.



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"KAV KOMERC AND AGRO KAV KOMERC" from Kavadarci. Within the framework of the topic "Renewable Energy Sources", in its companies, the company KAV KOMERC has its own panels for its own energy production, which it uses for its own needs, the most modern new vineyards of Odrina construction, covered with anti-hail nets, Italian stainless steel construction and a digital peronosporic service, automatic for measuring all soil parameters.

moisture, relative humidity, temperature, etc. parameters.

Regarding the "Use of technologies in agriculture", companies from Kavadarci, oriented primarily towards the production of the most modern table grape varieties, use automated irrigation systems (drip), soil sensors

and light, as well as digital applications for monitoring and management.

COMPANY „ STOJCHEVI and WINERY ARABESKA”, a field visit was carried out with a focus on "Sustainable Agricultural Practices", where raw material grapes from the indigenous Vranec variety are used for the production of red wines and the white Rkacsiteli variety for the production of high-quality white wines. The Stojchevi company also uses limited use of preparations and preparations that are on the green list, organic preparations, fertilize their areas with organic fertilizer and produce wonderful red and white wines. The prospects of this mini family company and winery are to develop wine tourism, to produce promising and organic wines and wine products and to develop rural tourism to the maximum.

REGISTERED INDIVIDUAL FARMER MARJAN TANCHEV from the village of Balinci, Valandovo

has organic greenhouses with greenhouses with peppers, village Balinci, Valandovo. The greenhouse is located in a clean environment around it of 20 km, near Valandovo. The greenhouse is 700 m2 covered with plasticized nylon PVC, which according to Mr. Tanchev protects against UV radiation 8 and above 8. The greenhouse is also covered with an anti-hail net.

The production method itself is completely organic from seeds or using hybrid seeds without any chemistry from the F 1 generation, which are placed in a smaller plate of warm soil, at the end of February, March until transplanting in April, May when the soil temperature is above 15 degrees Celsius. Today the plants are in a phase of vigorous growth of the pepper which by now has small fruits, flowers and large fruits. Transplanting is in other larger plates with a base of pure peat as an organic substrate without synthetic treatments with insecticides or fungicides. After about 20 days, it is transplanted under





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greenhouses or in a permanent place. The distance of planting in a permanent place is 30 cm from root to root and 90 cm from row to row, in the greenhouse itself. The entire greenhouse under the greenhouse is covered with a drip system using a submersible pump from own well of 42 m, with ecologically clean water. In this phase, the plants are growing rapidly as I said above with formed flowers, small fruits and large, large fruits on pears. The air temperature inside the greenhouse during the day ranges from 35 to 40 degrees Celsius, and during the night it is 18 - 20 degrees Celsius. The ventilation is fully controlled from all 4 sides, so that the warm air in this way of ventilation freely, which is mounted at the top of the greenhouse, cools down. The entire process of production of this organic product of pepper from the Caprima variety, which is a variety of pepper intended for ajvar, is also controlled. During the vegetation, feeding is done with nettle and composted organic fertilizer. So far, only biological protection with natural extracts of garlic, nettle,

wormwood.

" LISA – COM KAVADARCI " The company does not specialize specifically in precision agriculture, it uses drones and technology for precise application of chemicals. funds.

In Macedonia, there are two companies that specialize in precision agriculture: Agridron and Agfutura, which offer advanced solutions for precision agriculture through the use of drones (drone spraying, photogrammetry, NDVI).

analysis.

For more efficient agricultural protection, in our city of Kavadarci, measuring stations for so-called smart agriculture have been established, which collect data on weather, humidity and other parameters. This information can be combined with so-called drone applications in order to achieve more efficient agricultural protection.

The above-mentioned field activities and field visits provide direct insight into modern digital practices and technologies that contribute to more rational, economically viable, more efficient, environmentally friendly and sustainable agricultural production and modern sustainable agriculture. All of the above practical examples from these advanced and modern agricultural companies provide a secure basis for their implementation and adaptation in the educational process in agricultural - veterinary and

the other vocational schools.



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Citizens' Association - Center for Herbalism, Tourism and Sustainable Development BIL KIL IFE yuŷer

Sandevo, social enterprise : deals with the production of medicinal and spicy herbs, herbal tourism and sustainable development. The production takes place organically, starting from the fact that the production itself is at a high altitude in an ecologically clean environment, no chemical preparations are used for plant protection and nutrition, a drip system is used for irrigation, as well as rainwater collection and its use. In the process of drying the plants, they use a solar dryer as a type of renewable energy source. When packaging the products they produce, great attention is paid to ensuring that the packaging is made of recycled material or glass. They use the remains of the plants for composting, which produces their own organic fertilizer. The very surface on which the plants are grown is terraced, which prevents soil erosion.

Aquaponics at SUGS "Braka Miladinovci" Skopje

Aquaponics is a sustainable system of growing plants in an aqueous solution, the presence of soil and in combination with aquaculture (aquarium with fish) in a closed system. The system is located in a greenhouse that is hygienically maintained, located in a quiet and clean environment. The plants are grown in an aqueous solution, in the aquarium fish are grown from which food for the plants is obtained (sustainable agricultural practices). Many more plants are planted per unit area than would be planted on the surface of the soil, because a vertical garden is formed. Vegetable and flower crops are produced, mostly annuals. The amount of water that is

consumption is reduced to a minimum and no pesticides are used, i.e. aquaponics is protected from diseases (closed system). The products obtained are organic, without the use of pesticides or mineral fertilizers. The heating of the greenhouse in which the aquaponics is located is heated by solar energy and LED growth lighting.

Proposal for improving the representation of sustainable agricultural practices, precision agriculture, organic agriculture, renewable energy sources and the use of technology in agriculture in the curricula of the qualification

Improving the quality and relevance of vocational education through the inclusion of modern practices and technologies, identified during field visits, to better prepare students for modern challenges in agriculture.

Sustainable agricultural practices



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Inclusion of thematic modules on Crop Rotation, Composting and Organic Fertilization, Biological Pest Control, Efficient Water Use (Drop by Drop, Moisture Sensors). Project Task: Development of a Crop Rotation and Agrobiodiversity Plan.

Organic farming

Revision of the elective course "Organic Production", with practical content, such as Preparation of organic soil, Application of natural biopreparations and composts, Methods of organic drying, packaging and storage, Visit to organic farms and preparation of field reports.

Precision Agriculture

Updating the teaching in subjects such as "Agricultural Mechanization" and "Informatics in Agriculture". Use of drones, sensors, GPS/GIS. Basics of NDVI analysis, digital soil mapping and VRT technologies. Laboratory exercise: simulation of plant monitoring using free applications or simulation software.

Renewable energy sources

Inclusion of thematic units for Solar energy - solar panels and collectors, Biomass - use of plant residues, Geothermal energy and its possibilities in greenhouses.

Project: Design of a small farm with a solar and biomass system.

Agricultural Technologies

Including thematic units for Automated Irrigation and Fertigation, LED Growth Lighting, Sensors for Microclimate Monitoring.

Practical training: Installing sensors and monitoring conditions in a school greenhouse.

- Training of teaching staff in cooperation with companies such as AG FUTURA, ADUT GVN and others.
- Development of teaching materials and manuals based on real examples from the field.
- Establishing school demonstration plots for organic and precision agriculture.

This proposal aims to:

- Better alignment of teaching with contemporary trends and practices.
- Increasing the practical readiness of students.
- Encouraging innovative and sustainable thinking among young farmers.



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