Cultivation of blueberries on infertile/degraded soils using plant pots (Milenko Blesić)

Cultivation of blueberries on infertile/degraded soils using plant pots (Bosnia and Herzegovina)

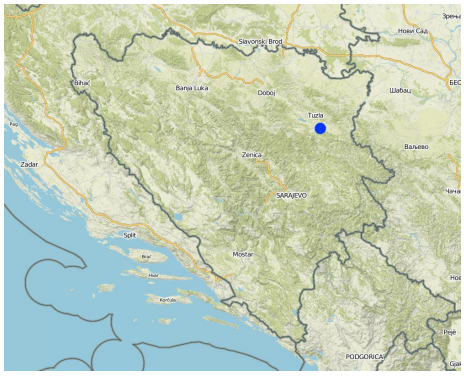
Kontejnerski uzgoj borovnice na neplodnim ili degradiranim tlima

DESCRIPTION

Establishment of blueberries cultivation in plant pots on soils with bad physical or chemical properties. The technology improves productivity and generates income for the farmers. The implementation requires drip irrigation system.

The cultivation of blueberries in plant pots has been successfully implemented in the area of Živinice municipality - on soils of poor composition, physical properties and low fertility. Many efforts have been made to introduce a conventional production of blueberries but did not bring the expected results due to the bad soil quality.
The soil (Stagnogley) is poorly permeable to water, so even moderate rainfalls cause water remain on the surface, making it difficult or completely impossible to cultivate the land. In addition, soils of high acidity are required for the successful cultivation of blueberries.
Planting blueberries in a conventional way is often carried out on soils where the acidity is increased by various additives (often with wood sawdust or similar wooden materials).
Practical experience has showed that in the course of time the acidic properties of the soil in the zone of the development of the blueberry root change, i.e. soil/substrate acidity decreases due to resorption processes on the primary soil. Todays' market offers multi-component substrates for the cultivation of blueberries, which, in addition to their adequate acidity, have other properties necessary for a good development of the blueberry's root system. These substrates were also used in some localities of the municipality of Živinice in conventional or modified conventional planting of blueberries (on embankments using soil and commercial substrates). This technique did not yield satisfactory results, probably because of the loss of substrate properties (decrease of soil acidity) due to resorption to the nearby original soil. The substrate keeps its desirable properties much longer if it is put into the planting where blueberries are being planted.
The basic advantage of this technology is its ability to be applied on practically all soils of poor agricultural-productive properties, including heavily degraded and low water permeable soils. Even if the cost for introducing the technology is relatively high, its maintenance is reduced to standard agro-technology (fertigation, plant protection, weed control, harvesting, etc.) due to the type of crop. In the Živinica municipality, technology is currently being applied only in the cultivation of blueberries. The results have shown that the cultivation of blueberries in plant pots provides a yield of about 15 t/ha, which is about 5 t/ha (50%) higher than in the conventional cultivation of the blueberries. The farm on which the technology is described cultivated blueberries of the Duke variety on 8 ha whose fruits are sold at prices between 3.50 and 4.50 USD/kg. The estimated life span of the blueberries grown in plant pots under full yield is 15 years.
Regarding the technical characteristics of the SLM technology, the plant pots with blueberry plantings are placed in rows of low trenches with a distance of 100-120 cm between the plant pots (from center to center); and 250-300 cm between rows. The plant pots (60 to 90 liters) are placed in later formed embankments (trussing with the original soil), thus ensuring the stability of the plant pots (e.g. from wind) and more favorable temperature and humidity conditions of the substrate in the plant pots. The technology implies possession and use of the drip irrigation system, using the water collected in accumulations and distributed from tanks situated on the farm.
The technology offers relatively innovative use of infertile or degraded soils for the intensive and profitable production of blueberries or other crops, primarily berry fruits. Positive experiences from the implementation of the technology on about 8 ha, on the observed farm resulted in the replacement of the earlier conventionally planted and grown blueberries in the wider area of Živinice. By expanding blueberries cultivation in wider areas, the municipality is considered among the leading blueberry producers in the Balkans.

LOCATION



Location: Živinice municipality, Federation of Bosnia and Herzegovina, Tuzla Canton, Bosnia and Herzegovina

No. of Technology sites analysed: single site

Geo-reference of selected sites
- 18.73306, 44.42306

Spread of the Technology: evenly spread over an area (approx. < 0.1 km2 (10 ha))

In a permanently protected area?:

Date of implementation: 2014

Type of introduction
- [x] through land users' innovation
- [ ] as part of a traditional system (> 50 years)
- [ ] during experiments/ research
- [ ] through projects/ external interventions

In row cultivation of blueberries in plant pots. (Milenko Blesić)

Detail of the blueberries cultivation in plant pots. (Milenko Blesić)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [x] reduce, prevent, restore land degradation
- [ ] conserve ecosystem
- [ ] protect a watershed/ downstream areas – in combination with other Technologies
- [ ] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [x] create beneficial economic impact
- [ ] create beneficial social impact

Land use

Cropland

- Tree and shrub cropping

Number of growing seasons per year: 1

Water supply

- [ ] rainfed
- [ ] mixed rainfed-irrigated
- [x] full irrigation

Purpose related to land degradation

- [ ] prevent land degradation
- [ ] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [x] adapt to land degradation
- [ ] not applicable

Degradation addressed

chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion)

physical soil deterioration - Pc: compaction, Pk: slaking and crusting, Pu: loss of bio-productive function due to other activities

other -

SLM group

- Crop management

SLM measures

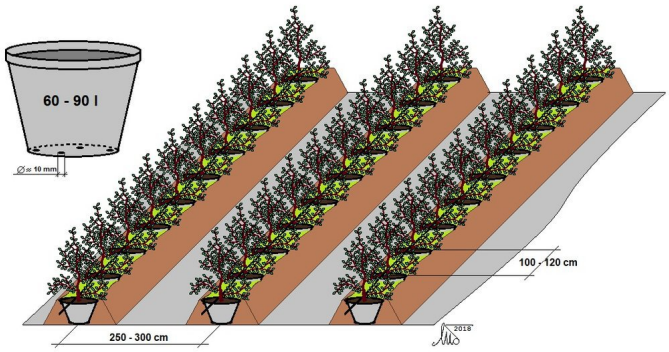
vegetative measures - V1: Tree and shrub cover

management measures - M2: Change of management/ intensity level

TECHNICAL DRAWING

Technical specifications

None



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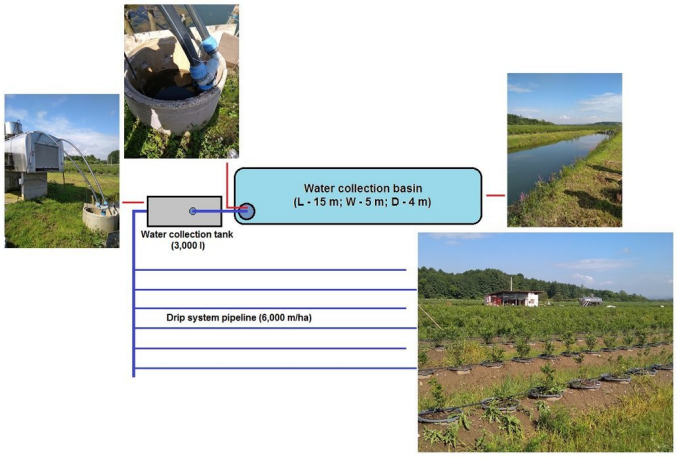
None



Author: Milenko Blesić

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **1 ha**)
- Currency used for cost calculation: **USD**
- Exchange rate (to USD): 1 USD = n.a
- Average wage cost of hired labour per day: 29.25 USD

Most important factors affecting the costs

The prices of blueberry plantings, containers, and multi functional substrate for blueberries on the market.

Establishment activities

1. Purchasing of plantings (Timing/ frequency: Any time)
2. Purchase of substrate (Timing/ frequency: Any time)
3. Ground leveling (if necessary) (Timing/ frequency: Any time)
4. Filling the containers with substrate and planting blueberries in containers (Timing/ frequency: Any time)
5. Formation of rows of containers (Timing/ frequency: Any time)
6. Trussing of rows of containers by original soil (Timing/ frequency: Any time)
7. Installation of drip irrigation system (Timing/ frequency: Any time)

Establishment inputs and costs (per 1 ha)

Specify input	Unit	Quantity	Costs per Unit (USD)	Total costs per input (USD)	% of costs borne by land users
Labour					
Filling the containers with substrate and planting of blueberries	Person day	28.0	29.25	819.0	100.0
Forming and trussing the rows of containers (embankments)	Person day	30.0	29.25	877.5	100.0
Equipment					
(Mecahnization for ground leveling - optional)	Hour	4.0	70.2	280.8	100.0
Plant material					
Blueberry plantings in containers (2 or 3 L plant pots)	Piece	2800.0	5.26	14728.0	100.0
Other					
Plastic containers (65 l)	Piece	2800.0	5.47	15316.0	100.0
Drip irrigation system (including water tank and pump)	ha	1.0	13460.0	13460.0	100.0
Multi-functional substrate for blueberries	L	182000.0	0.07	12740.0	100.0
Total costs for establishment of the Technology				**58'221.3**	

Maintenance activities

1. Checking and maintenance of embankments (rows of containers) (Timing/ frequency: Once a year)
2. Maintenance of drip irrigation system (Timing/ frequency: During the growing season)
3. Maintenance of blueberry orchard (Timing/ frequency: During the growing season)

Maintenance inputs and costs (per 1 ha)

Specify input	Unit	Quantity	Costs per Unit (USD)	Total costs per input (USD)	% of costs borne by land users
Labour					
Checking and maintenance of embankments (rows of containers)	Person day	10.0	29.25	292.5	100.0
Equipment					
Maintenance of drip irrigation system	ha	1.0	344.08	344.08	
Other					
Maintenance of blueberry orchard (lump sum)	ha	1.0	20644.57	20644.57	
Total costs for maintenance of the Technology				**21'281.15**	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [x] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Average annual rainfall in mm: 894.0
The highest precipitations appear during spring and early summer, (June 111 L/m2; February 55 L/m2). Heavy downpours during the summer are one of the climatic features of this area.
Name of the meteorological station: Tuzla

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [x] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [x] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [x] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?
- [ ] Yes
- [x] No

Occurrence of flooding
- [x] Yes
- [ ] No

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial)
- [x] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [ ] average
- [x] rich
- [ ] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [x] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [ ] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [x] employee (company, government)

Gender
- [ ] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha

Scale
- [ ] small-scale

Land ownership
- [ ] state

Land use rights
- [ ] open access (unorganized)

- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [x] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

- [ ] medium-scale
- [x] large-scale

- [ ] company
- [x] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

- [ ] communal (organized)
- [x] leased
- [ ] individual

Water use rights

- [x] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	good
education	poor	good
technical assistance	poor	good
employment (e.g. off-farm)	poor	good
markets	poor	good
energy	poor	good
roads and transport	poor	good
drinking water and sanitation	poor	good
financial services	poor	good

IMPACTS

Socio-economic impacts

Crop production	decreased	increased
crop quality	decreased	increased
demand for irrigation water	increased	decreased
expenses on agricultural inputs	increased	decreased
farm income	decreased	increased

Socio-cultural impacts

SLM/ land degradation knowledge	reduced	improved

Ecological impacts

soil cover	reduced	improved
soil compaction	increased	reduced

Off-site impacts

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

CLIMATE CHANGE

Gradual climate change

annual temperature increase	not well at all	very well	
seasonal temperature increase	not well at all	very well	Season: summer
seasonal rainfall decrease	not well at all	very well	Season: summer

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [x] single cases/ experimental
- [ ] 1-10%
- [ ] 11-50%
- [ ] > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- [ ] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [x] 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- [ ] Yes
- [x] No

To which changing conditions?

- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Much more profitable agricultural production compared to previous use of the land characterized by heavy, less fertile soils unfovorable for most of agricultural crops growing.
- Decreased workload compared to conventional cultivation of blueberries.

Strengths: compiler's or other key resource person's view

- Possibility to organize profitable agricultural production on less fertile, non fertile or degraded lands.
- Possibilities to apply the technology at the landfill sites of many coal mines in the region.

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- Relatively high costs of the technology introduction due to high prices of the inputs for blueberry cultivation in plant pots. Cultivation in plant pots could be applied with other crops whose plantings are cheaper and which does not need specific, multi component, expensive substrate.
- Necessity of drip irrigation system.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Relatively short period of the exploitation of the technology (an expert estimate: 15 years). Producing of the goods (fruits in this case) with high market prices.
- Due to the high introduction costs the technology could be reasonably applied in growing of highly priced crops.

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_4126/

Linked SLM data
n.a.

Documentation was faciliated by

Institution
- n.a.

Project
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