



Ripe pea, good quality (Hanns Kirchmeir)

Introduction of Crop Rotation (Georgia)

DESCRIPTION

In the municipality of Dedoplistskaro, Georgia, 100 ha of land have been cultivated with peas on approx. 25 fields (each 1-10 ha in size). The introduction of peas as an alternative crop that is now used in rotation with wheat, helps to increase soil fertility sustainable and ecologically.

Dedoplistskaro is located in the Shiraki Plain, in eastern Georgia, and consists of steppes, where grain crops are cultivated and livestock is grazed in the winter. The steppe soils are dominated by Chernozems and Kastanozems, the climate is warm and temperate and the small-scale land (2-5 ha) is in individual ownership. The labour including plowing, seeding and harvesting is fully mechanised, the machines are mainly borrowed from agricultural machinery cooperatives and less often from private machinery suppliers. For the inhabitants of Dedoplistskaro municipality, agricultural production is an important source of income. 74% of the Georgian wheat production is located in the Kakheti region. Shiraki valley has a great share of this. The area of wheat production in Dedoplistskaro is 13,693 ha (Census 2014). Securing the productivity of arable land and stopping degradation due to the loss of soil fertility is of local and national importance. The introduction of pea as an alternative crop, which can be used in rotation with wheat or other crops, should help to increase soil fertility in a sustainable and ecologically viable way. Pea is a plant from the legume plant family. The root system of Pea can thus fix nitrogen from air by symbiotic bacteria. This helps to increase the C/N ratio in the soil leading to higher decay rates of organic carbon (e.g. from straw residuals) and higher fertility of soils. Most farmers sowed on 23 and 24 March 2018 - some until 29 March 2018. Later sowing led to lower yields.

LOCATION



Location: Dedoplistskaro, Kakheti, Georgia

No. of Technology sites analysed: 10-100 sites

Geo-reference of selected sites

- 46.2781, 41.4061
- 46.29603, 41.42276
- 46.4416, 41.35959
- 46.29423, 41.42233
- 46.37109, 41.46936
- 46.27897, 41.40579
- 46.49551, 41.30454
- 46.43313, 41.39906
- 46.1315, 41.44715
- 46.1315, 41.44715
- 46.0543, 41.45946
- 46.05438, 41.46486
- 45.906, 41.53242
- 46.06098, 41.4657
- 45.88604, 41.49798
- 45.90224, 41.52866
- 45.92089, 41.50322
- 46.23908, 41.38574
- 46.27668, 41.40691
- 46.10803, 41.41572
- 46.22579, 41.42317
- 46.26676, 41.40896
- 46.27257, 41.40892
- 45.47645, 41.43503
- 46.12216, 41.43767
- 46.13002, 41.44162

Spread of the Technology: evenly spread over an area (1.0 km²)

In a permanently protected area?: No

Date of implementation: 2018

Type of introduction

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



Field with ripe pea, good quality (Hanns Kirchmeir)



Bad quality pea field; still not ripe and high abundance of weeds (Hanns Kirchmeir)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- improve production
- 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
- create beneficial economic impact
- create beneficial social impact

Land use

Land use mixed within the same land unit: No



Cropland

- Annual cropping: cereals - wheat (spring), legumes and pulses - peas, buckwheat
- Number of growing seasons per year: 1
Is intercropping practiced? No
Is crop rotation practiced? Yes

Water supply

- rainfed
- mixed rainfed-irrigated
- full irrigation

Purpose related to land degradation

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

Degradation addressed



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

SLM group

- rotational systems (crop rotation, fallows, shifting cultivation)

SLM measures



agronomic measures - A2: Organic matter/ soil fertility

TECHNICAL DRAWING

Technical specifications

Proposed rotation schema for wheat, pea and buckwheat

| | | | | | | | | |
|---------|---------|---------|---------|-----------|---------|---------|---------|---------|
| Wheat | Pea | Wheat | Wheat | Buckwheat | Wheat | Wheat | Pea | Wheat |
| 1. year | 2. year | 3. year | 4. year | 5. year | 6. year | 7. year | 8. year | 9. year |

Author: Hanns Kirchmeir

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: 100 ha)
- Currency used for cost calculation: USD
- Exchange rate (to USD): 1 USD = n.a
- Average wage cost of hired labour per day: 20

Most important factors affecting the costs

It was a challenge to organise the high amount of pea-seeds, as they are not commonly available in the region.

Establishment activities

1. Selection of farmers and fields according to the selection schema and signed subsidy contracts to all farmers (Timing/ frequency: Until January 2018)
2. Scientific assessment of soil fertility before seeding (Timing/ frequency: October 2017-November 2018)
3. Seeding, maintaining and harvesting (Timing/ frequency: March-October 2018)
4. Scientific assessment of soil fertility before seeding (Timing/ frequency: October 2018)

Establishment inputs and costs (per 100 ha)

| Specify input | Unit | Quantity | Costs per Unit (USD) | Total costs per input (USD) | % of costs borne by land users |
|---|------|----------|----------------------|-----------------------------|--------------------------------|
| Labour | | | | | |
| plowing | ha | 100.0 | 35.71 | 3571.0 | 40.0 |
| harrowing | ha | 100.0 | 14.29 | 1429.0 | 40.0 |
| seeding | ha | 100.0 | 8.93 | 893.0 | 40.0 |
| harvesting | ha | 100.0 | 35.71 | 3571.0 | 40.0 |
| Plant material | | | | | |
| pea-seeds (250kg) | ha | 100.0 | 133.93 | 13393.0 | 40.0 |
| Fertilizers and biocides | | | | | |
| herbicide (1l) | ha | 100.0 | 5.36 | 536.0 | 40.0 |
| Total costs for establishment of the Technology | | | | 23'393.0 | |
| <i>Total costs for establishment of the Technology in USD</i> | | | | <i>23'393.0</i> | |

Maintenance activities

n.a.

NATURAL ENVIRONMENT

Average annual rainfall

- < 250 mm
- 251-500 mm
- 501-750 mm
- 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
- sub-humid
- semi-arid
- arid

Specifications on climate

Average annual rainfall in mm: 697.0

The driest month is January, with 25 mm of rainfall. The greatest amount of precipitation occurs in June, with an average of 108 mm. The difference in precipitation between the driest month and the wettest month is 83 mm.

Name of the meteorological station: Dedoplistskaro Met. Station
The climate is warm and temperate in Dedoplistskaro. The average annual temperature in Dedoplistskaro is 11.3 °C. The warmest month of the year is July, with an average temperature of 22.7 °C. The lowest average temperatures in the year occur in January, when it is around 0.1 °C.

Slope

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

Landforms

- plateau/plains
- ridges
- mountain slopes
- hill slopes
- footslopes
- valley floors

Altitude

- 0-100 m a.s.l.
- 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
- not relevant

Soil depth

- very shallow (0-20 cm)
- shallow (21-50 cm)
- moderately deep (51-80 cm)
- deep (81-120 cm)
- very deep (> 120 cm)

Soil texture (topsoil)

- coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

Soil texture (> 20 cm below surface)

- coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

Topsoil organic matter content

- high (>3%)
- medium (1-3%)
- low (<1%)

Groundwater table

- on surface
- < 5 m
- 5-50 m
- > 50 m

Availability of surface water

- excess
- good
- medium
- poor/ none

Water quality (untreated)

- good drinking water
- poor drinking water (treatment required)
- for agricultural use only (irrigation)
- unusable

Water quality refers to: ground water

Is salinity a problem?

- Yes
- No

Occurrence of flooding

- Yes
- No

Species diversity

- high
- medium
- low

Habitat diversity

- high
- medium
- low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation

- subsistence (self-supply)
- mixed (subsistence/commercial)
- commercial/ market

Off-farm income

- less than 10% of all income
- 10-50% of all income
- > 50% of all income

Relative level of wealth

- very poor
- poor
- average
- rich
- very rich

Level of mechanization

- manual work
- animal traction
- mechanized/ motorized

Sedentary or nomadic

- Sedentary
- Semi-nomadic
- Nomadic

Individuals or groups

- individual/ household
- groups/ community
- cooperative
- employee (company, government)

Gender

- women
- men

Age

- children
- youth
- middle-aged
- elderly

Area used per household

- < 0.5 ha
- 0.5-1 ha
- 1-2 ha
- 2-5 ha
- 5-15 ha
- 15-50 ha
- 50-100 ha
- 100-500 ha
- 500-1,000 ha
- 1,000-10,000 ha
- > 10,000 ha

Scale

- small-scale
- medium-scale
- large-scale

Land ownership

- state
- company
- communal/ village
- group
- individual, not titled
- individual, titled

Land use rights

- open access (unorganized)
- communal (organized)
- leased
- individual

Water use rights

- open access (unorganized)
- communal (organized)
- leased
- individual

Access to services and infrastructure

| | | | | | | |
|-------------------------------|------|-------------------------------------|--------------------------|--------------------------|--------------------------|------|
| health | poor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | good |
| technical assistance | poor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | good |
| employment (e.g. off-farm) | poor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | good |
| markets | poor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | good |
| energy | poor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | good |
| roads and transport | poor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | good |
| drinking water and sanitation | poor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | good |
| financial services | poor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | good |

IMPACTS

Socio-economic impacts

Crop production decreased increased

The average yield of peas 3 t/ha, 98 t pea yield was taken from the pilot plots. Some of the farmers will sow the peas in other plots to improve soil fertility on another land under their ownership. Buckwheat was sown only on 2 plots, 450 kg at all. The farmers who had opted for the concept of starting the crop rotation with buckwheat cultivated the green mass in the soil to improve their fertility. The harvest of peas/buckwheat was very variable between the different farmers depending on their timing of measures: 1. The farmers who could not use the possibility to seed the crops in March - 1 farmer, because of rainy weathers afterwards, seeded pea later, in the middle of April. This farmer could not get yield from the plot. The others (2-3 farmers) who could not harrow the soil after seeding (as we recommended to harrow), they got the small yield.

Socio-cultural impacts

Ecological impacts

Off-site impacts

COST-BENEFIT ANALYSIS

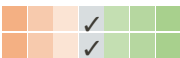

Benefits compared with establishment costs

Short-term returns very negative very positive

Long-term returns very negative very positive

Benefits compared with maintenance costs

Short-term returns
Long-term returns

very negative  very positive
very negative  very positive

Maintenance costs were not applied.

CLIMATE CHANGE

ADOPTION AND ADAPTATION

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

- 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%
- 91-100%

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

- Yes
- 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

- The project gave farmers the opportunity to try the new crops (peas and buckwheat) for the community of Dedoplistskaro, as they only sow wheat and barley over the years. They had the opportunity to get advice on how to sow peas and buckwheat and how to improve the soil fertility of their land. They invested through ploughing, harrowing and maintenance, as well as by taking over the yields. They were also interested in maintaining the yield from the proposed crops, using this seed for further plots next year and passing on the knowledge to other farmers. Some farmers sold harvested peas as forage, some gifted others for the same purposes to improve soil fertility.
- The farmers, who sow the peas in time and cultivate them with appropriate agrotechnical measures, harvested 3.5-4t/ha. The profit was 12 250 - 14 000 GEL/ha. The yield rate was as follows: 3.5.5 t/ha yield - 4.8 yield rate; 4 t/ha --- 5.5 yield rate.
- The expected yield of barley per hectare in the years following pea sowing will be 7-9 tonnes. Income ratios - 9.6 for 7 t/ha yield; 12.4 for 9 t/ha yield. The expert calculated the expected yield on the basis of yield data from the davit Nateladze area in Dedoplistskaro, where peas were sown in 2017 and then 5.5 t barley/ha instead of 1.5 t barley/ha (in previous years before peas were sown) was harvested. As part of the pilot project, 23,750 kg of peas were sown on 92 ha in Dedoplistskaro in 2018. 98 t of peas were harvested in mid-July in the municipality of Dedoplistskaro.

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

- The machinery for preparing the soil and seeding are available.
- Especially pea has a very positive effect on soil fertility.
- Most of the farmers used the technology for next year(2019). They seeded the harvested pea in spring 2019 at another plots in Dedoplistsakro municipality (about 100 ha). This confirms the positive impact of the approach on soil fertility and guarantees the sustainability of the project.

Weaknesses/ disadvantages/ risks: land user's view → how to overcome

- Some farmers (2-3) sow the pea later than others. They did not get a good yield because of the sowing in April. The reason for the delay was 1. rainy weather; 2. lack of machinery. Timely harvesting was also the problem because of the lack of machinery, since Dedoplistskaro is called the barn of wheat and there are not enough machines in the community. The problem of the realization of peas and buckwheat was also the problem because of the lack of companies for peas and buckwheat not only in the municipality but throughout the country. → The farmers asked for a support for the municipality in the development of such enterprises to process the mentioned crops for realization.
- Of the 3 schemes proposed, 19 farmers choose the first scheme to sow the peas in the first year. The second scheme was not chosen at all. The 3rd scheme to start crop rotation in the 1st year with buckwheat was chosen by 2 farmers. A farmer ploughs the yield of buckwheat as a green mass in the soil and improves the fertility of the soil. Another harvested and prepared 120 hay presses. The farmers improved the soil, but the expenses were at 1 ha / 2 645 GEL, 1 press / 7 GEL, the income ratio 0,31. The sowing of buckwheat to prepare the press is ineffective to benefit from the harvest. The farmers who opted for the third scheme (start of crop rotation with buckwheat) were geared towards improving soil fertility, but most farmers prefer to do the rotation in order to benefit from the yield.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's view → how to overcome

- There is no local market or seller for peas and it is difficult to sell the product for the local farmers. → It needs national support to develop a pea-processing industry.

REFERENCES

Compiler

Hanns Kirchmeir

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Resource persons

Hanns Kirchmeir - SLM specialist

Kety Tsereteli - co-compiler

Reviewer

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Full description in the WOCAT database

https://qcat.wocat.net/en/wocat/technologies/view/technologies_4275/

Linked SLM data

n.a.

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-