Organic-PLUS - grant agreement No [774340]

Pathways to phase-out contentious inputs from organic agriculture in Europe

Deliverable 6.4: Version 1.1

Sustainability assessment report of *case farms working with alternatives to contentious inputs.*

Funding

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [774340 — Organic-PLUS]

Project Details:

Programme: **H2020, SUSTAINABLE FOOD SECURITY – RESILIENT AND RESOURCE- EFFICIENT VALUE CHAINS**

Call topic: **SFS-08-2017, (RIA) Organic inputs – contentious inputs in organic farming**

Project Title: **Pathways to phase-out contentious inputs from organic agriculture in Europe**

Project Acronym: **Organic-PLUS**

Proposal Number: **774340-2**

Lead Partner: **Coventry University, Centre for Agroecology, Water and Resilience**

Time Frame: **01/05/2018 – 31/10/2022**

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Acknowledgements:

The authors of this report are very grateful for the kind assistance of many organic farmers, willing to share their farm data, knowledge and experiences. We also thank Erica Montemayor, Lucas Knebl and Dr Dennis Touliatos for being surveyors in RISE, and Christian Thalmann from HAFL Bern, for his assistance and services in the RISE methodology and software. Further contribution was by Dr Dennis Touliatos and Judith Conroy.

Deliverable Details:

WP: 6 Model

Task(s): 6.4: Sustainability assessment

Deliverable Title: Sustainability assessment of case farms using alternatives for contentious inputs

Lead beneficiary: Aarhus University

Involved Partners: CU, UTH, INRAe, UHoH, AU, CUT, L&F/ICOEL, IRTA, NORSØK, FORI
Deadline for delivery: month 44, 31/12/21

Date of delivery: 10/01/2022

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1. Summary with conclusions

This sustainability report is based on the sustainability evaluation of 10 case farms, using the **RISE** (Response Inducing Sustainability Evaluation) methodology, designed by the School of Agricultural, Forest and Food Sciences, HAFL. The case farms represent a wide range of organic farms in Europe, experimenting with alternatives to contentious inputs. Results of the case farm reports were discussed in two additional expert workshops, who have been working with the topical work packages (WP) of **Organic-PLUS**, WP SOIL, WP PLANT and WP LIVESTOCK. Work in progress and results from these WPs have given rise to discussions, which are reflected in this report. Specifically, alternatives for conventional manure, copper and antibiotics were identified.

Regardless of case farm, biodiversity scored in a lower range, but this was not specifically linked to any of the contentious inputs. The lack of some nutrients on some of the case farms was more a conscious choice, than supply problem. If this resulted in lower yields this was not always seen as a problem, particularly if there were community shares (e.g. in vegetable boxes which required all year round supply) or when mitigated by premium prices (e.g. high quality wine or olive oils).

Some farms were in the process of replacement, by using composted biogas digestate. Replacement of copper by substitution with alternative treatments was not seen to be a simple solution.

A set of preventive measures was recorded, including more resistant varieties, management, combinations of natural repellents, but also the acceptance of lower yields to guarantee alignment to organic principles and not create non-disputable products towards the specific consumers (e.g. vegan consumers).

Antibiotic use in organic livestock was identified as being reduced, but not completely gone. Organic livestock farmers increase vaccination, preventive measures and alternative treatments, using farmer schools to gain and exchange of experiences. Ultimately, avoidance of animal cruelty by treating sick animals, is thought to be more ethical than culling or selling to conventional farms, where animals would potentially live in poorer or even industrial conditions.

2. Introduction

The **Organic-PLUS** project has the overall aim of providing high quality, transdisciplinary, scientifically informed decision support to help all actors in the organic sector, including national and regional policy makers to reach the next level of the EU's organic success story. Three large topical work packages (WPs PLANT, LIVESTOCK, SOIL) have been working for three years, investigating contentious inputs and identifying and testing the implementation and performance of alternatives in practice, for the topics soil, plant and livestock. Work package 6 (called WP MODEL) has the task to evaluate the outcomes of the mentioned topical work on an interrelated system level. This has been done by evaluating the environmental impact of the use of alternatives by using the Life Cycle Assessment (LCA) method, which was presented in D6.3, by investigating on a case-by-case basis the feasibility of the implementation in practice of invested alternatives (presented in D6.2) and by investigating the consequences of phasing out contentious inputs on overall sustainability, evaluated in a holistic way. Sustainability can be invested in many ways (De Olde et al., 2016): system based, sector based, country-wide, but also at farm level. In order to provide support and insight to changes and transitions of farms that use novel and known practical approaches towards alternatives, it was decided to use a widely used sustainability assessment tool. This tool is **RISE**, which stands for **R**esponse **I**nducing **S**ustainability **E**valuation. RISE is an interview-based method for assessing the sustainability of farming operations across the economic, social and environmental dimensions. It was first developed in 1999 and is distributed by the Swiss College of Agriculture (www.shl.bfh.ch). It has been used and tested in many countries (references see section 3.2 scientific background). For example, in Denmark the organic advisory services have been using the tool for more than 7 years. In addition, in Germany the advisors of the largest private organic sector body Bioland (www.bioland.de) are active in using RISE.

3. Methodology

3.1 Choice of case farms and data collection

Scenarios were designed, covering the phase-out topics addressed in Organic-PLUS (D 6.1) and from these, farms in different countries were used as case farms for the RISE analysis. Case farms are very suitable for the objective of producing decision support, which does not ask for generalised results, but actual cases that can be used as inspiration and motivation for managing transitions and general production management. Farm type and size vary greatly both within countries and especially across Europe. Farms and their governance are often so individual and different, that averaging is of limited use in actual advisory services or decision support. The case farms are analysed and presented as individual enterprises with their own narrative.

RISE consultants were trained and supervised during the process, as part of the project. As RISE is a tool based on quantitative and qualitative data, it requires production data acquired when the surveyor visits the farm, but also uses the impressions the visit gives when visiting the fields, the nature on surroundings of the farm, the barns and the workshops. The process requires access to the farmers' accounts, fertility planning, journals for pesticide use and medicine use, land subsidy application, etc. Often these data are entered into the RISE software, before the actual interview visit, so it is not prolonged.

3.2 Scientific background

RISE is an indicator-based sustainability assessment tool developed at the Bern University of Applied Sciences (School of Agricultural, Forest and Food Sciences, HAFL) (Grenz, 2016). The aim of the tool is to enable a holistic evaluation of sustainability at the farm level and support the dissemination of sustainable practices (Grenz, 2016). Since its start in 1999, RISE has been applied in over 2500 farms in 56 countries (Thalmann, Grenz, 2013). Experiences and results of RISE versions 1.0, 2.0 and 3.0 have been described in the academic literature: e.g. Häni et al., 2003; Häni et al., 2006; Grenz et al., 2009; Mobjörk, 2010; Urutyan & Thalmann, 2011; De Olde et al., 2016.

Users of RISE assess the sustainability performance of a farm for 10 themes and 47 indicators (Table 1) The sustainability performance of each indicator is based on an aggregation of various parameters. These parameters are normalised (i.e., converted to a 0–100 scale) differently for each indicator and can include comparisons between farm and reference data. The score at the theme level is based on the average of the scores of the 4–7 indicators included in each theme. Scores on theme and indicator level range from 0–100 and are visualised in a spider web polygon. According to the RISE assessment, a performance between 0 and 33 is considered 'problematic' (red), between 34 and 66 'critical' (yellow) and between 67 and 100 'increasingly sustainable' (green). RISE results are presented in a farm report, which includes the farm's sustainability polygon, a table with the theme and indicator scores and an explanation of the calculation and scores. Based on this report, a farmer and auditor define the measures for improvement. The RISE software is available on a license and requires the interviewer to undergo training.

Table 1. Themes and Indicators in RISE 3.0.

Soil Use	
1.1	Soil Management
1.2	Crop Productivity
1.3	Soil Reaction
1.4	Soil Organic Matter
1.5	Soil Erosion
1.6	Soil Compaction

Animal Husbandry	
2.1	Herd Management
2.2	Livestock Productivity
2.3	Opportunity for Species Appropriate Behaviour
2.4	Living Conditions
2.5	Animal Health

Materials and Environmental Protection	
3.1	Material Flows
3.2	Fertilisation
3.3	Plant Protection
3.4	Air Pollution
3.5	Soil and Water Pollution

Water Use	
4.1	Water Management
4.2	Water Supply
4.3	Water use intensity
4.4	Irrigation

Energy and Climate	
5.1	Energy Management
5.2	Energy Intensity
5.3	Greenhouse Gas Balance

Biodiversity	
6.1	Biodiversity Management
6.2	Ecological Infrastructures
6.3	Distribution of biological infrastructures
6.4	Intensity of Agricultural Production
6.5	Diversity of Agricultural Production

Working Conditions	
7.1	Personnel Management
7.2	Working Hours
7.3	Safety of Work
7.4	Wage and Income Level

Quality of Life	
8.1	Occupation and Training
8.2	Financial Situation
8.3	Social Relations
8.4	Personal Freedom & Values
8.5	Health
8.6	Other Areas of Life

Economic Viability	
9.1	Liquidity
9.2	Profitability
9.3	Stability
9.4	Indebtedness
9.5	Livelihood Security

Farm Management	
10.1	Business Goals, Strategy, Implementation
10.2	Availability of Information
10.3	Risk Management
10.4	Resilient Relationships

To compute the sustainability performance of a farm, four types of data are used: 1) facts allocated to farm practices and measures, 2) quantitative farm data, 3) regional data and 4) master-file data (these are global reference data).

Qualitative information on farm practices and quantitative farm data are gathered through a questionnaire-based interview with the farmer and farm workers, conducted by a trained auditor. For the themes working conditions and quality of life, the farmer decides whether the employees may be interviewed, and if so, who. A certain number of points (positive or negative) is given, based on the answers of the farmer, farm worker and/or auditor to questions on farm management, activities and the on-farm situation (e.g., animal welfare conditions). In this way, qualitative information is translated into a quantitative score. Most indicators integrate this type of data, to compute the performance of the farm on the indicator level. Of these indicators, about half are exclusively based on points allocated to certain measures, activities or situations on-farm. These indicators are related to quality of life, farm management, animal husbandry, soil use, water use, nutrient flows and working conditions. For the other half of indicators, this type of data is combined with one or more of the other data types.

Quantitative farm data (e.g., energy consumption, crop yields and income) are used in 28 indicators, especially in combination with other types of data (23 indicators) (see table 2). In five indicators, quantitative farm data are used exclusively and compared to regional reference values. These subthemes are related to economic viability (4) and biodiversity (1).

Table 2. Example of an indicator combining points, quantitative farm data, regional data and regional reference values: livestock productivity (2.2).

The indicator is calculated in four steps.
1 The livestock units, per animal category (i) and in total (t), are calculated and corrected for temporarily absent or present animals. The livestock units are derived from regional data (livestock unit factors).

2 The productivity of each animal category (e.g., annual milk yield, growth rate, egg production) is compared to regional reference values. The score on the productivity for each animal category is calculated using this formula: productivity/regional productivity x 100 - 33.

3 For each animal category, the farmer is asked to give an estimation of the product quality (q1) and of the development of the performance and quality over the last 5 years (q2). For both questions, the farmer can select the answer from five options: significantly above average/improvement (20 points), slightly above average/improvement (10 points), average/stagnation (0 points), slightly below average/decline (-10 points), significantly below average/decline (-20 points).

4 The results of Steps 2 and 3 are added and corrected for the share of the animal category in the total livestock units on the farm: sum ((result step 2i + q1i + q2i) x (LUi/LUt)).

Regional data are specific to the respective region but are not assessed or available at the farm level e.g., nitrogen losses from farm and storage facilities, livestock unit factors and water demand of crops. The regional data can be from a country or from a smaller region. There are nearly 150 regional data sets for more than 20 countries. Global reference data are provided by the RISE master-file and cover, for example, the composition of feedstuffs, the toxicity and persistency of pesticides, the energy consumption of machinery, energy density (i.e., energy contained in MJ), the emissions of energy carriers (e.g., coal, wood, natural gas, petroleum) and the nutrient contents of organic fertilisers. Regional and global reference data are integrated in the calculations of 11 and 14 indicators respectively, always in combination with points and/or quantitative farm data. Five indicators integrate all four data types.
Next to farm, regional and global reference data, regional reference values are used in 11 indicators to compare the performance of the farm to the regional average or target (e.g., crop yields, livestock production, share of ecological priority areas, working hours and days per week). In the RISE software, a standard set of crops (i.e., yields, water content and cultivation period) and livestock (i.e., productivity and livestock units) is given that can be adjusted to the region and extended. What should be considered as 0 and 100 points is defined by the tool, except for six indicators in which a regional reference value is used. For each indicator, different calculations are used to aggregate data and compute a score. Decisions regarding these calculations, for example on indicators, units (i.e., hectares, MJ), weights and the use of an average or minimum score of the indicators, influence the result. These calculations are mostly fixed within RISE, except for quality of life-related subthemes, in which the interviewee determines the weight of each parameter within the indicator score. In the RISE software it is also possible to by-pass some computation of indicators or parameters used for the computation of an indicator, by entering a direct score. This is if the data-information is very hard or impossible to retrieve. The entry of a direct score should only be done on the basis of expert knowledge and never purely on farmer testimony.

3.3 Case Farms

Considerable difficulty was experienced in finding case farms willing to share all farm data with the surveyor. Many also required anonymisation, when doing so. Attitudes towards this vary between countries and are connected to the possible misuse of very personal data. All organic farms in Europe are required to have regular annual inspections (also called farm-control or farm audit) and spot inspections.

Any non-compliance with the regulations has to be treated as confidential and in the worst case, non-compliance sanctions can result in selling without the 'organic' logo, which can have disastrous financial consequences for farmers. In some cases, this led to the denial of access to the economic accounts, so the surveyor had to estimate values by expert opinion. It appeared also, there were differences in the national regulative authority requirements for farms to document, for example, the amount of imported fertiliser or feed. In Denmark and Germany this is obligatory for all organic farms, and information is freely obtainable.
Finally, the ongoing COVID-19 pandemic jeopardised the visiting of farms, which led to many cancellations and fewer case farms than originally planned.

<u>Case farms addressing the WP SOIL theme:</u>

The <u>WP SOIL</u> theme comprises the phasing-out of conventional manure and other products derived from conventional livestock such as bone or feather meal. The <u>SOIL</u> theme also comprises the phasing out of peat for the use of nursery plants in pots and fossil-based plastic for weed regulation by covering the soil. The most comprehensive way of phasing out conventional animal products is growing for vegan consumers and abandoning all livestock inputs (conventional and organic) in farming.

1. Vegetable production, Spain

Producing organic sugar beet, sweet potatoes, watermelons, onions, sweet peppers, tomatoes, broccoli, and melons on 16 ha in Spain. Here the fertiliser used is composted conventional cow manure for all vegetables. There is no livestock kept on the farm.

2. Arable farm in England, UK

Producing oats and wheat (spring and winter) on 5.2 ha cultivated land. There is a focus on nutrients and cover crops/green manures. The farm uses compost made of plant wastes and wood chips as an alternative fertiliser. There is no livestock on the farm.

3. Vegetable farm in England, UK

Producing on 0.9 ha agricultural area with organic fruits, cabbage, tomatoes, beans, salad, leeks and plums. For all production, compost made of plant wastes is used as fertiliser. For tomatoes, a "non-livestock based" concentrate fertiliser was used. There is no livestock on the farm and products are sold as vegan organic.

4. Vegetable farm in England, UK

Produces organic potatoes, onions, cabbage, tomatoes, beans and green manure on 2.2 ha. The focus is to use homemade compost as an alternative for all vegetable productions. No livestock on the farm and products sold as vegan organic.

5. Arable farm in Denmark

Produces organic cereals, legumes, grass and potatoes on 590 ha. The farm uses conventional pig manure, but is trying to phase out this import by finding biogas digestate produced by a nearby organic egg producer. There is no livestock on the farm.

<u>Case farms addressing the WP PLANT theme:</u>

The <u>WP PLANT</u> theme comprises the phasing out of copper and sulphur for fungus and insect regulation, as well as the phasing out of mineral oils as insecticide and fungicide. Copper has been the subject of discussion in the organic growing of grapes, potatoes and some vegetables in recent years, but no serious *stand-alone alternatives have been found. Therefore, the phasing out of copper is a complex of alternatives, using growing techniques, disease resistant varieties, management etc.*

1. Vegetable farm in Spain (same as in SOIL theme)

Producing organic sugar beet, sweet potatoes, watermelons, onions, sweet peppers, tomatoes, broccoli and melons on 16 ha in Spain. There is a focus on minimising the use of copper as a plant protection product and instead using biological insecticide and fungicide. There is no livestock at the farm.

6. Olive production in Spain

Producing organic olives on 15 ha in Spain, where the goal is to minimise the use of copper as a plant protection product by minimising the use and trying alternatives using sulphate.

7. Vineyard farm in Germany

The farm produces grapes and wine on 18 ha cultivated area. The focus is to reduce copper and sulphur inputs. Instead, resistant strains are grown and the farm recycles the spray that doesn't reach the plants to minimise the amount that reaches the soil.

5. Arable farm in Denmark

This farm is also discussed in the SOIL theme, as the potatoes are the main cash-crop, and no copper is used as this is prohibited in Denmark.

Case farms addressing the WP LIVESTOCK theme:

The LIVESTOCK *theme comprises the phasing out of antibiotics and anthelmintics in the production of pigs, cows and poultry. Abandoning antibiotics and anthelmintics totally could result animal cruelty if sick animals are left untreated and suffer; this is also illegal. Organic guidelines regulate all use of veterinary treatment be documented and retention time after treatment is twice that of conventional.*

8. Pig production in Denmark

This is an organic farm focussing on pig production. Each year there are 623 sows with piglets < 7.1 kg, and 14,360 piglets produced between 7.1-31 kg of which 12,447 are fattened on the farm, the rest sold as piglets. They use antibiotics on average, for 12% of the pigs. This means 88% of all pigs are already fattened without the use of any antibiotics. This indicates a focus on minimising the use of antibiotics. The farm has 256 ha of productive farmland.

9. Dairy farm in Germany

A dairy farm with 90 dairy cows and 25 1-2 years old heifers a year. The aim is to reduce the use of antibiotics. The farm has 145 ha of productive farmland.

4. Base Line Results

4.1 Metrics and reading guide

In RISE, the results are presented to the farmers as a report, which starts with a spider web polygon, summarising all theme and indicator results in one graphics picture. The colours show the degree of sustainability performance, the indicators are shown as black dots on the scale line for the themes. The scale line is reflecting the scores 0-100, where zero is the minimum. The indicators per theme are weighted equally for calculation of the theme score, and the result of the average is presented as a red line.

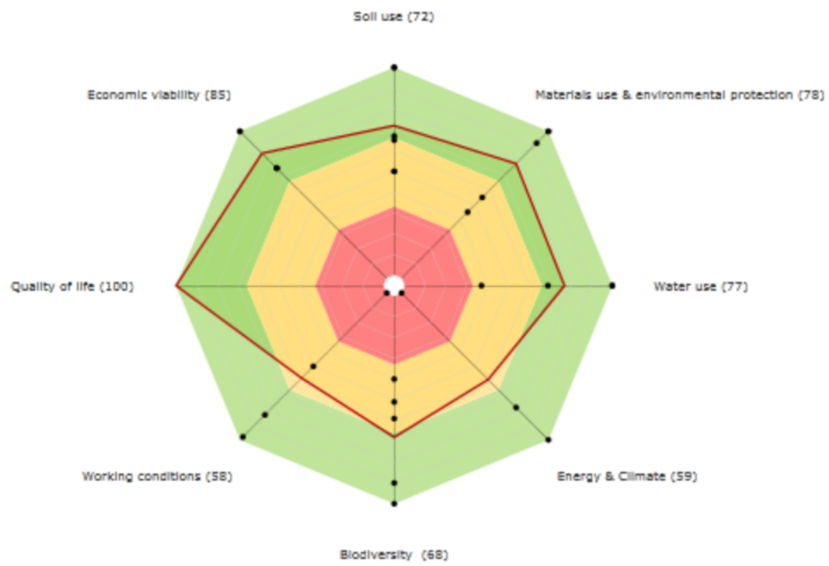
— (red line)	Degree of sustainability
●	Indicators

Low performance	Medium performance	Good performance

In the report the farmer is presented for all scores of the themes, and for the individual indicators. If the farmer is interested in knowing exactly how the scores were found, the underlying sub-calculations of the indicators from the parameters are presented. For each case farm (1-10), the polygon, the theme and indicator results, and the crop production or livestock production results are shown, showing the current (base line) sustainability performance of the farm. Each farm is hereafter discussed, on basis of the results.

4.2 SOIL theme

1. Vegetable production in Spain



Results themes & indicators - short list

1	**Soil use**	**72**
1.1	Soil management	50
1.2	Crop productivity	67
1.3	Soil organic matter	65
1.4	Soil reaction	50
1.5	Soil erosion	100
1.6	Soil compaction	100

2	**Materials use & environmental protection**	**78**
2.1	Material flows	55
2.2	Fertilization	45
2.3	Plant protection	100
2.4	Air pollution	100
2.5	Soil and water pollution	92

3	**Water use**	**77**
3.1	Water management	37
3.2	Water supply	100
3.3	Water use intensity	100
3.4	Irrigation	69

4	**Energy & Climate**	**59**
4.1	Energy management	78
4.2	Energy intensity of agricultural production	0
4.3	Greenhouse gas balance	100

5	**Biodiversity**	**68**
5.1	Biodiversity management	59
5.2	Ecological infrastructures	100
5.3	Distribution of ecological infrastructures	90
5.4	Intensity of agricultural production	51
5.5	Diversity of agricultural production	40

6	**Working conditions**	**58**
6.1	Personnel management	0
6.2	Working hours	83
6.3	Safety at work	98
6.4	Wage and income level	50

7	**Quality of life**	**100**

8	**Economic viability**	**85**
8.1	Liquidity	75
8.2	Profitability	100
8.3	Stability	75
8.4	Indebtedness	75
8.5	Livelihood security	100

The theme "quality of life" was inserted as direct input and therefore not specified in terms of specific indicators. Average sustainability score = 75.

Specific benchmarking results are presented for the farm as regards the yields, and crop soil organic matter for the farm. Yields are based on the reference values for these yields in this region. Crop soil organic matter balance are calculated by accounting for import of organic matter and material removed (yield, straw).

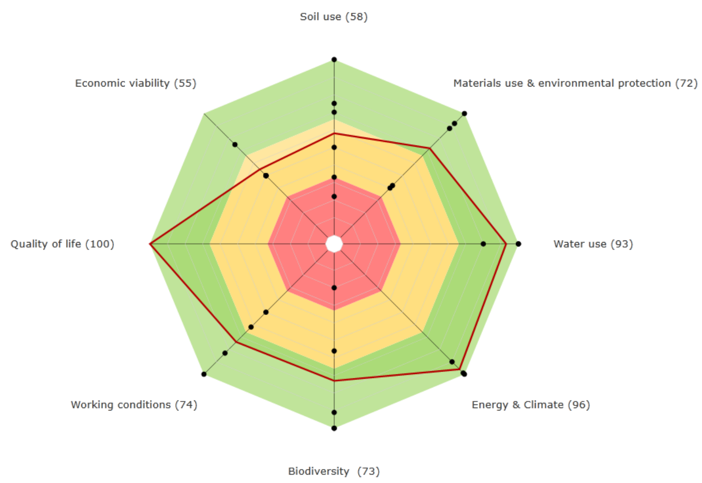
4 Crop production

Text	Unit	Sugar beet	Sweet potato (	Water melon	Onions	Sweet pepper	Tomatoes	Broccoli	Melon:
Crop productivity									
Crop area	ha	1.0	0.5	1.0	0.5	0.5	0.2	0.2	0.2
Score yield level per crop	points	67	67	67	67	67	67	67	67
Yield per hectare	t/ha	60.0	12.5	28.0	10.0	60.0	80.0	35.0	23.7
Regional standard yield (for crop)	t/ha	60.0	12.5	28.0	10.0	60.0	80.0	35.0	23.7
High yield	t/ha	80.0	17.3	43.0	14.0	102.0	136.0	47.0	35.0
Low yield	t/ha	41.0	7.8	13.0	6.0	25.0	24.0	23.0	13.0
Quality trends during the past 5 years		Stagnation	Stagnation	Stagnation	Stagnatio	Stagnation	Stagnation	Stagnation	Stagnati
Production quality criteria		Market Requir	Market Requirem	Market Require	Market Re	Market Requirem	Market Requ	Market Rec	Market R
Fulfilment of quality requirements		Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled
Soil organic matter									
Crop soil organic matter balance	points	100	4	42	100	100	39	20	44

Comments

The overall score for sustainability performance for the farm is high (75) but there are some "red" indicator and parameter scores. There are though some issues that could be improved within soil management (the farm is not using soil analysis as decision support), soil organic matter (even though compost was used, the soil organic matter balance is negative for especially potatoes and broccoli), material flows (import necessary), fertilisation (more nitrogen applied then harvested) , water management (not recorded nor investigated for possible savings), energy intensity (high use of electricity and diesel per ha), intensity of agricultural production (high fertilisation level), diversity of agricultural production (the forest doesn't count here).

2. Arable production in England, UK



Results themes & indicators - short list

1	**Soil use**	**58**
1.1	Soil management	50
1.2	Crop productivity	22
1.3	Soil organic matter	33
1.4	Soil reaction	75
1.5	Soil erosion	100
1.6	Soil compaction	70

2	**Materials use & environmental protection**	**72**
2.1	Material flows	42
2.2	Fertilization	40
2.3	Plant protection	100
2.4	Air pollution	92
2.5	Soil and water pollution	88

3	**Water use**	**93**
3.1	Water management	80
3.2	Water supply	100
3.3	Water use intensity	100

4	**Energy & Climate**	**96**
4.1	Energy management	90
4.2	Energy intensity of agricultural production	99
4.3	Greenhouse gas balance	100

5	**Biodiversity**	**73**
5.1	Biodiversity management	56
5.2	Ecological infrastructures	100
5.3	Distribution of ecological infrastructures	100
5.4	Intensity of agricultural production	91
5.5	Diversity of agricultural production	20

6	**Working conditions**	**74**
6.1	Personnel management	83
6.2	Working hours	62
6.3	Safety at work	100
6.4	Wage and income level	50

7	**Quality of life**	**100**

8	**Economic viability**	**55**
8.1	Liquidity	50
8.2	Profitability	50
8.3	Stability	75
8.4	Indebtedness	50
8.5	Livelihood security	50

The theme quality of life was registered as direct input, based on the surveyor's expert opinion and informed by discussions with the farmer. The average sustainability score is 78, but there are some "red" indicator scores.

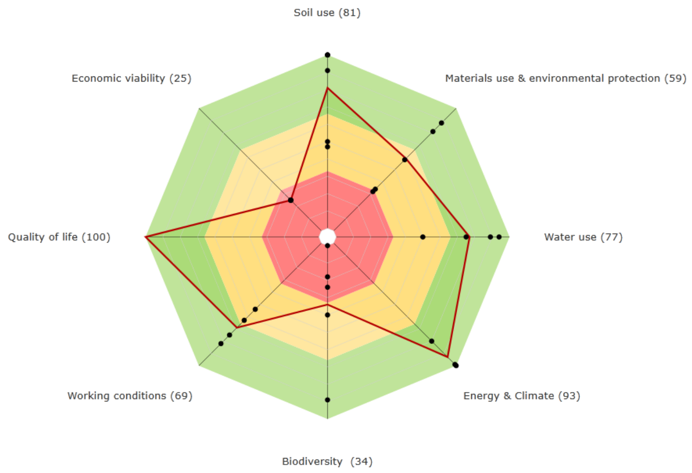
The reference values for this region in England are used for scoring the yields on the farm, which were surveyed quite accurately.

Text	Unit	Oats (Avena sativa), winter - Crop	Wheat (Triticum aestivum), spring - Crop	Wheat (Triticum aestivum), winter - Crop
Crop productivity				
Crop area	ha	1.7	1.7	1.7
Score yield level per crop	points	30	16	20
Yield per hectare	t/ha	4.0	2.0	3.0
Regional standard yield (for crop)	t/ha	5.5	5.0	6.0
High yield	t/ha	6.5	5.9	6.9
Low yield	t/ha	4.5	4.2	5.2
Quality trends during the past 5 years		Stagnation	Stagnation	Stagnation
Production quality criteria		Marktanforderungen	Marktanforderungen	Marktanforderungen
Fulfilment of quality requirements		Fulfilled	Fulfilled	Fulfilled
Soil organic matter				
Crop soil organic matter balance	points	33	33	33

Comments

The overall sustainability performance of this farm was high (78), but a production of only cereals could not provide a sole income. The farm was reported to be an experimental farm, investigating whether the production of only cereals could be feasible without importing animal manure. Green manuring is practiced, both under sown and seeded after harvest, when weed management allows this. Both legumes (to fix nitrogen) and other catch crops (to prevent leaching and to accumulate organic matter) were used. Wood chips were imported, they contain potassium and some phosphorous, but hardly nitrogen. The idea behind was, that if a production without using livestock manure (vegan organic) could be sold for higher prices, it might be profitable. Soil organic matter balances are difficult to maintain, when harvesting low yields (few residues), but are expected to become stable when continuing import of wood chips. The yields are expected to remain relatively low compared to the reference values of cereal yield in England. No peat or plastic mulching is used on the farm.

3. Vegetable production in England, UK



Results themes & indicators - short list

1	**Soil use**	**81**
1.1	Soil management	50
1.2	Crop productivity	47
1.3	Soil organic matter	91
1.4	Soil reaction	100
1.5	Soil erosion	100
1.6	Soil compaction	100

2	**Materials use & environmental protection**	**59**
2.1	Material flows	34
2.2	Fertilization	32
2.3	Plant protection	58
2.4	Air pollution	88
2.5	Soil and water pollution	81

3	**Water use**	**77**
3.1	Water management	94
3.2	Water supply	50
3.3	Water use intensity	75
3.4	Irrigation	89

4	**Energy & Climate**	**93**
4.1	Energy management	80
4.2	Energy intensity of agricultural production	99
4.3	Greenhouse gas balance	100

5	**Biodiversity**	**34**
5.1	Biodiversity management	24
5.2	Ecological infrastructures	18
5.3	Distribution of ecological infrastructures	0
5.4	Intensity of agricultural production	89
5.5	Diversity of agricultural production	40

6	**Working conditions**	**69**
6.1	Personnel management	54
6.2	Working hours	75
6.3	Safety at work	82
6.4	Wage and income level	63

7	**Quality of life**	**100**

8	**Economic viability**	**25**
8.1	Liquidity	25
8.2	Profitability	25
8.3	Stability	25
8.4	Indebtedness	25
8.5	Livelihood security	25

The theme quality of life was registered as direct input, based on the surveyor's expert opinion. The average sustainability score for this farm is 67.

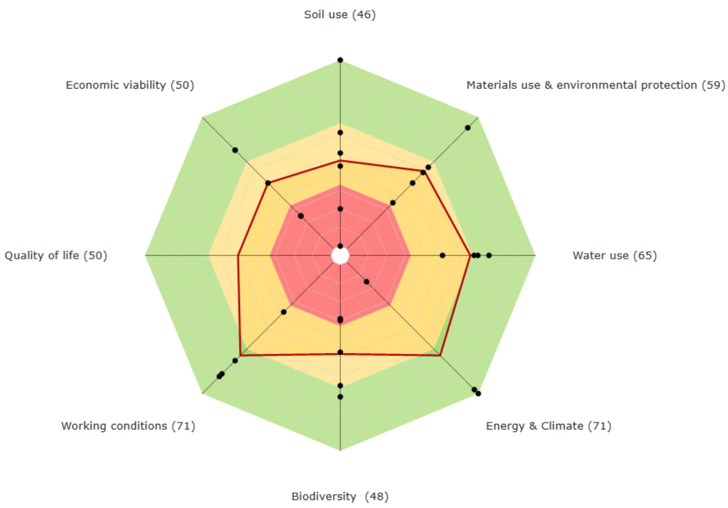
4 Crop production

Text	Unit	Fruit orchard	Cabbage	Tomatoes	Bean, Garden	Salad, lettuce	Leeks, units	Plum
Crop productivity								
Crop area	ha	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Score yield level per crop	points	100	67	10	72	24	28	28
Yield per hectare	t/ha	20.0	50.0	20.0	1.0	20.0	50,000.0	5.0
Regional standard yield (for crop)	t/ha	15.0	50.0	80.0	1.0	40.0	100,000.0	10.0
High yield	t/ha	18.0	71.0	94.0	1.3	52.0	150,000.0	14.0
Low yield	t/ha	12.0	29.0	66.0	0.7	28.0	60,000.0	6.0
Quality trends during the past 5 years		Stagnation	Stagnation	Stagnation	Stagnation	Stagnation	Stagnation	Stagnat
Production quality criteria		Marktanforderu	Marktanforc	Marktanforde	Marktanforderun	Marktanforderun	Market Require	Marktar
Fulfilment of quality requirements		Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled
Soil organic matter								
Crop soil organic matter balance	points	100	93	100	100	88	59	100

Comments

The farm has a moderate sustainability score (67). The farm pays no attention to biodiversity aspects, no evaluation of nature elements that might need protection, and was said to have no areas of nature value (no hedges, stone walls, small natural biotopes etc.). In addition, the economic sustainability was low. Nevertheless, the farm will have a possibility to exist in the future, as it is a community supported agricultural (CSA), which guarantees the farm a survival income. The aspects of soil fertility and organic matter were no problem on this farm. Substantial amounts of compost were provided, coming from household waste. This also is reflected in the low score for fertility, as too many nutrients are supplied, giving a potential risk for leaching, if nutrients are mobile. Management was not based on planning. The yields however were registered to be low, but this might have been due premature harvest, as the community support lies partly in the provision with vegetables all year round, which are harvested when needed in the farm share. It can be concluded that even though the agronomic and economic performance was rated low, this might not jeopardise the enterprise, due to the community support. It is however interesting to note that additional biodiversity management was not prioritised, besides being vegan organic. The farm doesn’t use peat and plastic for mulching.

4. Vegetable production in England, UK



Results themes & indicators - short list

1	**Soil use**	**46**
1.1	Soil management	50
1.2	Crop productivity	43
1.3	Soil organic matter	61
1.4	Soil reaction	100
1.5	Soil erosion	0
1.6	Soil compaction	20

2	**Materials use & environmental protection**	**59**
2.1	Material flows	50
2.2	Fertilization	35
2.3	Plant protection	58
2.4	Air pollution	92
2.5	Soil and water pollution	62

3	**Water use**	**65**
3.1	Water management	67
3.2	Water supply	75
3.3	Water use intensity	50
3.4	Irrigation	69

4	**Energy & Climate**	**71**
4.1	Energy management	15
4.2	Energy intensity of agricultural production	97
4.3	Greenhouse gas balance	100

5	**Biodiversity**	**48**
5.1	Biodiversity management	47
5.2	Ecological infrastructures	29
5.3	Distribution of ecological infrastructures	30
5.4	Intensity of agricultural production	71
5.5	Diversity of agricultural production	65

6	**Working conditions**	**71**
6.1	Personnel management	87
6.2	Working hours	75
6.3	Safety at work	85
6.4	Wage and income level	38

7	**Quality of life**	**50**

8	**Economic viability**	**50**
8.1	Liquidity	75
8.2	Profitability	75
8.3	Stability	25
8.4	Indebtedness	50
8.5	Livelihood security	25

The theme quality of life was registered as direct input, based on the surveyor's expert opinion. The average sustainability score for this farm is 58.

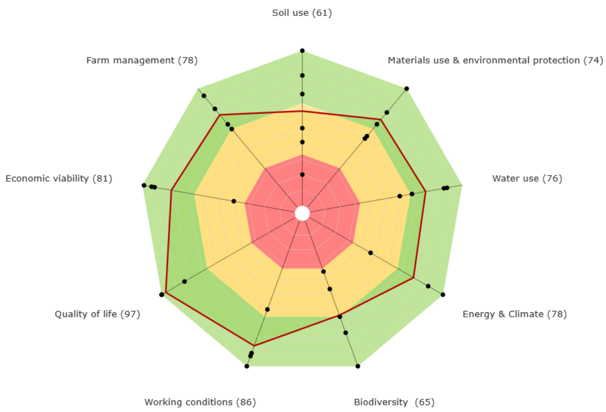
4 Crop production

Text	Unit	Potatoes, eating	Onions	Cabbage	Tomatoes	Bean, Garden	Green manure
Crop productivity							
Crop area	ha	1.0	0.2	0.2	0.1	0.5	0.5
Score yield level per crop	points	24	67	51	43	67	
Yield per hectare	t/ha	20.0	10.0	40.0	70.0	1.0	
Regional standard yield (for crop)	t/ha	45.0	10.0	50.0	80.0	1.0	0.0
High yield	t/ha	62.0	12.0	71.0	94.0	1.3	
Low yield	t/ha	28.0	8.0	29.0	66.0	0.7	
Quality trends during the past 5 years		Stagnation	Stagnatior	Stagnation	Stagnation	Stagnation	Not yet answerec
Production quality criteria		Marktanforderunge	Marktanfo	Marktanford	Marktanforde	Marktanforderun	
Fulfilment of quality requirements		Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfilled	Not yet answerec
Soil organic matter							
Crop soil organic matter balance	points	51	100	17	100	70	64

Comments

The sustainability performance of the farm could be improved (58). The biodiversity score could be increased by better management, including preserving ecological infrastructures like hedges, flower banks, stone walls etc. In addition, energy management (how to save fossil energy), and soil management could be improved. The crop productivity seems low, however, as this farm also is a CSA farm, it might not be the potential yield level that is measured. Soil erosion and soil compaction, seem to be a problem. As to material flows, the farm seems to be able to import sufficient green material for compost, but in the longer run, phosphorous deficiency might occur. No peat or plastic for mulching is registered.

5. Arable production in Denmark



Results themes & indicators - short list

1	**Soil use**	**61**
1.1	Soil management	84
1.2	Crop productivity	41
1.3	Soil organic matter	72
1.4	Soil reaction	100
1.5	Soil erosion	50
1.6	Soil compaction	20

2	**Materials use & environmental protection**	**74**
2.1	Material flows	60
2.2	Fertilization	58
2.3	Plant protection	100
2.4	Air pollution	70
2.5	Soil and water pollution	80

3	**Water use**	**76**
3.1	Water management	59
3.2	Water supply	90
3.3	Water use intensity	67
3.4	Irrigation	88

4	**Energy & Climate**	**78**
4.1	Energy management	46
4.2	Energy intensity of agricultural production	89
4.3	Greenhouse gas balance	100

5	**Biodiversity**	**65**
5.1	Biodiversity management	35
5.2	Ecological infrastructures	100
5.3	Distribution of ecological infrastructures	66
5.4	Intensity of agricultural production	77
5.5	Diversity of agricultural production	47

6	**Working conditions**	**86**
6.1	Personnel management	93
6.2	Working hours	91
6.3	Safety at work	100
6.4	Wage and income level	61

7	**Quality of life**	**97**
7.1	Occupation & Training	100
7.2	Financial situation	100
7.3	Social relations	100
7.4	Personal freedom & values	83
7.5	Health	100

8	**Economic viability**	**81**
8.1	Liquidity	40
8.2	Profitability	92
8.3	Stability	94
8.4	Indebtedness	99

9	**Farm management**	**78**
9.1	Business goals, strategy, implementation	94
9.2	Availability of information	70
9.3	Risk management	66
9.4	Resilient relationships	83

The average sustainability score is 77.

4 Crop production

Text	Unit	Barley	Oats	Potatoes, eating	Wheat	Rye	Clover grass in rotation,	Barley and pea mix	Græs med kløver/lucerne	Eft.afg	Permanent pasture	Green manure
Crop productivity												
Crop area	ha	187.4	61.0	58.0	21.8	95.2	111.4	49.4	3.1	260.9	1.4	1.4
Score yield level per crop	points	47	44	51	29	36	26	50	32		67	
Yield per hectare	t/ha	3.8	3.6	25.0	3.0	4.1	4.5	3.5	4.5		2.5	
Regional standard yield (for crop)	t/ha	5.0	5.0	34.0	5.0	6.0	9.0	9.0	7.0	0.0	2.5	0.0
High yield	t/ha	6.5	6.5	50.0	6.5	8.0	11.0	7.0	10.0		3.5	0.0
Low yield	t/ha	3.0	3.0	15.0	3.5	4.0	6.0	10.5	4.8		1.5	0.0
Quality trends during the past 5 years		Stagnati	Stagna	Stagnation	Stagnatio	Stagna	Stagnation	Stagnation	Stagnation	Not yet a	Stagnation	Not yet answered
Production quality criteria		Market R	Market	Market Requiremen	Market Re	Market	Market Requirements	Fodder Quality	Fodder Quality	Fodder Q	Market Requirements	Market Requirem
Fulfilment of quality requirements		Fulfilled	Fulfillec	Fulfilled	Fulfilled	Fulfille	Fulfilled	Fulfilled	Fulfilled	Not yet a	Fulfilled	Not yet answered
Soil organic matter												
Crop soil organic matter balance	points	75	55	64	100	89	33	100	100	79	100	64

* Græs med kløver/lucerne = grass with clover and alfalfa; Eft.afg. = green manure/catchcrop.

Comments

The farm has a high sustainability score (77). The farm has a large area of sandy soil, normally in need for irrigation. In dry summers, before emerging, the soil can cause dust storms. The soil doesn't have much natural fertility as it is cultivated heather, and requires almost all nutrients. Nutrients must be imported (in this case partially as organic manure and partially as conventional pig slurry), but the total available nitrogen is not high enough for reaching higher yields, even though the total amount of nitrogen and phosphorous surpass the crops uptake. The farm rotation is dedicated to potatoes, which need 6 years of space between, as here the best prices and income can be generated. There is a huge problem with early blight (*phytophthora infestans*) in potatoes, killing the green leaves prematurely, every year. However, each year is different, and combinations of wet weather, temperate temperatures, and infection hot spots all influence the incidence of yield decline. The farm machines are high capacity, and early springtime seeding, planting and cultivation is the key to higher yields. But due to workability constraints, often the ground is still wet, and vulnerable for compaction.

4.3 PLANT theme

1. Vegetable production in Spain

This farm is the same as farm 1 in the SOIL theme, but here, evaluated for the use of alternatives for copper. One of the indicators under theme 3; materials and environmental protection, has an indicator 3.5 soil and water pollution. The vegetable farm in Spain, does not use copper to protect the vegetables for fungi and insects. Instead, they use intercropping with herbs, diverting potential insect hazards and pests, herbs for possible synergetic effects, and plant and bacteria derived or natural repellents.

Details

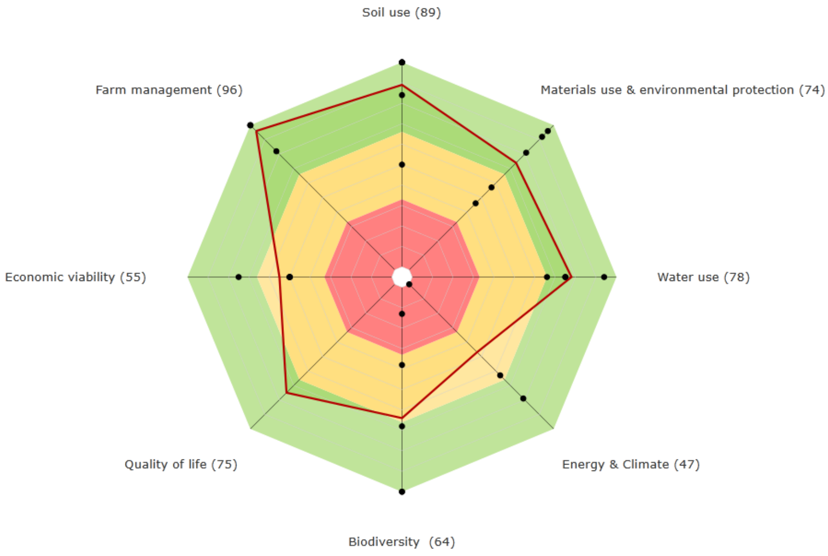
Text	Unit	Value	Value	Value	Value	Value
Soil and water pollution	points	92				
Nutrients	points		75			
Respectation of buffer strips (along surface waters) when spreading fertilizer				Yes		
Quality of slurry storage (worst installation)				No stora		
Quality of farm manure storage (worst installation)				Unsealec		
Quality of silage storage (worst installation)				No stora		
Sites with high nutrient entry or temporary manure storage on unpaved ground				No		
Problematic compounds in fertilizers	points		100			
Use of fertilizers containing heavy metals				No		
Use of residues (compost, etc.) without pollutant analyses				No		
Farm manure containing antibiotic residues				No		
Plant protection products	points		92			
Respectation of buffer strips (along surface waters) when spreading fertilizer				Yes		
Water erosion	points			100		
Water erosion risk	points				100	
Effective measures taken to reduce risk of erosion (in addition to soil cover)						Not yet a
Observed water erosion	points				100	
Frequency with which water erosion was observed in last 5 years						Never
Area affected by water erosion in last 5 years						Not yet a
Extent of soil loss through water erosion in last 5 years						Not yet a
Technical and practical measures to reduce spray drift	points			Yes		
Score toxicity and persistence of plant protection products	points			69		
Pollutants from wastes, residues and waste water	points		100			
No environmental risk by deposition or disposal of critical substances	points			Yes		
No environmental risk from waste water from the household and the farm	points			Yes		
Nutrient input into water caused by livestock	points			Never		
Further immissions, e.g. from highways, factories or ashes	points			No		

6 Plant protection products

Text	Unit	insecticide: Bacillus Thuringiensis:	insecticide: Spintor: Mikrobielle Produkte: Spinosad	insecticide: Neem oil	fungicide: Potassium bicarbonate:
Type of plant protection product		Insecticide	Insecticide	Insecticide	Fungicide
Active ingredient		Bacteria (Bakterien)	Mikrobielle Produkte: Spinosad	Neem oil / Neem-Öl / A	Potassium bicarbonate
Acute toxicity		Low toxicity	Low toxicity	Low toxicity	Low toxicity
Chronic toxicity		Low toxicity	Low toxicity	Low toxicity	Low toxicity
Toxicity for non-target and beneficial organisms		Low toxicity	High toxicity	Medium toxicity	Medium toxicity
Persistence		Less than 1 month	Less than 1 month	Between 1 and 3 montł	Less than 1 month
Treated area	ha	2.0	10.0	2.0	2.0
Number of treatments	number	1.0	3.0	2.0	1.0
Comment		-	-	between 1 -2 treatment	-

Because of the relatively low toxicity of the used repellents Neem oil and Potassium Bicarbonate, the score for the indicator 3.5 was still 92 out of 100 and the score for the parameter toxicity and plant persistence of plant protection products was 69 out of 100.

6. Olive production in Spain



4 Crop production

Text	Unit	Olive t
Crop productivity		
Crop area	ha	14.7
Score yield level per crop	points	100
Yield per hectare	t/ha	6.2
Regional standard yield (for crop)	t/ha	3.8
High yield	t/ha	4.6
Low yield	t/ha	3.0
Quality trends during the past 5 years		Stagnatio
Production quality criteria		Market R
Fulfilment of quality requirements		Fulfilled
Soil organic matter		
Crop soil organic matter balance	points	

*Crop soil organic matter balance also scores 100%, as the culture is totally perennial.

Results themes & indicators - short list

1	**Soil use**	**89**
1.1	Soil management	84
1.2	Crop productivity	100
1.3	Soil organic matter	100
1.4	Soil reaction	50
1.5	Soil erosion	100
1.6	Soil compaction	100

2	**Materials use & environmental protection**	**74**
2.1	Material flows	46
2.2	Fertilization	57
2.3	Plant protection	92
2.4	Air pollution	96
2.5	Soil and water pollution	81

3	**Water use**	**78**
3.1	Water management	66
3.2	Water supply	75
3.3	Water use intensity	75
3.4	Irrigation	94

4	**Energy & Climate**	**47**
4.1	Energy management	63
4.2	Energy intensity of agricultural production	0
4.3	Greenhouse gas balance	79

5	**Biodiversity**	**64**
5.1	Biodiversity management	38
5.2	Ecological infrastructures	100
5.3	Distribution of ecological infrastructures	100
5.4	Intensity of agricultural production	68
5.5	Diversity of agricultural production	13

6	**Quality of life**	**75**

7	**Economic viability**	**55**
7.1	Liquidity	50
7.2	Profitability	50
7.3	Stability	50
7.4	Indebtedness	75
7.5	Livelihood security	50

8	**Farm management**	**96**
8.1	Business goals, strategy, implementation	100
8.2	Availability of information	82
8.3	Risk management	100
8.4	Resilient relationships	100

The theme quality of life was registered as direct input, based on the surveyor's expert opinion. The Average sustainability score for this farm is 72.

Comments

The farm has an olive orchard, partly more than 100 years old. Copper is used against leaf spot fungi like *Ascomycota*, *Venturia oleaginea*, *Pseudocercospora cladosporioides*, causing defoliation and fruit set problems, as it is the only known remedy to the farmer. The farmer sprays 0-3 times, depending on the rain amount, with Bordeaux mix (20% of Copper). He also used mineral sulphur against insects supplemented with pheromones.

6 Plant protection products

Text	Unit	fungicide: Bordeaux mixture: Copper sulfate + Calcium hydroxide	fungicide: sulfur: Azufre mineral (sulfur)
Type of plant protection product		Fungicide	Fungicide
Active ingredient		Copper sulfate + Calcium hydroxide	Azufre mineral (sulfur)
Acute toxicity		Low toxicity	Medium toxicity
Chronic toxicity		Low toxicity	Low toxicity
Toxicity for non-target and beneficial organisms		Low toxicity	Medium toxicity
Persistence		More than 3 months	More than 3 months
Treated area	ha	14.0	14.0
Number of treatments	number	2.0	1.0
Comment		application ranges from 0-3 times a year, depending on the amount o	-

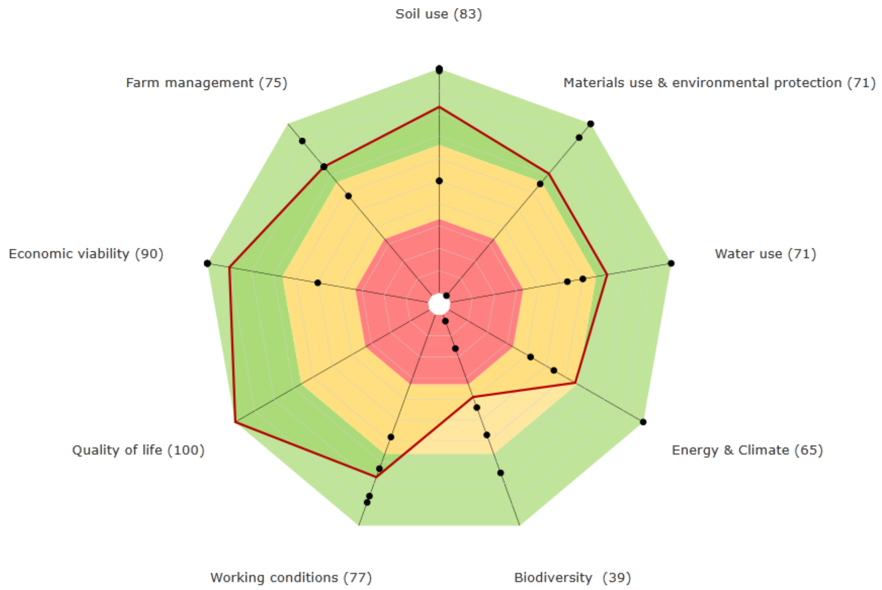
This, of course, gives a low score on the parameter for toxicity and persistence, which is part of the soil and water pollution score. There are however many other parameters gathered in this indicator score (see table below).

Table 3 Details on calculation soil and water pollution score.

Soil and water pollution	points	81					
Nutrients	points		100				
Respectation of buffer strips (along surface waters) when spreading fertilizer				100	Yes		
Quality of slurry storage (worst installation)				100	No storage on farm		
Quality of farm manure storage (worst installation)				100	No storage on farm		
Quality of silage storage (worst installation)				100	No storage on farm		
Sites with high nutrient entry or temporary manure storage on unpaved ground				100	No		
Problematic compounds in fertilizers	points		67				
Use of fertilizers containing heavy metals				0	Yes, some in manure		
Use of residues (compost, etc.) without pollutant analyses				100	No		
Farm manure containing antibiotic residues				100	No		
Plant protection products	points		81				
Respectation of buffer strips (along surface waters) when spreading fertilizer				100	Yes		
Water erosion	points			100			
Water erosion risk	points				100		
Effective measures taken to reduce risk of erosion (in addition to soil cover)							
Observed water erosion	points				100		
Frequency with which water erosion was observed in last 5 years						100	Never
Area affected by water erosion in last 5 years							
Extent of soil loss through water erosion in last 5 years							
Technical and practical measures to reduce spray drift	points			100	Yes		
Score toxicity and persistence of plant protection products	points			25			
Pollutants from wastes, residues and waste water	points		75				
No environmental risk by deposition or disposal of critical substances	points			0	No		
No environmental risk from waste water from the household and the farm	points			100	Yes		
Nutrient input into water caused by livestock	points			100	Never		
Further immissions, e.g. from highways, factories or ashes	points			100	No		

The farm is managed without very much planning and evaluation of executed activities, so some indicators might be improved if counselling and optimisation of on energy, biodiversity, or fertiliser amount was used. There is an import of composted animal manure, but the total amount of nitrogen exceeds the nitrogen harvested and exported from the farm, which causes the lower scores for fertilisation and material flows.

7. Vineyard farm in Germany



Results themes & indicators - short list

1	Soil use	83
1.1	Soil management	50
1.2	Crop productivity	100
1.3	Soil organic matter	99
1.4	Soil reaction	50
1.5	Soil erosion	100
1.6	Soil compaction	100

2	Materials use & environmental protection	71
2.1	Material flows	100
2.2	Fertilization	0
2.3	Plant protection	100
2.4	Air pollution	92
2.5	Soil and water pollution	65

3	Water use	71
3.1	Water management	60
3.2	Water supply	100
3.3	Water use intensity	53

4	Energy & Climate	65
4.1	Energy management	54
4.2	Energy intensity of agricultural production	42
4.3	Greenhouse gas balance	100

5	Biodiversity	39
5.1	Biodiversity management	57
5.2	Ecological infrastructures	44
5.3	Distribution of ecological infrastructures	3
5.4	Intensity of agricultural production	75
5.5	Diversity of agricultural production	16

6	Working conditions	77
6.1	Personnel management	86
6.2	Working hours	73
6.3	Safety at work	89
6.4	Wage and income level	58

7	Quality of life	100

8	Economic viability	90
8.1	Liquidity	100
8.2	Profitability	100
8.3	Stability	50
8.4	Indebtedness	100
8.5	Livelihood security	100

9	Farm management	75
9.1	Business goals, strategy, implementation	90
9.2	Availability of information	58
9.3	Risk management	75
9.4	Resilient relationships	75

The theme quality of life was inserted as a direct score based on expert opinion. The average sustainability score is 75

4 Crop production

Text	Unit	Wine (Vitis) - Crop
Crop productivity		
Crop area	ha	12.7
Score yield level per crop	points	100
Yield per hectare	t/ha	8.8
Regional standard yield (for crop)	t/ha	5.5
High yield	t/ha	7.5
Low yield	t/ha	3.5
Quality trends during the past 5 years		Slight deterioration
Production quality criteria		Geschmack, Qualitätspyramide (Gu
Fulfilment of quality requirements		slightly exceeded
Soil organic matter		
Crop soil organic matter balance	points	

6 Plant protection products

Text	Unit	fungicide: Phytocuivre (35%):	fungicide: Phytocuivre (35%):	fungicide: Netzschwefel Stulln:	fungicide: Netzschwefel Stulln:
Type of plant protection product		Fungicide	Fungicide	Fungicide	Fungicide
Active ingredient		Kupfer / Copper / Cobre (35%)	Kupfer / Copper / Cobre (35%)	Schwefel / Sulfur / Azufre	Schwefel / Sulfur / Azufre
Acute toxicity		High toxicity	High toxicity	Low toxicity	Low toxicity
Chronic toxicity		Medium toxicity	Medium toxicity	Low toxicity	Low toxicity
Toxicity for non-target and beneficial organisms		High toxicity	High toxicity	Low toxicity	Low toxicity
Persistence		More than 3 months	More than 3 months	Less than 1 month	Less than 1 month
Treated area	ha	9.8	2.9	9.8	2.9
Number of treatments	number	12.0	2.0	12.0	2.0
Comment		Klassische Rebsorten	Piwis	Klassische Rebsorten	Piwis

Comments

Overall, the sustainability performance of the farm is high (75), and there are only few scores directly red (critical). One of them is the fertilisation, as there is none. The farm is managed using biodynamical principles, and no fertiliser import is used. Nevertheless, the yields are high. The farm uses copper (Phytocuivre) and sulphur (Netzschwefel), and experiments with using less on 2.9 ha, where more resistant cultivars are planted. In a vineyard, however, it is not easy to replace one variety or cultivar with another, as the wines that are made, also need to be of constant quality. The total score on soil and water pollution is affected by this use.

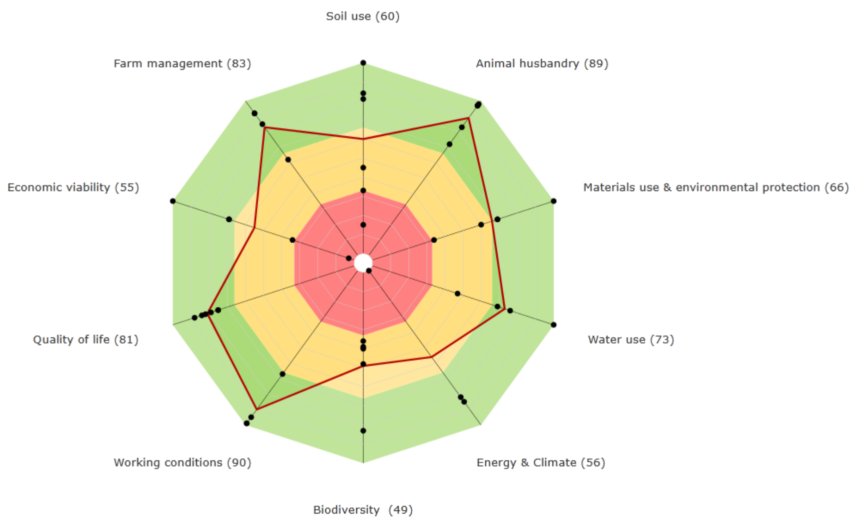
In addition, the biodiversity score is lower, the perennial crop doesn't allow much diversity of agricultural production.

5. Arable farm in Denmark

Danish potato growers have 'survived' the ban of copper in Denmark and organic potatoes are still widely grown. Their yields are about half of the conventional, but their soil and water pollution by using copper and synthetic fungicides (conventional potato growers use both), but also herbicides, is reduced to zero. This case farm proves, that even though copper is not used and the farm lies in a wet climate (for Danish conditions), potato is still the main cash crop, delivering the farmer the major fraction of his earnings. The farm is economic sustainable, because Danish consumers are willing to pay extra, for this product.

4.4 LIVESTOCK theme

9. Pig production in Denmark



Results themes & indicators - short list

1	Soil use	60
1.1	Soil management	84
1.2	Crop productivity	45
1.3	Soil organic matter	81
1.4	Soil reaction	100
1.5	Soil erosion	33
1.6	Soil compaction	15

2	Animal husbandry	89
2.1	Herd management	83
2.2	Livestock productivity	98
2.3	Opportunity for species-appropriate behavior	97
2.4	Living conditions	97
2.5	Animal health	72

3	Materials use & environmental protection	66
3.1	Material flows	60
3.2	Fertilization	34
3.3	Plant protection	100
3.4	Air pollution	69
3.5	Soil and water pollution	69

4	Water use	73
4.1	Water management	47
4.2	Water supply	100
4.3	Water use intensity	76
4.4	Irrigation	69

5	Energy & Climate	56
5.1	Energy management	85
5.2	Energy intensity of agricultural production	82
5.3	Greenhouse gas balance	0

6	Biodiversity	49
6.1	Biodiversity management	83
6.2	Ecological infrastructures	36
6.3	Distribution of ecological infrastructures	40
6.4	Intensity of agricultural production	48
6.5	Diversity of agricultural production	39

7	Working conditions	90
7.1	Personnel management	99
7.2	Working hours	67
7.3	Safety at work	99
7.4	Wage and income level	95

8	Quality of life	81
8.1	Occupation & Training	79
8.2	Financial situation	75
8.3	Social relations	88
8.4	Personal freedom & values	75
8.5	Health	82
8.6	Other areas of life	84

9	Economic viability	55
9.1	Liquidity	3
9.2	Profitability	69
9.3	Stability	69
9.4	Indebtedness	34
9.5	Livelihood security	100

10	Farm management	83
10.1	Business goals, strategy, implementation	85
10.2	Availability of information	92
10.3	Risk management	62
10.4	Resilient relationships	92

The average sustainability score is 70.

4 Crop production

Text	Unit	Græs til udegrise	Oats	Clover grass	Clover grass	Rye	Barley	Lavskov	Peas	Miljøgræs	Willow	Poplar	Permanent grassland	Natural meadow
Crop productivity														
Crop area	ha	0.3	28.9	15.4	68.4	24.6	90.6	2.3	3.9	5.5	1.2	9.1	0.8	5.4
Score yield level per crop	points	100	59	36	36	37	44	0	34		67	67	18	89
Yield per hectare	t/ha	3.0	4.5	6.2	6.2	4.2	3.6	0.0	3.6		56.0	56.0	3.1	3.0
Regional standard yield (for crop)	t/ha	1.1	5.0	9.0	9.0	6.0	5.0	28.0	4.5	0.0	56.0	56.0	8.5	2.0
High yield	t/ha	1.5	6.5	11.0	11.0	8.0	6.5	40.0	5.4	0.0	70.0	70.0	10.2	3.5
Low yield	t/ha	0.7	3.0	6.0	6.0	4.0	3.0	10.0	3.6	0.0	40.0	40.0	6.0	1.0
Quality trends during the past 5 years		Stagnation	Slight ir	Stagnation	Stagnation	Stagna	Stagnati	Stagnation	Stagnat	Not yet answ	Stagnatic	Stagnatio	Stagnation	Stagnation
Production quality criteria		Fodder Quality	Market	Market Requirer	Market Requirer	Market	Market R	Market requ	Market		Market re	Market re	Market Requirements	Market Requiremer
Fulfilment of quality requirements		Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfillec	Fulfilled	Fulfilled	Fulfilled	Not yet answ	Fulfilled	Fulfilled	Fulfilled	Fulfilled
Soil organic matter														
Crop soil organic matter balance	points	100	60	90	90	92	78	100	58	47	100	100	100	100

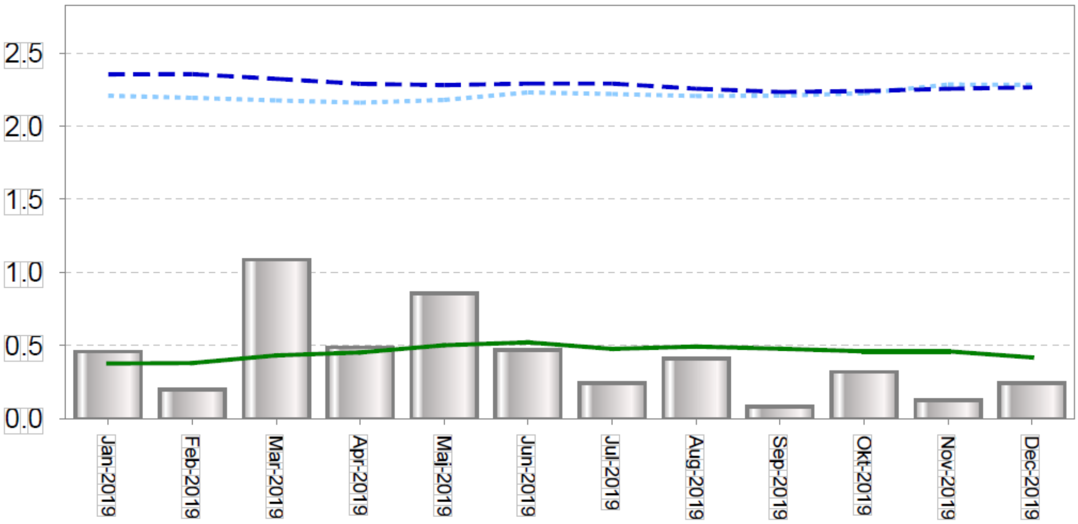
5 Livestock production

Text	Unit	Organic sow with piglet	Organic piglet 7.1-31 kg	Organic slaughter pig 30-110 kg	Laying hen,
Number of units (corrected for animals present/absent)	number	623.0	14,360.0	12,447.0	82.5
Unit		places	animals/year	animals/year	100 pl.
Regional LAU factor		0.2	0.0	0.0	0.6
Number of Large Animal Units (LAU) (corrected for animals present/absent)	number	143.3	71.8	323.6	48.7
Livestock productivity					
Score productivity	points	100	85	100	100
Farm productivity		26.1	547.0	964.0	36,500.0
Standard regional performance level		21.5	505.0	790.0	30,750.0
Unit		offspring	g DGR	g DGR	eggs
Productivity by animal category		Significant improvement	Stagnation	Slight improvement	Stagnation
Product quality (quality standard)		Significantly above region	At the same level	At the same level	Slightly above
Opportunity for species-appropriate behavior					
Score conduciveness to animal welfare of animal husbandry	points	100	100	86	100
Living conditions					
Score animal living conditions	points	100	100	93	93
Cleanliness and number of waterers		Quantity and purity of the	Quantity and purity of the v	Quantity and purity of the water is	Quantity and p
Protection from heat and/or cold		Shade/wallow sufficient, r	Shade/wallow sufficient, no	Shade/wallow sufficient, no panting	Shade/wallow
Light		Not yet answered	Not yet answered	Animals are pastured during the da	Window area i
Air quality		Not yet answered	Not yet answered	Light ammonia load (respiratory tra	During the day
Noise protection		Not yet answered	Not yet answered	No mechanical noise (ventilation, m	No mechanical
Animal health					
Score animal treatment products used	points	100	100	100	100
Score animal mortality	points	100	7	47	58
Score mutilation	points	50	100	100	100

Comments

The farm scores quite high on sustainability performance (70), giving only few indicator scores in the red (critical). The farm is situated on sandy soil, which causes dust storms (erosion) occasionally, even though there has been planted a considerable amount of windbreaker trees. The greenhouse gas balance is in the red, which is caused by the large number of animals causing methane emissions from manure storage, as well as high nitrogen applications. On the economic side (the farmer was willing to share this), liquidity is low and indebtedness rather high (which causes a low score). It should be said though, that for Danish circumstances the indebtedness is low in comparison, in general the costs for loans on real estate are low, so the farms can handle this. Biodiversity didn't score high, even though there are considerable amounts of small nature biotopes, trees, and perennial grass meadows. The percentage of selected area with ecological quality (6%) was still well under the FAO standard of 17%. Material flows and fertiliser score lower as there are high levels of nitrogen and phosphorous available from the large livestock herd. The livestock production scores well, and the antibiotic usage is very low.

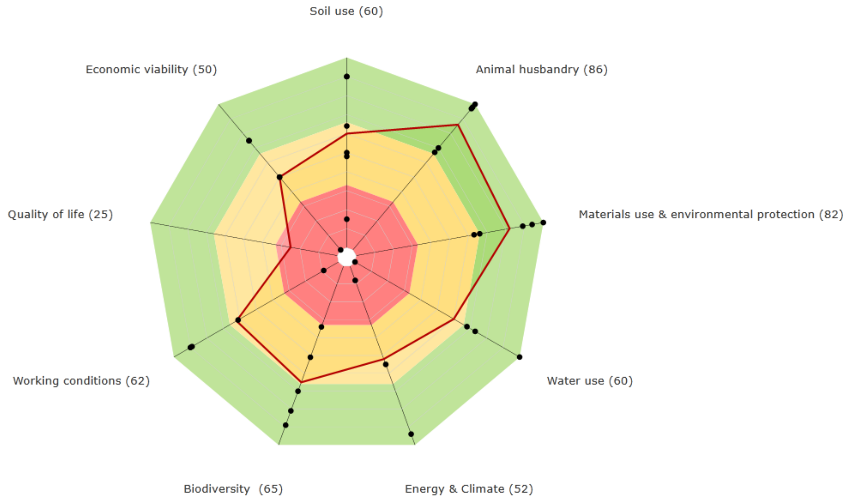
In the figure below, the monthly weighted animal daily dose is shown, and compared with the national and regional level for the same group of animals. The farms usage of antibiotics; tetracyclines, simple penicillin's, sulfamethoxazole, and trimethoprim is more than 75% lower.



* Blue and light blue dotted line = regional and national level for all pig farms (conventional and organic) in Denmark
* Green line = case farm level.

Figure: Example of weighted Animal Daily Dose (ADD) of antibiotics used on case farm in 2019 for sows, weaning piglets, gilts, and hogs compared to regional and national levels for all farms in Denmark.

10. Dairy production in Germany



Results themes & indicators - short list

1	Soil use	60
1.1	Soil management	90
1.2	Crop productivity	64
1.3	Soil organic matter	48
1.4	Soil reaction	90
1.5	Soil erosion	50
1.6	Soil compaction	15

2	Animal husbandry	86
2.1	Herd management	100
2.2	Livestock productivity	67
2.3	Opportunity for species-appropriate behavior	97
2.4	Living conditions	98
2.5	Animal health	70

3	Materials use & environmental protection	82
3.1	Material flows	94
3.2	Fertilization	66
3.3	Plant protection	100
3.4	Air pollution	63
3.5	Soil and water pollution	89

4	Water use	60
4.1	Water management	73
4.2	Water supply	100
4.3	Water use intensity	0
4.4	Irrigation	68

5	Energy & Climate	52
5.1	Energy management	94
5.2	Energy intensity of agricultural production	8
5.3	Greenhouse gas balance	55

6	Biodiversity	65
6.1	Biodiversity management	81
6.2	Ecological infrastructures	34
6.3	Distribution of ecological infrastructures	70
6.4	Intensity of agricultural production	89
6.5	Diversity of agricultural production	51

7	Working conditions	62
7.1	Personnel management	90
7.2	Working hours	61
7.3	Safety at work	89
7.4	Wage and income level	9

8	Quality of life	25

9	Economic viability	50
9.1	Liquidity	75
9.2	Profitability	0
9.3	Stability	75
9.4	Indebtedness	50
9.5	Livelihood security	50

Average sustainability score of the farm is 60. The quality of life theme was scored by expert opinion.

4 Crop production

Text	Unit	Beetroot	Beans	Potatoes,	Corn silage	Rye ı	Wheat ı	Wheat	Barley	Green manure	Pasture in rotation	Pasture in rotation
Crop productivity												
Crop area	ha	6.6	6.6	7.3	7.4	10.0	8.5	9.0	8.9	4.0	5.0	5.0
Score yield level per crop	points	10	38	85	100	88	45	29	61		100	100
Yield per hectare	t/ha	4.5	11.0	36.0	34.0	3.5	3.5	3.5	5.3		5.0	5.0
Regional standard yield (for crop)	t/ha	26.0	15.0	30.0	23.0	2.7	5.5	5.0	5.9	0.0	4.0	3.0
High yield	t/ha	35.0	19.5	41.0	27.0	4.0	7.9	5.9	6.5	0.0	4.6	3.5
Low yield	t/ha	15.0	10.5	19.0	14.0	1.8	2.5	4.1	2.5	0.0	3.4	2.6
Quality trends during the past 5 years		Stagnation	Stagnati	Stagnation	Stagnation	Stagna	Stagnatio	Stagnatio	Stagnati	Not yet answered	Stagnation	Stagnation
Production quality criteria		Market Requ	Market R	Market Req	Fodder	Market	Market	Market Re	Market		feed efficiency	feed efficiency
Fulfilment of quality requirements		Fulfilled	Fulfilled	Fulfilled	Fulfilled	Fulfillec	Fulfilled	Fulfilled	Fulfilled	Not yet answered	Fulfilled	Fulfilled
Soil organic matter												
Crop soil organic matter balance	points	33	33	0	0	100	57	57	57	75	53	53

* Beet root should be red beet, and in red beet the yield is lower.

** The 9 ha of wheat, is bread-quality type, with lower yields compared to feed-wheat for a dairy concentrate ration

5 Livestock production

Text	Unit	Dairy cows,	Heifers, 1-2 years	Heifers more then 2 years ı	Bulls	Bulls 1-2 years	Fattening pigs	Heifers (female)	Heifers for breeding < 1 y
Number of units (corrected for animals present/absent)	number	90.0	25.0	10.0	3.0	3.0	40.0	5.0	25.0
Unit		animals	animals	animals	animals	animals	places	animals	animals
Regional LAU factor		1.0	0.4	0.6	0.6	0.4	0.2	0.3	0.3
Number of Large Animal Units (LAU) (corrected for animals present/absent)	number	90.0	10.0	6.0	1.8	1.2	6.8	1.3	6.3
Livestock productivity									
Score productivity	points	67	67	67			67	67	67
Farm productivity		7,000.0	700.0	1.0			750.0	800.0	800.0
Standard regional performance level		7,000.0	700.0	1.0	0.0	0.0	750.0	800.0	800.0
Unit		l milk	g DGR	offspring	no prod	no prod.	g DGR	g DGR	g DGR
Productivity by animal category		Stagnation	Stagnation	Stagnation	Not yet	Not yet answered	Stagnation	Stagnation	Stagnation
Product quality (quality standard)		Slightly above	Slightly above region	Slightly above regional averaı	Not yet	Not yet answered	Slightly above re	Slightly above regic	Slightly above regional avera
Opportunity for species-appropriate behavior									
Score conduciveness to animal welfare of animal husbandry	points	92	100	100	100	100	86	100	100
Living conditions									
Score animal living conditions	points	100	100	100	100	100	86	100	100
Cleanliness and number of waterers		Quantity and p	Quantity and purity c	Quantity and purity of the wa	Quantity	Quantity and purit	Quantity and pur	Quantity and purity	Quantity and purity of the wa
Protection from heat and/or cold		Shade/wallow	Shade/wallow sufficie	Shade/wallow sufficient, no p	Shade/\	Shade/wallow suff	Shade/wallow su	Shade/wallow suffic	Shade/wallow sufficient, no ı
Light		Not yet answei	Not yet answered	Not yet answered	Not yet	Not yet answered	Window area insı	Not yet answered	Not yet answered
Air quality		Not yet answei	Not yet answered	Not yet answered	Not yet	Not yet answered	Light ammonia lc	Not yet answered	Not yet answered
Noise protection		Not yet answei	Not yet answered	Not yet answered	Not yet	Not yet answered	No mechanical nı	Not yet answered	Not yet answered
Animal health									
Score animal treatment products used	points	100	100	100	100	100	100	100	100
Score animal mortality	points	81	33	100	100	100	58	100	33
Score mutilation	points	100	100	100	100	100	100	100	100

* for the bulls, reference values were missing, so no score for productivity

Comments

The sustainability performance of this farm could be improved if the quality of life theme scored better, the farm had problems with the workload and sufficient skilled labour. In addition, the indicator "profitability" scored low in the economy theme. For the soil use, especially the soil compaction was a problem. Animal welfare scores are high, suggesting the animals are not stressed. The production with 7000 litres per cow is not geared towards extreme high yields. In addition, more pasturing is known to improve animal welfare. Healthy animals and good husbandry skills with attention to detail also reduce the necessity of any antibiotics.

5. Discussion

The RISE sustainability evaluation method is designed to give the farm, the farm workers and co-workers, customised documentation and incentives, to improve certain issues on sustainability. Issues not performing well are identified in the process. The method is not designed for and not capable of benchmarking farms against each other. This is because each farm is different, with different background, management, market channels, regional nature, climate etc. Therefore, there is no overall table shown for all case farms with all scores. Instead, all case farms are presented individually. The RISE tool, however, does show different strengths of farms, making it a useful tool to compare strengths and weaknesses, and to improve management by highlighting areas to work on. The RISE tool has proven its value in local advisory services and induces a critical evaluation of the farms' scores. In practice, when a report is presented to the farmer, the advisor and farm manager with or without their co-workers or employees, discuss the results. Sometimes a critical score has a plausible explanation, sometimes not. Even though performance is low on some indicators, the farm management might still decide not to take action, as other issues are of more concern, or because improvement would be disproportionately costly. Interesting observations from the case farm evaluations are discussed below under the following headlines:

5.1 Biodiversity

When observing the case farms' sustainability performances, it is striking that biodiversity is not scoring higher and generally could be improved further. This has also been observed as a general problem for most farms that have been analysed in other studies (Oudshoorn, 2021). The percentage of area with ecological quality has influence on the total score for the theme and is rated quite differently from farm to farm. The aim is relatively high - 17% of the farm areal should be of ecological quality or protected (Target 11 from UN environmental program, Aichi Biodiversity Targets 2020). There is no agreed definition of how to quantify this, so the surveyors' and farmers' opinion weighs high. The theme biodiversity is scored by making a simple average of the indictors 6.1) biodiversity management, 6.2) ecological infrastructures, 6.3) distribution of ecological infrastructures, 6.4) intensity of agricultural production, and 6.5) diversity of agricultural production.

One explanation could be that organic farms are already high in biodiversity and the observation indicates a saturation effect, however it could also be that further biodiversity enhancing features like agroforestry in hedges and trees inside the fields or other features like ponds have not been fully explored by most organic farms. Whilst organic regulation acknowledges biodiversity as important in the general text, is not specific to 'enforce' biodiversity increases on farm. For example, regulation does not say that all fields require hedges or that every organic farm needs at least some agroforestry features. If this were added to EU organic farming regulation in the future the biodiversity saturation issue might change. Organic certification bodies address the lack of focus on biodiversity and Bioland in Germany says it is the first certification body bringing in specific biodiversity regulations (chapter 2.5) for any farm certified organic with the Bioland logo (Bioland 2019):

*"**2.5.3 Basics of the System of Points:** The biodiversity point system is based on a catalogue of measures for the entire farm, including the farm itself and the various types of land use (e.g. arable land, grassland, fruit growing, horticultural crops). The points are predominantly awarded relative to the total farm area or to the area of the usage type in order to fairly evaluate operations of different sizes. Operations with several types of use can collect their points freely within the types and have no minimum requirements for each type of use. However, the points of a land use type are always calculated relative to the total operating area according to the BIOLAND guidelines."*

The EU is contributing to enhance biodiversity in agriculture in general, through their Eco-schemes (eco-schemes, 2021) and the taxonomy schemes (used for documenting sustainable investments addresses the issue (EU taxonomy, 2021).

Addressing the WP SOIL, the intensity of agricultural production is among other parameters, measured according to the nitrogen balance on the cultivated land. High excesses of nitrogen and phosphorous are considered to decrease biodiversity. Also, the use of pesticides (copper and sulphur) are aspects which are included in this score. As can be seen in the table below, the score for agricultural intensity is quite high (meaning low nutrient surplus), usually seen in organic production. Enhancing biodiversity is a global goal towards which organic farming can contribute and a reason why the EU aims for 25% of organic farm area by 2030.

Farm number.	1	2	3	4	5	7	8	9	10
Biodiversity score	68	73	34	48	65	64	39	49	65
Diversity of agricultural production score	40	20	40	65	47	13	16	39	51
Area with ecological quality (%)	98	100	3	5	24	63	7.5	6.1	5.8
Intensity of agricultural production	51	91	89	71	77	68	75	48	89

Biodiversity scores, diversity scores, and percentage of area with ecological quality on case farms

5.2 Soil, yield, nutrients

Conventional manure is often used in areas or countries with no or few organic livestock farms. In addition, organic livestock farms are often not inclined to export their manure, as they prefer to grow as much feed at home as possible. Buying organic feed stuffs is expensive and often not appreciated by the local consumers. In deliverable 'D2.2 Survey on public opinion' (Vittersø et al., 2019), the authors did not ask the consumers in Europe of their opinion on the use of conventional livestock manure in organic farming. They did, however, ask for consumers' opinion of phasing out all livestock products (vegan production). This was not regarded as important, but referring to the EU legislation on the use of animal products from factory farming (Annexes of Regulation (EU) 2021/1165), and the present discussion on definition of factory farming, it is regarded as being an important contentious input. This is also cited by an expert group in the sister project RELACS (Oelofse et al., 2020):

"Experts expressed differentiated views of reliance, often contingent on location and systems types. The use of contentious inputs is predicated by a number of factors influencing the sourcing and usage of conventional manures: limited availability, the high price of application, and farmers' principles. Furthermore, reliance of arable farms on conventional sources can be high in some countries as it is difficult to source organic manure. Reliance in horticulture is quite high, due to the nutrient requirements in intensive systems, but sometimes price and availability limit use. A general view was that the main contentious input in the organic sector is by far conventional manure, particularly pig and cattle slurry, as well as chicken manure pellets. The use of commercial chicken manure pellets is gaining popularity in some countries, due to conveniences of use, and the source of such inputs is not always clear. Finally, a strong view particularly from those involved in regulation was a clear need to more explicitly describe what 'industrial farming' refers to in the legislation. It is evident that there are different interpretations of what industrial farming is"

Two aspects are being discussed: 1) The technological side, the possible contamination with antibiotics or antibiotic resistant bacteria, and 2) The ethical side, the justification of maintaining livestock farming as an industrial production system. A consequence of phasing out conventional manure, slurry or bone/feather meal could for arable and vegetable farmers in many areas mean a severe yield decline, if alternative nutrient sources are not used. Nitrogen can be fixed by legumes (Biological Nitrogen Fixation = BNF) in the rotation, but this needs space (once every five years maximum, or undersowing for shorter periods more often), and amounts needed for demanding vegetables as cabbage, lettuce, or crops like oil seed rape or bread-wheat can be hard to match, especially late season nitrogen demand to reach quality parameters. Some minerals can be added by stone meal or other waste products (recycled household waste), but these can be hard to obtain or can be more expensive.

As the results of the sustainability reports of the case farms show, the plant productivity indicators for the farms in the SOIL theme are rather low. On the CSA farms 3 and 4 (community supported agriculture), this was not a problem, as their income is not directly dependant on the sold products, they prioritise 'all year round yield' over 'peak yield' in the prime of a crop and they have much lower food waste so highest yields are not required to provide food for all community members (the economics of sufficiency). Regarding yields of production (indicator 1.2; plant productivity and 2.2; livestock productivity): reference values are used for evaluation. For plant productivity the reference yields may not always be a good benchmark. One could argue that food waste is lower or nearly zero as everything harvested is added in the shares of the CSA farms. In other words, higher yields are not required as the usual 30-40% food waste on-farm, in processing, distribution, retail is not happening. Even at the end, consumer level as food is community owned lower food waste can occur. A sustainability tool for comparing CSAs with other organic farms with a longer route from farm to fork would have to assess the food supply chain sustainability issues too to compare the approaches holistically.

For other farms, not community supported, the premium price has to compensate for the lower yield. It should be said that the reference values for yield are general figures, not specifically for organic. Usually organic yields are 20% lower on average than conventional, however it can range from 0-40% lower and is largely depending on crop (e.g. de Ponti et al. 2012).

Cereal growing however, becomes a problem when having less available nutrients in spring as yield greatly depends on a spring growth and sprouting. Many other crops can better produce on soil fertility, slowly unlocking nutrients by mineralisation of the organic matter content of the soil.

When fertilising with plant material or compost, almost no ammonium nitrogen is available in early springtime when soil temperatures are low. Therefore, growing cereals without animal manure inputs could be seen as one of the ultimate challenges of organic production. Without green waste compost, biogas digestate and fertiliser recycled from human waste streams it will not be possible at achieve high and sustained yields over a long term. Growing crops as fertilisers, like beans for intensive organic horticulture in greenhouses and using agroforestry to increase nutrient reach in deeper soil levels with leaf litter and ramial wood are further options to explore also in arable farming. All these are unexplored issues requiring further innovation actions.

Replacing conventional pig slurry with slurry from organic pig farming would provide the required nutrient demand. However, organic pig manure might not be as easily available. Even if it is available, it might be more expensive at source and come with extra charges for transport. Therefore, as long as conventional pig slurry is permitted within organic certification, there is no economic reason for the farmer to opt for a more expensive input. If conventional manure is phased-out, an alternative would be organic laying hen or meat chicken manure, if available. Increasing the organic land share to 25% will help with availability of organic animal manure sources, while digestates and other bio-economy fertilisers, including struvite from human manure are also an option to provide the nutrients required for the yield levels achieved. Lower yields and less food waste would be an alternative strategy to deliver sufficient food and fibre in organic farming. Sufficient yield levels (together with lower food waste) are however not economically rewarded at present.

5.3 Vegan Organic

Vegan organic cereal production has clearly room for yield improvements, however from a a thermodynamics/sustainability perspective as cereals are not fed to animals with a 3:1 conversion loss of cereal to animal protein, even with the low levels of cereal yields achieved, theoretically more people could be fed from the farmland with a vegan diet compared to one including animal products. To compensate for current yield losses, the vegan organic price premium on cereal would however be double that of the organic cereal price premium. For committed vegans this could be possible as there might be savings for not buying meat protein (although this might not be the case for milk alternatives). Also, the costs of grain in e.g. a loaf of bread, compared to other costs (transport, manufacture, labour, retail) are usually below 10%, so an increase in grain price would not result in an equally high increase of bread price.

5.4 Plastic

None of the case farms had problems with phasing out fossil plastic for weed control. They used mechanical hoes or harrows, hand weeding, and systemic management like rotation and crop order (winter/spring cereals, row crops/broad sown crops). For other farms, bio-based non-fossil fuel derived plastic alternative can be developed and research into this has been started within the Organic-PLUS project. Further innovation action is required to bring more alternative products to market.

5.5 Plants, fungicides, insecticides, repellents

Often the phasing out of copper and sulphur (and to a lesser degree mineral oils) cannot be done by replacing the active substance with another that is less contentious.

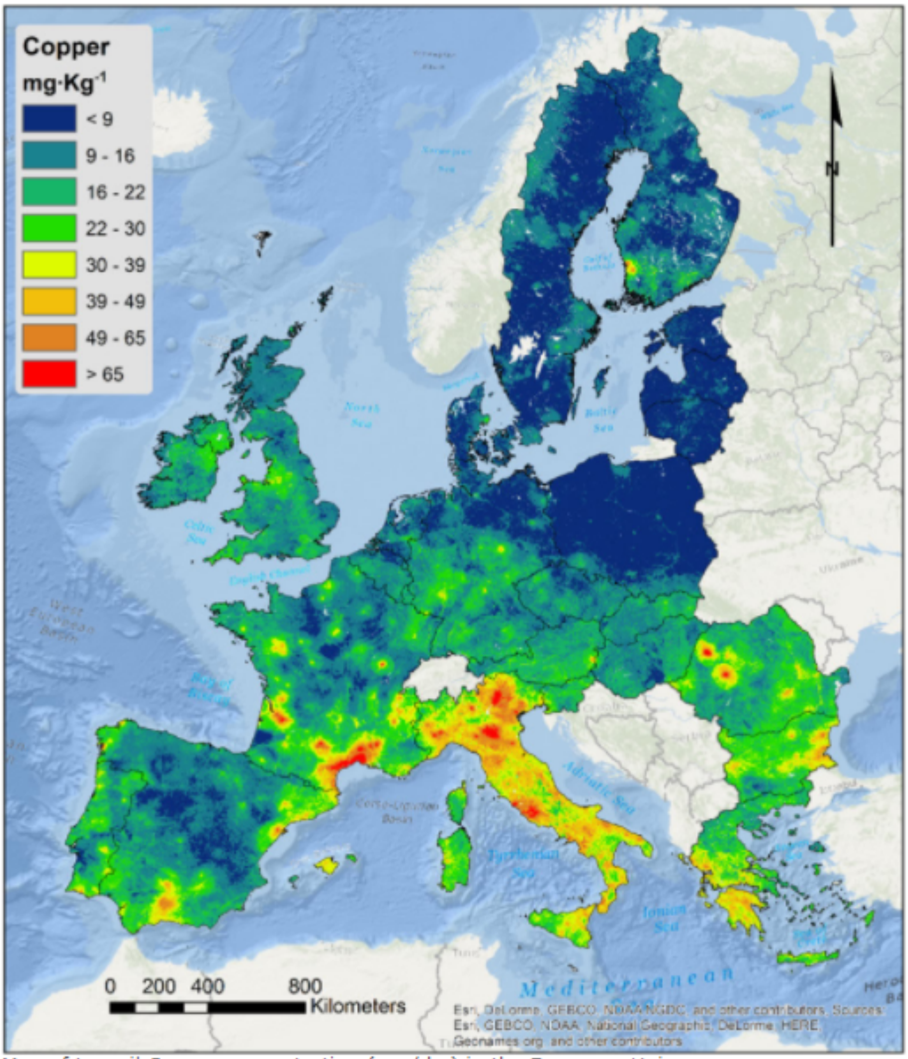
A combination of management measures, choice of varieties or cultivars, technology and robustness for yield depression is necessary. The problem with copper is its persistence in soil, slowly making the ground toxic for soil fauna and sometimes even for animals grazing (see map figure below for situation in Europe). In addition, copper is not very specific in its target, suppressing not only fungi, but also beneficial organisms that would otherwise give biological control (ladybug larvae, predatory beetles). The same problem occurs with sulphur, although the soil contamination is not the problem, as sulphur is a nutrient for plants and water solvable (copper is strictly speaking also a micro-nutrient, so the aim is not for it to be eliminated completely, only minimising in the affected soils to non-polluting, natural levels).

For the vegetable case farms, there seems to be satisfactory measures available, like herb intercropping, pheromones, biological insecticides and repellents. For the wine, olive and potato growing, however, copper is still needed. Here the case farms, besides from Denmark where copper is banned, find other ways of trying to use less copper. In the wine groves of e.g. Germany, fungus resistant grapes (FRG) are starting to be grown, despite the obstacle of trying to change consumer habits. In this registration the amount of copper and the spraying frequency could be reduced from 12 to 2 times per growth season (dependent on year). In the olive tree orchards of the Mediterranean, fertilisation is used to try and release the trees from stress, which cause susceptibility to fungi. Both the grape and the olive producers were satisfied with the results to minimise copper and plan to continue.

This shows extensively managed orchards can reach high sustainability scores, however copper and potentially to high fertiliser inputs and fertiliser imbalances in compost can be the remaining issue.

Alternatives to copper should have a similar efficacy, as the farm cannot become even more extensive. Decision support tools, when and how much to spray based on weather data could help to greatly reduce inputs. Also, Bordeaux mix is an ‘old traditional’ copper treatment; modern copper formulations with lower copper 4 kg/ha or even 2 kg/ha could have the same or better effects, which could be even better in combination with other novel bio-fungicide treatments. For this farm, as spraying is weather dependent, having a 7-year ‘copper account’ so zero copper in one good year could be followed by double the legal copper amount in the next (if needed due to weather) which would help with flexible management.

The Danish potato grower (farm 5) was disappointed with the progress made in finding resistant varieties, as he didn't believe in control by spraying even organically certified bio-based pesticides. His theory was that prevention is the organic way. Prevention by minimising the initial infection by really cleaning up after harvest, so no weed potatoes emerge in the spring. Prevention by planting seedlings early in the spring, selecting healthy seed potatoes, in healthy soils (good rotation). His yield is half of the conventional, when leaves wither because of blight. Experts say (see workshop report in appendix), that his yields could increase by as much as 50% when resistant varieties are produced, and some further organic fungicides (being developed on non-synthetic basis) would be allowed.



Map of topsoil Copper concentration (mg/ kg) in the European Union

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Vineyards (average 50 mg/kg), olive groves (average 33 mg/kg) and fruit orchards (average 27 mg/kg) have the highest copper concentration levels of all land use categories compared to average of all cultivated soils in EU (17 mg/kg) (LUCAS survey). There have been vineyards and olive groves found with copper concentrations of >400 mg/kg of soil. Perennial crops, therefore remain the main issue, while copper accumulation in soils with annual rotational crops like potatoes, tomatoes, peppers and aubergines can be an issue, but never as critical.

RISE scores low, if there is 'no fertilisation'. However, in organic wine production for example and especially biodynamic, yield maximisation is not at all an agronomic or economic aim. It is all about quality and premium products. Vines are perennial crops with long underground root systems, if not fertilised (like forests) they will access all required nutrients and acquire more draught tolerance and vigour especially in terroir with fertile soil for quality wines. In other words, investing any money in fertiliser could be detrimental to the quality of the grapes.

The farm could however increase biodiversity, by more intercropping with green manures, including poultry to graze grass between vines, bird boxes, hedges around the vineyard, replacing some vines (up to 10% especially in late-frost pockets where yields are already marginal) with fruit trees to have a more agroforestry-type vineyard. Current organic vineyards are often too dense as they are 'converted' from conventional plantations. New organic vineyard plantings could use wider spacing, with fewer plants per hectare and more space for a more optimal micro-climate. They could produce higher yields per individual vine. Such system re-design could reduce the need for any further inputs, including copper alternatives.

5.6 Livestock, antibiotics, anthelmintics

Abandoning use of antibiotics in livestock production could cause animal cruelty if individual animals are allowed to suffer without being treated. This would be illegal and could result in criminal prosecution for veterinarians and farmers. However, antibiotic reduction is possible and of course the only curative allopathic treatment. In the organic guidelines the use of alternatives is promoted; " When treating a sick animal, plant based medicines, homeopathic medicines, trace elements, vitamins and minerals should be used in preference to antibiotics or other allopathic medicines. If, however, these alternative treatments are inappropriate or ineffective, allopathic medicines or antibiotics must be used".

High general antibiotic use can be an indication that the whole farming system is inhumane and causing ill health, e.g. lack of space to move, ventilation, natural light, free-range, mixed grazing, diverse pasture with trees. Or it can be generally too high stocking densities either inside or outside. This can be true even for organic if dairy cows or sows are pushed to produce the highest yields. Antibiotic use is then the result of a failed farming system, and not a last resort treatment for individual animals following injury.

Scientific investigations have proven that organic livestock already uses less antibiotics and thereby, contribute less to antibiotic resistant bacteria than conventional (Danish organic farming contribution to public goods, 2015; Alliance, 2021)). The Danish pig case farm is an example of this. However, sometimes a massive treatment is seen necessary, to prevent spreading and of course suffering of the animals. However, it should be noted that in fully-free range organic pig systems, antibiotic use is often close to zero.

The case dairy farm only uses antibiotics on 5% of the animals per year. The organic pig farmer delivers many slaughtering pigs, who have never been treated with antibiotics.

Both the dairy and the pig farmer repeatedly say that prevention by hygiene, co-worker instruction, identification of the contaminated animals and alternative prophylactic treatments with herbs, oils, and sick bays, can and have reduced the amounts used very much. Also, the veterinarians must be instructed how to address the organic principles of no allopathic treatments before infection. Happily, in many countries the stable schools for learning face to face by colleague experiences sharing, are now default measures, which already have helped many farmers. Stable schools are often financed by dairies, slaughter houses and other industry/retail promoting the restraint of antibiotic use.

The case study results also show that a 100% antibiotic free organic product could also be produced in the EU (like already done in the US). This would require that the remaining 5% of produce are sold as conventional. Such a move could be covered by a 10% higher price for antibiotic free milk, however it is important that this does not infringe the 'right' of an individual animal to get antibiotic treatment, if needed, even if it is later downgraded to 'conventional' milk or meat. The practise of using antibiotic milk to feed calves also needs scrutiny as this could lower efficacy later in life.

Getting from very low to zero antibiotics may however be still be challenging. Many organic farmers, think this is impossible (Alliance, 2021). Using lower stocking rates and including more free-range could help. This does not have to be total 365-day free-range like common in UK organic pig farms. It is also important to reduce antibiotics for all animals as routine treatment and reserve these drugs, only for individual animals and accidents.

More pasture together with less manure spreading could also help with the soil compaction issue. Compacted soil increases run-off and reduces yield potential even with ample organic fertiliser applications. Reducing milk yield intensity slightly while increasing the benefits with reduced veterinary costs and regenerative soil practices to reduce compaction could benefit this farm. If a price premium for antibiotic-free organic milk were available in Germany (like in the US market) this farm could aim for 6000 litre per cow on average and still be more profitable and sustainable than it is currently. Case study farms indicated that anthelmintics against intestinal parasites are less problematic and can often be fully substituted by alternative deworming agents, such as natural herbs, tannins or biological substances.

5.7 Economic assessment

The low economic performance might also be an issue with the current RISE version which was not developed to compare and assess CSAs. Some of the low economic ratings on liquidity and livelihood security in this CSA may be a reflection of an owner-occupied family farm perspective in the RISE assessment design inherited from its Swiss roots. If all CSAs were economically fragile, why have they existed for 30 years – one could ask? A sustainability tool to improve CSAs and help them avoid bankruptcy in the worst case would nevertheless be desirable.

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7. Annex 1: Workshop reports

Two workshop reports from WP 5, SOIL and WP 3 PLANT. The same numbering for the case farms is used in the workshop summaries.

7.1 Report of workshop on sustainability of case farms using alternatives to contentious inputs plastic, and conventional manure, related to the WP 5, SOIL.

Participants; Local RISE interviewers, experts on organic soil matters, and facilitators.
Rapporteur; Frank Oudshoorn, Majken Husted

Notes from the workshop
In work package 6, a holistic sustainability assessment of case farms is performed and the farm results are discussed in a workshop. Three workshops are grouped using the work packages soil, plants, and livestock as themes. For all packages the focus has been to assess alternative inputs to contentious inputs in organic farming at farm level, so the agricultural sector in higher degree can understand, how the use of alternatives can influence farm sustainability. Here the RISE tool has been used to assess the status quo of sustainability of each farm when working with the respective alternative. RISE is an international tool which is commonly used in DK and is facilitated to be used in different countries. Furthermore, it is possible to simulate if and how alternatives to contentious inputs could improve the sustainability of the farm. RISE data is 70% quantitative data and 30% qualitative data (De Olde et al., 2018). The people who have performed the surveys have collected data and used the RISE software, followed by an analysis.
As some of the data could not be gathered from the farmers, the surveyors have included some estimated data, based on expert opinion. This means that it is not 100% correct but is useful in understanding the effects of alternative inputs.

The following farms were discussed:

1. Vegetable production, Spain
Josep produces sweet potatoes, sugar beets, watermelons, onions, sweet pepper, tomatoes, broccoli, and melons on an area of 16 ha. The farm includes a lot of natural habitat, such as ponds, creeks, forest etc. They use composted conventional cow manure because they find it difficult to source organic cow manure. Composting is seen as a hygienic process to prevent unwanted inputs of antibiotics or antibiotic resistant bacteria and thereby avoid problematic inputs. As alternatives to plastic they are trying bio-plastic mulching and paper mulching. The latter helps to prevent weeds better than plastic mulching, but the farmer only uses paper mulching in the dry seasons. Furthermore, they use intercropping systems with herbs like basil as hosts for predators to pests and diseases and thereby avoid having to use mineral oils and high levels of Copper (WP 4, PLANT). The intercropping can give synergetic fertilisation by root contact between legumes and non-legumes. They also use herbs for intercropping; herbs take 20% of the land use on the field, so they choose varieties and species which they can sell afterwards. The maximum permitted amount of organic fertiliser (170 kg N/ha) is used.
The yields of the different crops look healthy, which shows there is no deficiency of nutrients and the management is well controlled.
The biodiversity score is high because of the many different vegetables, crops, natural surroundings etc. which is very good and an aspect which is assumed to be more and more important in the future.

Not all the diversity of vegetables which are grown on the farm, appear in RISE, so some of the crops were not included or substituted with others.

2. Arable farm in England, UK

An experimental farm which mainly produces cereal crops. The farm is vegan organic and is one of several in UK. For soil fertility they use green manure and compost. The green manures include clover and phacelia which are under sowed with the main crops. Furthermore, the farm uses biomass compost and wood chips. The yields of the farm are low, but this seems not to be a problem according to the surveyor, who was unsure if the farm had to support an income from farming. One of the explanations might also be the use of no-tillage methods. Tillage can often give yield suppression, especially in organic farms as weeds (perennial), cannot be controlled. Another reason is the lack of sufficient nutrients, as very little is was imported and cereal products are being sold yearly. Also, on this farm, data was difficult to collect as no actual organic registration was conducted (and not legally required) on the farm as no produce was sold with organic certification.

3. Vegetable farm in England, UK

A small farm on 0.9 ha producing different vegetables. The production is vegan organic, so no animal inputs. It is a CSA (Community Supported Agriculture scheme). In this construction the economic risks can be equalised or compensated by the membership payments (consumers' community support). The farm uses green manures as an alternative to animal manure because of the vegan focus. However, there were some issues regarding data collection for the RISE template. It is difficult for the farmer to document correctly as sales are not registered and members get a weekly share of produce. It is mentioned that this problem often occurs with smaller farms having direct sales of many products. They don't have enough quantitative data. It is documented that some questions in RISE are too detailed – it can be difficult for the farmer to answer them. It is suggested that bigger farms have better data knowledge, but this cannot be confirmed. Another issue with vegetable farms is that they do not know the specific land use in ha as they cannot apply for the EU or UK's common agricultural policy and rural payment support (The UK government has always excluded farms below 5 ha from any payments, while EU-payments to large landowners were not excluded, not even above 5000 ha.) One of the surveyors mentioned the land area was estimated, partly on the basis of the potential yields.

Regarding nutrient use beside the green manure, it was mentioned by the surveyor that the farm imported an organic certified tomato fertiliser, though it was not known how much. Their own compost was then mixed with this tomato product. Looking in the RISE results the farm has a low score in nutrients. However, the data upload could not be affirmed as the yields were not available, so it is difficult to score this aspect of sustainability in RISE given the data uncertainty on this farm. It was argued that yields and economy are less important to the sustainability of small community supported farms. This aspect of course doesn't exclude the fact that nutrient balances are important for continuous soil fertility. It can be concluded that it is difficult to make complete RISE assessments on small, non-commercial farms, as many data required for this are missing (or RISE was not designed with these types of farms in mind). The farm seems to have very good yields, which might seem in contradiction to the fact they only import very few nutrients, but there is good reason to analyse this apparent contradiction further.

4. Vegetable farm in England, UK

A vegan organic farm, which produces different kinds of vegetables. It is also a CSA as farm number 3. They do not use any animal manure but they do use imported, green waste compost plus a small amount of green manures are used. Here it was difficult to get specific data – especially for yield. As they harvest the vegetables early, to go directly to the market (weekly collection by a member in this case), it is difficult to relate yields to potential high and low values. The farm has problems with weeds and soil compaction which decreases the yields. It is further argued that adding more fertiliser would not necessarily increase the yields, meaning that there are other factors that are not included in the RISE questions, as even though the planning is ok, the actual crop management might be a limiting factor.

Summing up

With hindsight, it can be questioned whether these farms and analyses should have been included in the Organic-PLUS scientific analysis of sustainability, as limited quantitative facts could be obtained for the RISE tool. The conclusions might have a bias as this is a small selection of farms, and 3 out of 4 farms were vegan. Together with the size issue, the limited documentation of small farms this gives fewer results in the RISE assessment. They could all be considered pioneers, testing interesting alternatives, but it is problematic that some of the information is missing on the effects and impacts of these alternatives. Looking at these four farms again and focus on soil would put the results into a bigger, clearer picture. However, the sustainability assessment goes beyond yields, nutrient balances and economic aspects, and overall the sustainability scores on social aspects, nature and biodiversity a quality of life seems to be good. A more qualitative social science assessment tool could probably handle these farms better. Community Supported Agriculture can supply parts of the organic market and statistically this may not even be registered in many national databases in Europe. When registering the organic percentage of total amount of spending for food, direct producer-consumer chains are difficult to capture and are probably underestimated. As mentioned before, the economic scores in RISE are not of major concern to the farms, and often nutrients can be found locally, without having to document balances to certification bodies. However, it also shows that certification schemes can enforce a certain rigour on data collection and farm management in small-scale farms and since small farms also supply an increasing share of the organic market they should not be excluded from this in the interest of consumers and food safety (including adopting small-scale adapted certification schemes like group certification).

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7.2 Report of workshop on sustainability of case farms using alternatives to contentious inputs copper and mineral oils, related to the WP 3, PLANT.

Participants; Local RISE interviewers, experts on organic soil matters, and facilitators.
Rapporteur; Frank Oudshoorn, Majken Husted

Notes from the workshop:
In work package 6, a holistic sustainability assessment of case farms is performed, and the farm results are discussed in a workshop. Three workshops are grouped using the work packages PLANT, LIVESTOCK and SOIL as themes. For all work packages the focus has been to assess alternative inputs against contentious inputs in organic farming at farm level, so the agricultural sector in higher degree can understand, how the use of alternatives can influence farm sustainability. Here the RISE tool has been used to assess the status quo of sustainability of each farm when working with the respective alternative. RISE is an international tool which is commonly used in Denmark and is facilitated to be used in different countries. Furthermore, it is possible to simulate if and how alternatives to contentious inputs could improve the sustainability of the farm. RISE data is 70% quantitative data and 30% qualitative data (De Olde et al., 2018). The people who have performed the surveys have collected data and used the RISE software, followed by an analysis.
There has been a debate about LCA (life cycle assessment) and RISE, and it is questioned whether the two methods should be used on the farms for comparison. At an overall level the answer will be no. The LCA results are quantified as an environmental footprint per kg product produced and will be in addition to, especially the copper and sulphur alternatives, if the alternatives are actual substances.

The following Farms were discussed:

5. Arable farm in Denmark
Anders Stensgaard's farm has 500 ha of arable farmland in total, where 58 ha are potatoes. The farm is dedicated to potatoes and the bearing economy comes from this production. The RISE analysis shows the farm is sustainable in many ways, but the yields of potatoes are low. The focus is to increase yields by plant protection through rotation and good production craft, without the use of copper, as this is forbidden in Denmark. Furthermore, Stensgaard is against using any kind of materials for plant protection like plastic cover or other non-organic substances/materials. He prioritises experimenting with other alternatives like different crop systems strip-cropping of barley together with potatoes or other plants. The strips have been researched in France and the Netherlands with carrots and cereals with a good results regarding plant protection (www.wur.nl/en/project/Strip-cropping.htm). The strips must be planted across the wind, and that is not alwayss possible on a field. Additionally, one of the experts asked about the varieties of the potatoes, as that will affect the yield and susceptibility to diseases. The surveyor answered that the farmer uses both resistant and receptive varieties. However, the choice of varieties which are more resistant to phytophthora, might not be possible due to the contracts made with retailers. Also, because contracts are made to compete with conventional products and prices, when the farmer has a contract with supermarkets, the possibilities for choosing different varieties are limited. Regarding the reduction of copper, one of the experts points out a discussion from work package 3, where it was concluded that more initiatives must occur – it is not enough only leaving out copper compared to yields. Furthermore, the participant argues for not establishing irrigation systems too close to the potatoes on the edge of the field, because the irrigation system can cause high humidity and increase risk of infection. It is known late blight starts at hotspots of humidity – the more rain, the higher the risk. It is discussed

how much the yields could increase, if alternatives to copper were to be used at this farm. Another expert argues that it depends on the choice of variety, nutrient supply and disease pressure, and can be different from year to year and from field to field. If disease pressure is low, the farmer gets 20-50% higher yield. Additionally, one expert states, that if you combine the copper alternative with more resistant cultivars, it could be expected that the yield in 5-10 years will be 50% higher than today. Lastly, the expert mentions that the inoculum pressure must decrease as well and this is also part of the management, to clean up the weed potatoes (the leftovers from last year, which will sprout by themselves, if the frost does not take them) or sometimes even waste heaps left in the field. One expert concludes with the answer about the importance of using different methods – it is not just about adding something else in the production it is also about combinations and timing (generally, organic requires more skilled management in terms of evaluating the current/predicted state of, for example, crops, timing/scheduling of operations, etc. – it is not possible to remedy wrong actions with increased fertiliser, pesticides, etc). This was confirmed by the other expert who mentioned an experiment that had taken place at Stensgaard, where two alternative substances (allowed in organic farming) were used (Fytosol and Kumulus S), but due to the extreme wet summer and high infection rate, no differences were found in the total destruction of the green leav

1. Vegetable production, Spain

Josep produces sweet potatoes, sugar beet, watermelons, onions, sweet pepper, tomatoes, broccoli and melons on 16 ha. They use intercropping systems with a high percentage of herbs like basil. Due to the large area of natural habitat surrounding the farm, there is a low pest risk. The farmer uses different resistant varieties. There is no copper used but instead, potassium bicarbonate. Furthermore, plant oils like neem tree oil as an alternative for mineral oil are used 1-2 times a year against larvae. The yields are quite good. On this farm, there is a bigger focus on pest and insects than diseases. One expert suggests a push pull system regarding strip crop systems. Here it makes sense to find a strip crop that the insects love more than the main crop, as well as thinking about hosting natural enemies. At last, the expert mentions potato production together with solar panels might be an option, to keep them dry, and to have movable panels that can allow sunlight in dry periods (also called dynamic agrovoltaism). Additionally, one expert mentions, that technology in organic farming is necessary and that consumers must change their sight of seeing organic farming as the old-fashioned way of producing crops and vegetables.

6. Olive production, Spain

This Spanish olive production has new 10-15 years old trees and the old ones which are more than 100 years old. The production is a monoculture where they are trying to reduce the use of copper and to find extra nutrients as fertiliser. However, it can be difficult to find the right combination as e.g. one expert thinks trees could be more stressed under organic production than conventional, which is why they might need more protection. The yield is mainly 20-30% lower than conventional, but the owner is passionate about the environment rather than economy. When the copper is not used, the surveyor mentioned that a kind of fungus appears on the trees. One surveyor asks if any plants can remove copper from the soil and thus maybe relieve the poisoning of the soil. Some plants can take a higher proportion of copper than others, but it will require a crop rotation of that, which is different when the production is trees (it can only be additional crop rotation under the trees, but water can be limiting in Mediterranean climates without irrigation). It is more a technology issue. In this particular analysis, Baptiste used 116 litres/ha/year because of there was a lot of rainfall in the year analysed. Lastly it is discussed whether it is possible to leave out copper totally. One expert answers that copper is like a security net - some years you don't need it – other times the risk is very high and then you use it – using an alternative must be nearly as effective as copper, and such is not found yet.

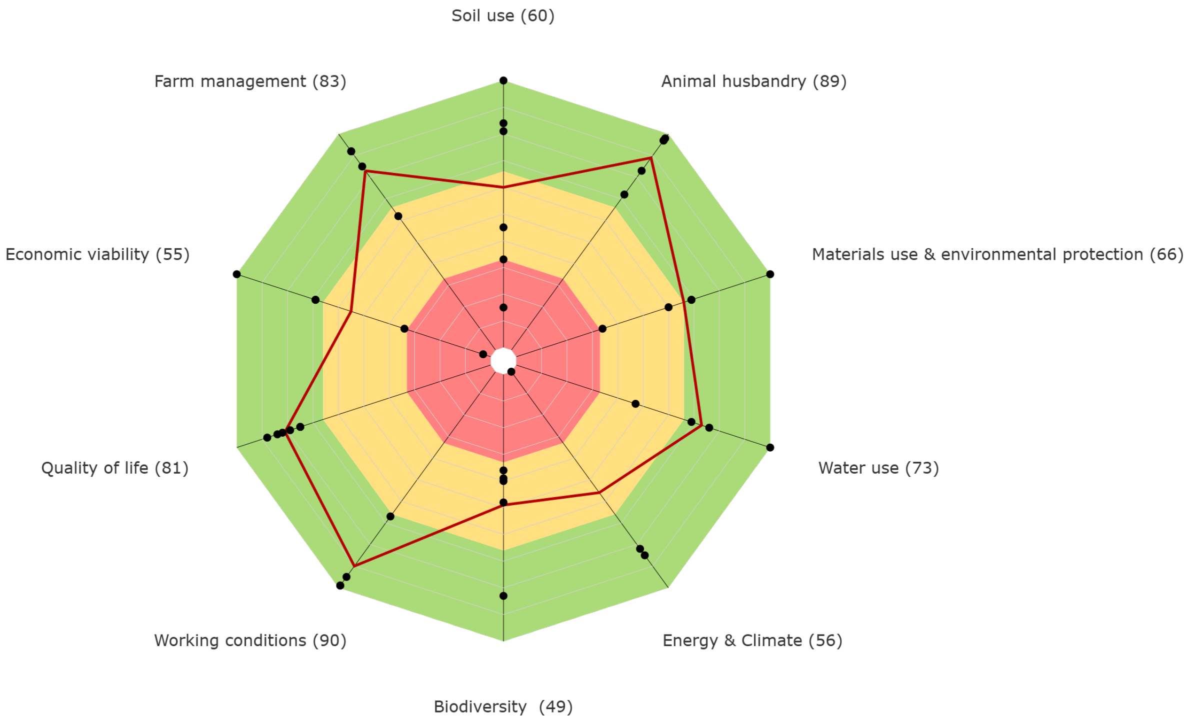
7. Wine grower, Germany

The farm has a production of organic grapes on 13 ha. 50% is for white wine and the other half is for red wine. 20% of the production the grapes are fungus resistant, which results in 80% less copper and sulphur use. Furthermore, they are using 1.5 kg/ha/year copper and use an advanced recycling sprayer for copper, catching the spray not reaching the leaves, and reusing it. This way they use copper more effectively, because less is lost to the soil during spraying. Right now, the biggest problem is the low biodiversity score. The farmers don't do much to improve this. One expert addresses the biodiversity and has observed a medium score in biodiversity. Here Majken Husted argues that some conventional areas around the farm are treated up to 12 times a year which decreases the biodiversity score a lot. Additionally, active biodiversity management will have a big influence. Furthermore, the infrastructure affects the biodiversity score in RISE as well as monoculture, intercropping, crop rotations etc. All this will have an effect, where it can be argued, that organic farming might have an advantage here.

Summing up:

The case farms have different approaches to the contentious input of copper and mineral oils. Mineral oils were no longer used in the case study farms, and if oils were used they are plant based (e.g. neem oil) and not fossil-fuel based. Rotation, alternative design of systems (strips, rows, mixes), resistant varieties and cultivars, technologies and lower doses were being applied on these farms. It doesn't seem to jeopardise the overall sustainability of the farms looking at the whole picture, but receding yields could be a threat to sustainability in the long term, if higher yields are required to compensate for higher food waste.

8. Annex 2: Example of sustainability report for farmer



Degree of sustainability

Indicators

Low performance	Medium performance	Good performance

Results themes & indicators - short list with points given in this example

1	Soil use	60
1.1	Soil management	84
1.2	Crop productivity	45
1.3	Soil organic matter	81
1.4	Soil reaction	100
1.5	Soil erosion	33
1.6	Soil compaction	15

2	Animal husbandry	89
2.1	Herd management	83
2.2	Livestock productivity	98
2.3	Opportunity for species-appropriate behaviour	97
2.4	Living conditions	97
2.5	Animal health	72

3	Materials use & environmental protection	66
3.1	Material flows	60
3.2	Fertilisation	34
3.3	Plant protection	100
3.4	Air pollution	69
3.5	Soil and water pollution	69

4	Water use	73
4.1	Water management	47
4.2	Water supply	100
4.3	Water use intensity	76
4.4	Irrigation	69

5	Energy & Climate	56
5.1	Energy management	85
5.2	Energy intensity of agricultural production	82
5.3	Greenhouse gas balance	0

6	Biodiversity	49
6.1	Biodiversity management	83
6.2	Ecological infrastructures	36
6.3	Distribution of ecological infrastructures	40
6.4	Intensity of agricultural production	48
6.5	Diversity of agricultural production	39

7	Working conditions	90
7.1	Personnel management	99
7.2	Working hours	67
7.3	Safety at work	99
7.4	Wage and income level	95

8	Quality of life	81
8.1	Occupation & Training	79
8.2	Financial situation	75
8.3	Social relations	88
8.4	Personal freedom & values	75
8.5	Health	82
8.6	Other areas of life	84

9	Economic viability	55
9.1	Liquidity	3
9.2	Profitability	69
9.3	Stability	69
9.4	Indebtedness	34
9.5	Livelihood security	100

10	Farm management	83
10.1	Business goals, strategy, implementation	85
10.2	Availability of information	92
10.3	Risk management	62
10.4	Resilient relationships	92

In each theme and indicator next to point there is room for 'Explanatory notes and 'Ideas and recommendations;. This is shown for the example of Soil use below:

Themes & Indicators		points	Explanatory notes	Ideas and recommendations
Calculation variant: RISE 3.0				
1	**Soil use**	**60**		
1.1	Soil management	84		
1.2	Crop productivity	45		
1.3	Soil organic matter	81		
1.4	Soil reaction	100		
1.5	Soil erosion	33		
1.6	Soil compaction	15		

9. Annex 3: Description of topics and indicators

Soil use

Fertile soils are a limited, easily degradable resource that is essential to both life and production. This topic reflects the state of the soil on the farm and how this state is affected by farming practices. The results for this topic answer the following questions for the farmer:
- How does the fertility of my soil rate?
- What impacts do my farming practices have on the fertility of my soil?

Soil management

Sustainability goal
Knowledge and technology are actively employed to facilitate productive, site-adapted and soil-conserving soil use.
Content
An assessment is made of whether soil analyses, nutrient and soil organic matter balances and changes in soil C content are calculated and taken into account, and whether any agricultural area has been lost in the last ten years.
Scoring
100 points are awarded if all the relevant analyses are performed and no agricultural area has been lost.

Crop productivity

Sustainability goal
Through appropriate yields per unit area, the farm contributes in terms of both quantity and quality to satisfying the demand for agricultural products and ensures its own economic competitiveness.
Content
Yields per unit area of all crops grown on the farm are compared to the regional benchmarks for very high, average and very low yields. In addition, product quality is evaluated based on regional or farm-specific criteria.
Scoring
The three benchmark yields are equivalent to 100 RISE points (= very high yield), 67 RISE points (average yield for the region) and 34 RISE points (low yield), with 0 RISE points awarded for no yield, +/- a 20-point correction for product quality. Linear interpolation is used to fill in the gaps between the three defined points.

Soil organic matter

Sustainability goal
The arable soil on the farm is well supplied with organic matter, ensuring that the soil organic matter content in the topsoil at least remains stable.
Content
Either the arable soil organic matter content is directly evaluated or a simple soil organic matter balance is calculated and evaluated based on rotation and farming practices.
Scoring
In the interests of simplicity, RISE assumes a high and stable soil organic matter content for permanent grassland, permanent crops and woodland (Kuntze et al., 1994). There are two options for evaluating the situation on arable land (mineral soil). If reliable analysis data is available, the topsoil organic matter content is evaluated based on altitude and soil type. The benchmark data was provided by a comprehensive analysis of Bavarian farms (Capriel, 2010), although it is not valid for peaty soils and

chernozems. If robust data is not available, a simple soil organic matter balance is calculated and evaluated, with a distinction being drawn between organic and conventional farms. The coefficients for the soil organic matter balance are taken from the STAND “site-adapted method” (Kolbe, 2008). The goal is a stable soil organic matter content capable of ensuring an adequate nutrient supply whilst preventing nutrient inefficiency and high greenhouse gas emissions (Kolbe, 2012). The scoring functions of both the procedures used in RISE are only valid for the temperate climate zone. For areas outside of this zone, RISE uses coefficients that have not yet been scientifically validated.

Soil reaction

Sustainability goal

Soil reaction is within the optimal range for crop growth; soil use causes neither salinization nor acidification beyond this range.

Content

Soil pH is evaluated in terms of crop requirements and the risk of salinization or acidification is assessed (Fig. 11).

Scoring

Soil acidification and salinization are evaluated by a single indicator in RISE, since both are associated with soil pH. 100 points are awarded if all the soil on a farm has a pH of between 5.5 and 7.0. Points are deducted for higher or lower pH values. Further points are deducted if acidic fertilizers are used without the soil being properly limed. 25 points are deducted if more than 100 kg/ha per year (fertilizer quantity) of physiologically acidic fertilizers (e.g. urea, ammonium sulphate) are applied. In arid climates, adequate soil drainage is essential and soil pH should not exceed 7.0.

Soil erosion

Sustainability goal

The quantity of soil lost through water and wind erosion does not exceed tolerance levels even in the most threatened areas.

Content

Details are requested regarding the frequency and intensity of all erosion events to have occurred on the farm in the last 5 years. In addition, climate, slope gradients, soil type and cover and farming practices are used to calculate the risk of water and wind erosion for the highest-risk areas.

Scoring

100 points = no soil erosion observed; the risk of erosion does not exceed soil loss tolerance levels even in the highest-risk areas.

Soil compaction

Sustainability goal

Crop growth and soil life are not impaired by over-compaction of the subsoil.

Content

The risk of excessive soil compaction is assessed based on risk factors (wheel load, soil moisture, soil type, tillage) and protection factors (pressure reduction, improvement of soil stability).

Scoring

100 points = no over-compaction observed. Soil is neither vulnerable to compaction nor tilled; maximum wheel load is 2.5 t or less.

Animal husbandry

Animal husbandry is an integral part of many agricultural production systems. Livestock should be kept in a manner that ensures their welfare and does not harm the environment. Animal welfare-friendly practices encompass the “five freedoms”: freedom from hunger or thirst, freedom from discomfort, freedom from pain, injury or disease, freedom to express normal behaviour, and freedom from fear and distress (FAWC, 1979). At the same time, high performance and resource efficiency should also be pursued. This topic provides an indication of:

- whether livestock performance is at a high level,
- whether the husbandry system allows for species-appropriate behavior,
- whether the physiological needs of the animals are met and
- whether the animals are healthy.

Herd management

Sustainability goal

Livestock populations on the farm are managed in a long-term and site-adapted manner in order to optimize animal health, animal welfare and sustainability.

Content

An assessment is made of whether livestock-related information is collected and employed in a targeted manner in breeding and husbandry in order to improve animal welfare.

Scoring

100 points = systematic monitoring and documentation of animal husbandry (health and performance), balanced criteria for selection and breeding.

Livestock productivity

Sustainability goal

Appropriate livestock performance is achieved on the farm.

Content

Annual performance of all livestock categories on the farm is compared against regional benchmarks for very high, average and very low performance. Product quality is also rated based on regional or farm-specific criteria.

Scoring

The three benchmark performance values are worth 100 RISE points (= very high yield), 50 RISE points (average yield for the region) and 0 RISE points (very low yield), +/- a 20-point correction for product quality. Linear interpolation is used to fill in the gaps between the three defined points.

Opportunity for species-appropriate behavior

Sustainability goal

The animal husbandry system provides the animals with the freedom to express their natural social, movement, resting and sleeping, feeding, excretion, reproductive, comfort and exploring behaviors.

Content

An assessment is made of whether the animals enjoy sufficient time out of doors and contact with other members of the same species and of whether their environment permits them to behave as naturally as possible.

Scoring

100 points = based on current knowledge, the conditions in which the animals are kept allow species-appropriate behavior for all of the behavior categories included in RISE.

Living conditions

Sustainability goal

The physiological needs of the animals are met; they live in a species-appropriate environment.
Content
An assessment is made of whether temperature, lighting, air quality, noise level and feeding arrangements meet the needs of the species in question.
Scoring
100 points = all animals live in species-appropriate conditions.

Animal health

Sustainability goal
The animals live free from pain and disease. The number of unintended losses is as small as possible.
Content
An assessment is made of the number of unintended losses, veterinary treatments, zootechnical interventions and the animals' external condition.
Scoring
100 points = no veterinary treatments necessary, no mortality due to disease, injury or accidents, no mutilated animals.

Materials use & environmental protection

Sustainable agricultural production makes use of natural nutrient cycles. It preserves a good nutrient balance even at high productivity levels, while minimizing environmental pollution and materials use. This topic provides an indication of:
whether tight cycles and sustainable origins are taken into account by materials sourcing (fertilizer, feed, etc.);
whether damage to the environment is avoided in the storage, use and disposal of materials.

Material flows

Sustainability goal
The farm promotes sustainable production of consumables, machinery, infrastructure, feed and fertilizer through responsible sourcing. Targeted material selection and efficient resource utilization prevent waste.
Content
An assessment is made of (i) whether priority is attached to the use of nutrient sources (chiefly feed and fertilizers) either produced on the farm itself or at least sourced locally (within a region-specific radius), (ii) whether materials and equipment sourcing considers sustainability criteria and in particular the circular economy, (iii) whether unproductive losses are prevented.
This indicator integrates information on the following components:
(1)Self-sufficiency of feed supply (calculated): N-self-sufficiency, P-self-sufficiency.
(2)Self-sufficiency of fertilizer supply (calculated): N-self-sufficiency, P-self-sufficiency.
(3)Regionality of feed supply.
(4)Regionality of fertilizer supply.
(5)Losses from crop production („food loss").
(6)Degree of implementation of recycling potential.
Scoring
100 points = all materials are sourced locally, from sustainable sources. Unproductive losses are minimized.

Fertilization

Sustainability goal

A balanced crop nutrient supply facilitates good yields while preventing damage to the environment and soil nutrient deficiencies. Optimal use is made of the nutrients available on the farm and these are only supplemented by externally sourced nutrients where necessary.

Content

Nitrogen and phosphorus balances are calculated at farm level (supply-demand balance, the benchmark values for the scoring function can be adjusted in the regional data. Nutrient surpluses are evaluated more critically than deficits in surplus areas. The tolerance limit for surpluses is only increased in the event of a poor P supply, but not for poor N supply). An assessment is also made of whether fertilizers are used sparingly in accordance with best practice.

This indicator integrates information on the following components:

1)Fertilization management = Fertilization planning (factors taken into consideration): crop nutrient demand (envisaged yield x quality), results of soil analyses (P and K content, texture, soil organic matter content…), atmospheric nitrogen immission, biological nitrogen fixation, available quantities of organic fertilizers (types, N and P contents, dilution factors), nutrient mobilization from crop residues, mulch and green manure; fertilizer application (factors taken into consideration): time and quantities (demand-specific application and release, type and formulation of fertilizer, dosability, precise dosage and distribution (application technology, wind speed).

2)Farm nitrogen balance.

3)Farm phosphorus balance.

Scoring

100 points = fertilizers are only employed where necessary, based on the relevant analysis results. The farm has stable N and P balances, i.e. the difference between supply and demand does not exceed 10%. The exact details of the scoring function can be defined regionally for both N and P. As a rule, more points will be deducted for surpluses than for equivalently-sized deficits. The Figure contains some examples of scoring functions.

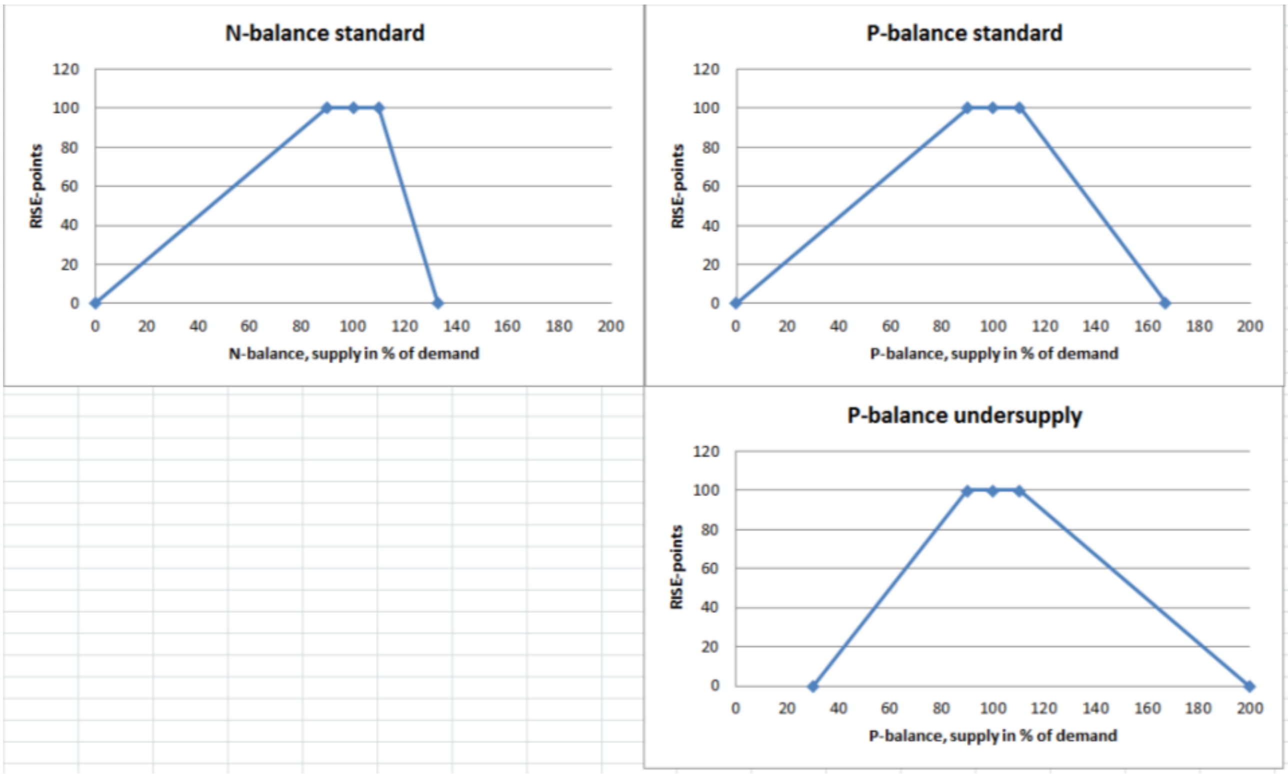


Figure. Standard scoring functions for farm nitrogen balance (left) and phosphorus balance (right). The functions' key indicators can be defined at regional level.

Plant protection

Sustainability goal

Plant protection on the farm is based on the principles of integrated plant protection. Hazardous substances that are harmful to the environment are only used where strictly necessary and their impact on the environment is minimized through targeted selection and application.

Content

An assessment is made of (i) the extent to which plant protection problems are managed in accordance with the principles of integrated plant protection, (ii) the toxicity and persistence of any plant protection products used and (iii) whether measures are in place to minimize any unintended side-effects caused by the use of genetically modified organisms (GMOs).

This indicator integrates information on the following components:

(1)Management of plant protection challenges according to the principles of integrated plant protection: site-adapted production systems, variety selection based on resistance and tolerance to pests and diseases, reliable identification of species prior to chemical treatments, application of damage thresholds, use of biological and mechanical rather chemical means of plant protection, measures to keep the effectiveness of PPP (e.g. herbicide rotation).

(2)Due diligence in GMO cultivation: compliance with relevant legislation, measures to prevent unwanted spread or outcrossing of genes, conservation of specific GM properties (e.g. herbicide tolerance, resistance to pests), development of PPP use since GMO adoption.

Scoring

100 points = plant protection practices are completely in line with integrated principles, or no plant protection products or GMOs are used.

Air pollution

Sustainability goal

The storage, use and disposal of materials does not cause gaseous emissions that threaten or harm the health of humans, animals or the environment (air, soil, water and natural ecosystems).

Content

This indicator deals with gaseous emissions that can harm the health of humans or ecosystems. It integrates information on:

(1)Ammonia: risk of ammonia emissions from animal production (number of livestock per area, rating of grazing practice, slurry storage, spreading and incorporation into the soil), risk of ammonia emissions from imported organic fertilizers (spreading and incorporation into the soil),), risk of ammonia emissions from mineral fertilizers (type and quantity).

(2)Exhaust gases, smoke and odor: Burning of problem wastes (e.g. plastics), complaints from neighbors due to unpleasant smell (e.g. from stables, slurry application, sewage sludge, biogas fermentation or composting).

This indicator addresses the storage, use and disposal of toxic substances (plant protection products, veterinary drugs, dyes and colours, etc.), as well as other substances that could be harmful to humans, animals or the environment (effluent, waste, spillages from feed or fertilizer stores, etc.). Interviewees are questioned about actual soil and water pollution incidents (in the last 5 years) and the risk of such pollution incidents occurring in the future is also assessed.

Scoring

100 points = no pollution incidents and no risk of pollution incidents occurring.

Soil and water pollution

Sustainability goal

The storage, use and disposal of materials does not cause liquid or solid emissions that threaten or harm the health of humans, animals or the environment (air, soil, water and natural ecosystems).

Content

This indicator deals with liquid and solid emissions that can harm the health of humans or ecosystems. It integrates information on:

(1)Nutrients (N and P): buffer strips for manure and slurry storage and spreading, silos, parcels with risks of nutrient leaching, temporary storage organic fertilizers on bare soil.

(2)Pollutants in fertilizer: heavy metals, radioactive isotopes, organic substances (compost, sewage sludge) that were not analyzed for pollutants, slurry and manure containing antibiotic residues.

(3)Plant protection products: buffer strips, water erosion (6 m wide vegetated buffer strip, permanent vegetation along field margins, prevention of siltation, maintenance of high water retention capacity = prevention of surface run-off)), prevention of drift, eco-toxicological characteristics of PPP (toxicity and persistence).

(4)Pollutants in wastes, residues and wastewater: storage and disposal of problematic materials, risks from household and farm wastewaters, share of adequately treated wastewaters, pollution caused by livestock entering into water, further risks of soil and water pollution.

This indicator addresses the storage, use and disposal of toxic substances (plant protection products, veterinary drugs, dyes and colors, etc.), as well as other substances that could be harmful to humans, animals or the environment (effluent, waste, spillages from feed or fertilizer stores, etc.). Interviewees are questioned about actual soil and water pollution incidents (in the last 5 years) and the risk of such pollution incidents occurring in the future is also assessed.

Scoring

100 points = no pollution incidents and no risk of pollution incidents occurring.

Water use

Clean fresh water is indispensable both to human life, and to crop and livestock production. The production system employed by the farmer affects the amount and quality of the water available to other users. This topic addresses:

- how good the quality and quantity of the farm's water supply is,
- how intensively and efficiently water is used for production and
- how sustainable the farm's irrigation practices are.

Water management

Sustainability goal

Knowledge and technology are actively employed to ensure efficient, site-adapted and resource-conserving utilization of water resources.

Content

This indicator is only calculated if "blue" water (taken from aquifers or surface waterbodies) is used on the farm (as opposed to only "green" water, i.e. rainwater naturally absorbed by the plants). Interviewees are questioned about whether water consumption is monitored, whether opportunities to collect rainwater are used where doing so is feasible, whether they are aware of the potential water-saving measures that could be implemented on the farm and the extent to which such measures have actually been introduced.

Scoring

100 points = water consumption is monitored, potential water-saving measures are known and fully implemented.

Water supply

Sustainability goal

The quantity and quality of the farm's water supply are secure in the short and long term.

Content

The current situation, trends and potential for conflicts concerning the quantity and quality of the water supply are recorded and assessed (Fig. 17).

Scoring

100 points = no problems on the farm (no need to increase depth of wells, no water-related conflicts, no deterioration in water quality, no decrease in water availability, no fall in the groundwater table), together with a low regional water stress level as defined by the WBCSD Global Water Tool.

Water use intensity

Sustainability goal

The quantity of water used in agricultural production is adapted to local conditions through the choice of crops and timing of cultivation. The farm is not dependent on externally supplied water and its irrigation requirements are minimized.

Content

The water demand of the farm's crops and livestock is calculated based on standard regional coefficients and compared with the water supply as determined by climatic conditions over the course of the year in question. Water requirements are estimated taking the timing and duration of crop cultivation into account.

Scoring

100 points = the farm's total water requirements are less than the annual volume of rain that falls on its land. Crop selection and the time of year at which crops are grown ensure that irrigation requirements are minimized, thereby preventing a structural water deficit.

Irrigation

Sustainability goal

Efficient irrigation methods enable high physical and financial yields.

Content

An assessment is made of whether (i) irrigation is carried out in a targeted and efficient manner, (ii) irrigation makes financial sense and (iii) there are any problems in connection with irrigation.

Scoring

100 points = irrigation is carried out in a targeted and efficient manner, as well as making financial sense and being problem-free.

Energy & Climate

To be sustainable, agricultural production must be energy-efficient and not reliant on non-renewable, environmentally harmful energy carriers. This helps to protect the climate, which in turn has an impact on the health of plants, humans and animals. This topic addresses:

- the extent to which production on the farm is reliant on non-sustainable energy sources,
- which energy-saving measures have been implemented,
- the net volume of greenhouse gases (minus sequestration) emitted by the farm.

Energy management

Sustainability goal

Sustainable energy use is facilitated through the active deployment of knowledge and technology.

Content

This indicator is only calculated if energy is actually used on the farm (as opposed to only human and animal labor). Interviewees are questioned about whether energy consumption is monitored, whether the potential for producing renewable energy on the farm is being used, whether they are aware of the potential energy-saving measures that could be implemented on the farm and the extent to which such measures are actually being implemented.

Scoring

100 points = energy consumption is monitored, full use is made of the potential for producing renewable energy, there is an awareness of the potential energy-saving measures and these are fully implemented.

Energy intensity of agricultural production

Sustainability goal

Agricultural production is not reliant on non-sustainable energy sources.

Content

The utilization intensity and the percentage of non-renewable energy carriers on the farm are calculated in a single indicator. This involves establishing the quantity and, where relevant, energy density of all energy carriers used. Only the farm's direct energy consumption is taken into account, while grey energy is not included (i.e. the energy "contained" in buildings, machinery and production inputs). Unlike in RISE 2.0, the term "renewable energy" is now preferred to "sustainable energy use", since there is no guarantee that even renewable energy can be used sustainably (Ellenberg, 1996; Anton & Steinicke, 2012).

Scoring

In RISE 3.0, energy intensity is scored using a sigmoid curve. The scoring function is based on the data gathered during 15 years of experience with RISE 1 and 2 and has been calibrated to be highly sensitive in terms of the scores awarded to energy-intensive farms in industrialized nations. The percentage of renewables has a modulating effect – a higher percentage of renewables leads to a higher score for the same energy intensity value (the curve shifts to the right) and a somewhat greater tolerance range up to the transition point (widening of the curve) (see Figure).

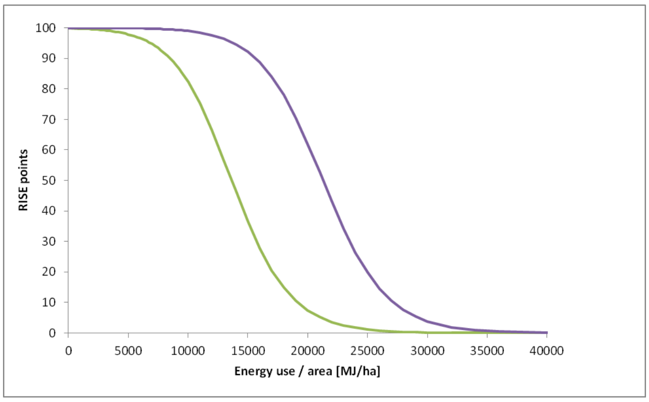


Figure: Example of the energy intensity scoring functions for 50% (green curve) and 100% (purple curve) renewables.

Greenhouse gas balance

Sustainability goal

The annual net GHG emissions of the area of the farm used for production do not exceed the amount that it would need to emit in order to prevent a rise in the average global temperature of more than 2C compared to pre-industrial levels.

Content

A GHG balance is calculated using data on land and energy use, production methods, animal husbandry and land use changes, and is then rated against global and/or EU benchmarks.

Scoring

The scoring function awards points as follows (Fig. 22): 100 points = 1.1 t CO_2 eq./ha (average global emissions in 1990), 67 points = 2.0 t CO_2 eq./ha (EU 15 average in 1990 minus 20%), 50 points = 2.5 t CO_2 eq./ha (EU 15 average in 1990), 0 points = 5 t CO_2 eq./ha (twice the EU 15 average in 1990). The benchmark values are based on data in Nabuurs et al. (2007), Smith et al. (2007), FAOSTAT (faostat.fao.org) and EEA (2013). Only a limited reduction of GHG emissions will be possible if demand for agricultural products remains unchanged. The estimated feasibility of reductions is based on data in Weiske et al. (2006).

Biodiversity

The diversity of living organisms and the health of ecosystems are closely connected. Indeed, agricultural production and human life itself are only possible at all thanks to the regulation of water, nutrient and gas balances, pollination, soil formation and other functions performed by ecosystems. This topic addresses:

- what is being done to promote the diversity of species, varieties and breeds on the farm,
- how well natural ecosystems are preserved and connected within the agricultural landscape,
- the quality of plant protection management and
- whether substances that are toxic to humans and nature are used for crop and livestock protection.

Biodiversity management

Sustainability goal

The farm has a biodiversity management system that incorporates a strategic and systematic approach to planning, decision-making, implementation and monitoring of activities geared towards species protection and ecosystem conservation.

Content

The farm should either be receiving comprehensive advice on biodiversity or have a knowledge of the current situation. There should also be planning and implementation of species and habitat protection measures and monitoring of the success of any measures implemented. A variety of farming measures to promote biodiversity should be implemented in the agricultural area (and optionally also unproductive land, woodland).

Scoring

100 points for comprehensive advice on biodiversity or a knowledge of the current situation, planning and implementation of species and habitat protection measures and monitoring of the success of any measures implemented. In addition, a variety of farming measures to promote biodiversity should be implemented in the agricultural area (and also optionally unproductive land, woodland).

Ecological infrastructures

Sustainability goal

The farm hosts several areas with high biodiversity potential that provide a habitat for rare and specialized plants and animals.

Content

An assessment is made of the percentage of the agricultural area that has a high ecological value (planar, linear and dotted structures). The area being assessed can be optionally extended to the entire farm area.

Scoring

100 points are awarded if 17% of the farm has high biodiversity potential. This figure is based on the UN Convention on Biological Diversity (Nagoya, Aichi), which states that 17% of terrestrial areas should be managed for nature. This threshold may be adjusted at regional level.

Distribution of ecological infrastructures

Sustainability goal

The landscape is well connected, allowing mobile animal species to move from one ecological stepping stone to another. There is no “erosion” of ecological structures.

Content

An assessment is made of the interconnectedness of ecologically valuable structures in the landscape as well as of how the proportion of these structures has evolved over the last 10 years (Fig. 29).

Scoring

100 points awarded if 100% of the arable land contains or is in close proximity (< 50 m) to ecologically valuable structures and if these structures’ development has followed a positive trend (+/- 20 points). The optimal value for the ecological quality of the landscape may be adjusted at regional level.

Intensity of agricultural production

Sustainability goal

Production intensity is low enough to provide habitat for a diverse flora and fauna.

Content

The intensity of fertilization, PPP use and livestock production (stocking density) is calculated on an area basis and the measures taken to foster biodiversity in the agricultural area are recorded. Both aspects are then scored.

Scoring

100 points = no nitrogen fertilization (0 kg N per ha), no PPP use, low stocking density (1 Large Animal Unit per ha). These values may be adjusted at regional level. Any sprays used should have only a low level of toxicity for non-target organisms (including beneficial insects and aquatic organisms) and low persistence (half-life <1 month).

Diversity of agricultural production

Sustainability goal

Through diverse agricultural production and on-farm use of genetically diverse crops and livestock, the farm contributes to the survival and development of plant and animal genetic resources. This helps to ensure that a wide diversity of primary genetic material will still be available to future generations for breeding purposes. By growing different types of crops, the farm helps to create a more diverse cultivated landscape.

Content

An assessment is made of various aspects of production diversity: the number of different land use types, the number of arable and permanent crops grown, the number of livestock breeds on the farm (with bonus points awarded for old or endangered varieties and breeds); for permanent grassland, frequency of use and yields are evaluated; beekeeping is rated positively.

Scoring

100 points = 5 different land use types (this figure may be adjusted at regional level), 6 different livestock breeds, 3 rare and/or old breeds or varieties and bees kept on the farm, high percentage of diverse permanent grassland (assessment based on frequency of use and yield), 10 different arable and permanent crops (for >10 ha of arable and permanent crops, max. 10 crops; for under 10 ha of arable and permanent crops, 1 crop per ha).

Working conditions

A committed and productive labor force is a basic requirement for a successful farm. Both of these traits are strongly influenced by on-farm working conditions. This indicator assesses the objective working conditions for farm employees and self-employed farm labor. The following aspects are addressed:
- occupational health and safety/physical working conditions,
- work organization,
- respect of basic rights,
- remuneration,
- justice.

Personnel management

Sustainability goal

Good personnel management ensures that the farm has a sufficient short-, medium- and long-term supply of satisfied, motivated and adequately trained personnel. There is little potential for conflict thanks to transparent and fair terms and conditions of employment.

Content

An assessment is made of whether the farm has a professional, forward-looking personnel management system in place and whether working conditions comply with the decent work standards established in the relevant human rights conventions and agreements.

Scoring

100 points = personnel requirements are known / arrangements are in place for replacing workers leaving the farm for age-related reasons / an apprenticeship program is in place / written employment contracts / pay stubs resp. payslips/ work permits for all personnel / measures are taken to motivate the workforce (e.g. incentive systems, praise) / protection against unfair dismissal / adequate income protection in the event of accidents, sickness, maternity, etc. / no discrimination / no forced labor of any kind / freedom to form labor unions.

Working hours

Sustainability goal

Each person working on the farm has enough free time to recover physically and mentally, so that they can remain healthy and productive in the long run.

Content

Daily, weekly and annual working hours and annual vacation are recorded and evaluated against the regional standard.

Scoring

100 points = 5 days a week, 40 hours a week, 6 weeks' paid vacation a year, overtime remunerated. These values may be adjusted at regional level.

Safety at work

Sustainability goal

Appropriate measures are taken to ensure that the number of work-related accidents and cases of illness on the farm are minimized. Children are not harmed by any work they do on the farm.

Content

An assessment is made of the frequency of work-related accidents and cases of illness on the farm, the measures taken to prevent them and whether there is a risk of illegal child labor (Fig. 33).

Scoring

100 points = no work-related accidents and/or illnesses in the last 5 years / safety strategy implemented / safe storage and application of PPPs / only low-toxicity PPPs used / no problematic child labor.

Wage and income level

Sustainability goal

The people employed to work on the farm earn an hourly wage that allows them to live comfortably above the poverty line when working normal hours.

Self-employed workers (mainly family members who are not paid a wage) also receive appropriate hourly compensation (private consumption and non-monetary benefits) and the farm delivers a very positive financial return.

Content

The income of the people working on the farm is compared against their financial needs. Self-employed workers are also asked about the farm's financial results (e.g. how the value of the business has changed, private account deposits/withdrawals, building up of reserves, equity capital formation), since it is possible that other assets may have been accumulated on the farm in addition to those used for private consumption.

Scoring

34 points = the people employed to work on the farm earn an hourly wage that allows them to live on the poverty line when working normal hours. 100 points = the hourly wage is double the poverty-line wage for an average household. For self-employed people (unpaid family members working on the farm), the same calculation is carried out based on the figure obtained by dividing private consumption plus all the non-monetary benefits enjoyed by the household by the total number of hours worked by all self-employed workers. The relevant threshold values (poverty line, factor for 100 points, household size, normal working hours) can be adjusted at regional level. Additional points are awarded or deducted (+/-50) based on the farm's financial results.

Quality of life

A high level of satisfaction with their work and their life in general is important for the physical, mental and social well-being of the people living on the farm. Quality of life, satisfaction and happiness are important indicators of successful sustainable development. Quality of life is achieved when individual goals are currently being met.

Occupation & Training

Sustainability goal

All farm personnel are satisfied with their occupation and their initial and ongoing training.

Content

An assessment is made for all interviewees of how important their occupation and initial and ongoing training are to them and how satisfied they are with their current situation in this regard.

Scoring

100 points = very satisfied with current occupation (on-farm, sideline activities, household work, etc.: type of work, working hours, workload, relationship with employees, authorities, customers, etc.; satisfaction, motivation), initial training (duration, type and level of training, etc.) and ongoing training (courses, self-study, study groups, etc.).

Financial situation

Sustainability goal

All on-farm personnel are satisfied with their financial situation.

Content

All interviewees are asked how important their financial situation is to them and how satisfied they are with it.

Scoring

100 points = very satisfied with current earnings (from agricultural work, sideline activities, other sources, etc.) and standard of living (housing, opportunities, consumption, training, vacations, leisure, pension, etc.).

Social relations

Sustainability goal

All on-farm personnel are satisfied with their social relations.

Content

All interviewees are asked how important social relations are to them and how satisfied they are with their current situation in this regard.

Scoring

100 points = very satisfied with family situation (relationship with partner, life together, communication, consideration, interaction, etc.) and social environment (friends, colleagues, neighbors, etc.; help, support, friendliness, trust).

Personal freedom & values

Sustainability goal

All on-farm personnel are satisfied with their personal freedoms and their ability to live by their personal values.

Content

All interviewees are asked how important personal freedoms and the ability to live by their personal values are to them and how satisfied they are with their current situation in this regard.

Scoring

100 points = very satisfied with the stability of the overall political and economic situation (security, peace, corruption, inflation, prices, employment, etc.), personal freedoms (hobbies, relaxation, activities, contacts) and cultural and spiritual life (music, dance, local culture and traditions, theater, film, literature, visual arts, etc.; religion, spirituality, etc.).

Health

Sustainability goal

On-farm personnel are satisfied with their health situation.

Content

All interviewees are asked how important their health (including time management) is to them and how satisfied they are with their current situation in this regard.

Scoring

100 points = very satisfied with (physical and mental) health and time management (pressure to meet deadlines, stress).

Other areas of life

Sustainability goal

All on-farm personnel are satisfied with the situation in the other areas of their lives.

Content

All interviewees are asked how important the other areas of their lives are to them and how satisfied they are with their current situation in this regard.

Scoring

100 points = very satisfied with the other areas of life mentioned by the interviewee (e.g. access to resources, participation and involvement in economic life, ability to choose how they want to live their lives and implement these choices, ability to choose how they work and implement these choices).

Economic viability

A farm is first and foremost a business that needs to deliver economic goals whilst working within the relevant environmental and social constraints. The aim is to ensure the short- and long-term profitability of the business and to maintain or even improve productivity so that the business can develop in a stable and self-determined manner that guarantees the livelihood of the farmer's family and the income of the people employed on the farm. This topic addresses the following aspects of a farm's economic viability:

liquidity

stability,

profitability,

indebtedness,

livelihood security

Liquidity

Sustainability goal

The farm's liquid assets are sufficient to meet its financial obligations at all times.

Content

An assessment is made of the ratio of cash reserves (liquid assets plus available credit lines) to average weekly expenditure (annual expenditure divided by 52 weeks), i.e. the number of weeks that the farm can live off its cash reserves. The farm's reserves are deemed to be sufficient if, at any time in its production cycles, it is able to pay wages and salaries, accounts payable to suppliers, loan repayments and interest payments out of its own reserves.

Scoring

100 points = 40 weeks of cash reserves. 0 points = 0 weeks of cash reserves. These values may be adjusted at regional level.

Profitability

Sustainability goal

The farm is financially profitable on both a short- and long-term basis. In other words, its earnings allow it to meet its financial obligations, make investments and earn a profit that adequately recompenses the equity invested in the business.

Content

The operating cash flow to sales ratio is assessed. If the relevant accounting data is available, return on equity is also assessed, i.e. the ratio of profits (cash flow minus depreciation) to invested equity capital.

Scoring

Cash flow to sales ratio: 20% = 100 points / 10% = 67 points / 0% = 0 points

Return on equity: 5% = 100 points / 0% = 0 points

If both figures can be calculated and awarded a score, the average score is taken.

The benchmark scores may be adjusted at regional level.

Stability

Sustainability goal

The farm is financially stable. This means that it is regularly able to break even over a period of several years with a normal level of household consumption, and that the long-term future of production on the farm is secure.

Content

The farm has several strings to its bow, maintains a modern infrastructure and is thus not wholly dependent on market price trends or individual customers. Guaranteed land access means that it is possible to plan and ensure the continuation of production on a long-term basis, whilst a high equity ratio allows the farmer to make their own decisions about how the business evolves.

Scoring

100 points = the farm's infrastructure is in good condition, the farm has several customers in all of its key areas of activity, its main income source accounts for less than 20% of total business revenue (no concentration risk), long-term access to all land is guaranteed and it has a high equity ratio.

Indebtedness

Sustainability goal

The farm's level of indebtedness is not problematic and is in keeping with its financial resources. There is leeway for it to take on more debt if necessary, e.g. to see it through a period when it is short of funds.

Content

Debt-to-equity ratio: gearing is calculated as the ratio between net debt and operating cash flow. This allows a figure to be calculated for the number of years that would be required to fully repay the farm's debts with its current cash flow.

Short-term debt service coverage ratio: this is the ratio between mandatory debt service (interest and mandatory amortization) and cash flow. It expresses the percentage of cash flow that is currently used to service debts and whether there is any leeway to take on more debt in the short term, e.g. to get through a period when the market is unfavorable or to make investments.

The indicator score is calculated as the average of the two components.

Scoring

Debt-to-equity ratio: 100 points if the farm would require 5 years to repay its debts with its operating cash flow / 0 points for 20 years.

Debt service coverage ratio: 100 points for 0% debt service coverage ratio / 67 points for 50% / 0 points if 100% of cash flow is used to service debts.

These thresholds may be adjusted at regional level. The indicator score is the average of the two components.

Livelihood security

Sustainability goal

The farm's income is sufficient to secure the economic livelihood of the household (family members who are not paid a wage).

Content

An evaluation is made of the ratio between private spending and a corrected minimum subsistence level. The minimum subsistence level is corrected for the size of the farmer's family and any payments in kind received by the farm are deducted. The private spending of family members who are not paid a wage (farmer's family) should clearly exceed the minimum subsistence level.

Scoring

Between 34 and a maximum of 66 points may be awarded for household spending amounting to between 100% and 200% of the poverty line (amber, critical). If household income is between two and a maximum of three times higher than the poverty line, the farm is awarded between 67 and a maximum of 100 points (green, sustainable).

Farm management

It may be perfectly viable to run a farm using traditional methods, even over the longer term. However, changes will need to be made if a poorly designed management process coincides with manifestly unresolved challenges. Where this occurs, it is necessary to modify the farm's strategy by implementing measures that incorporate sustainability into management systems, processes and culture.

Sustainable farm management

pursues goals and strategies that are in tune with the stakeholders' personal values and take into account the natural limitations of people, animals, the environment, finances and society;

has access to the knowledge needed to make informed decisions;

regularly assesses internal and external risks so that proactive measures can be taken and resources can be employed productively, safely and profitably;

cultivates sustainable relationships, ensuring that dealings with people and stakeholders both on and off the farm are characterized by respect and fairness.

Business goals, strategy, implementation

Sustainability goal

The people responsible for managing the farm consciously set goals, develop strategies to deliver these goals and implement the relevant measures. In this context, "conscious" means compatible with people's personal values and the conditions on and around the farm. The chosen strategy should have a positive impact on economic, social and environmental sustainability.

Content

This indicator covers both the rational (planning and forecasting) and subjective (values) aspecs of the farmer's strategic development process. The goals, strategy and implementation challenges are analyzed and the business objectives are checked for compatibility with sustainability goals.

Scoring

100 points = The farmer has well thought-out goals and an appropriate strategy for the farm and implements them systematically. These aspects are evaluated both by the farmer (satisfaction with how he/she manages the farm) and the extension agent (how complete and well thought-out the strategy is and how successfully it is implemented). The strategy is also assessed in terms of how holistic it is, i.e. whether it takes social and environmental aspects into account as well as economic aspects.

Availability of information

Sustainability goal

Where necessary, the people responsible for managing the farm have access to adequate information and reliable planning tools so that they are able to manage the farm systematically and professionally.

Content

An assessment is made of whether the farm has access to adequate information and the reliable planning tools needed to manage the farm systematically and whether these are actually used if required.

Scoring

100 points = The farmer has access to all the necessary information and reliable planning tools and employs them as and when required in order to facilitate sustainable farm management.

Risk management

Sustainability goal

The people responsible for managing the farm are aware of the risks and dependencies that could pose a threat to the farm's livelihood. They do everything in their power to minimize these risks.

Content

This indicator assesses how the people responsible for managing the farm deal with risks that pose a threat to its livelihood. An assessment is made of how much room for maneuver the farm management has internally, particularly in terms of risk prevention but also in terms of minimizing the negative impacts of any adverse events. The implementation of quality assurance measures is key to guaranteeing healthy and marketable produce.

Scoring

100 points = All risks posing a threat to the farm's livelihood are known and adequate measures are in place to protect against them.

Resilient relationships

Sustainability goal

The farm's internal and external relationships are managed in such a way as to provide a sound basis for its long-term success. The farm cooperates with colleagues and neighbours wherever it makes sense to do so. Conflicts are resolved by consensus and not by coercion.

Content

The stability of the farm's internal and external relationships and partnerships is assessed.

Scoring

100 points = Stable relationships are successfully cultivated on and off the farm and provide a sound basis for its success. The farm engages in sensible, productive cooperation with other farms and individuals. Conflicts on or involving the farm are solved by consensus rather than through coercion.