This manual is part of:

Ecological Recycling Agriculture
Vol. I Farming Guidelines
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BERAS implementation
Baltic Ecological Recycling Agriculture and Society

The software is also available at:
www.zalf.de/de/forschung/institute/lse/downloads/Seiten/oekolandbau.aspx

Why it matters

Forage legumes (e.g. clovers and alfalfa cultivated on arable fields and grasslands) build up soil fertility and therefore play a key role in crop rotations of ERA farms. Among other benefits legumes fix nitrogen (N) from the atmosphere which is available to current and subsequent crops. Moreover they provide a highly nutritious fodder for ruminants which, when their manure is recycled, also enriches the soil.

Why field estimations?

The amount of N fixed is dependent on the total yield and the percentage of legumes in the forage mixture [1, 5]. To assess the nutrient status of a rotation and to calculate N budgets a good estimation of the legume percentage is essential. This estimation needs to be conducted in the field at harvesting time. It cannot be estimated from the seed mixture [5]. Being able to accurately calculate the proportion of legumes in forages is important because this is one of the variables used in the N budget calculator. A more accurate estimation of the legume proportion will give a more accurate calculation of N fixation and N budgets.

Who can use it?

This learning tool is for farmers and advisors. It allows them to practice and improve their skills in estimating the legume percentage in legume-grass mixtures of arable and permanent grassland systems, an important variable in N budget calculations.

How it works

The Legume estimation trainer contains two sets of pictures to choose from – one of arable forage and one of permanent grassland. They show various legume-grass mixtures at different stages of maturity and the corresponding legume percentages. The data accompanying each photo are based on the results from scientific field experiments and nutrient analysis.

What kind of data is presented?

The computer based tool generates pictures randomly and allows the user to estimate the legume percentage of the dry matter yield by choosing one of the classes of percentages.

User interface

The user interface in the web-browser shows the legume-grass picture and options to estimate the legume percentage and additional information.

Estimate the legume proportion (%) in the mixture

How to use the tool

The Legume estimation trainer can be used with all standard web-browsers and can be started without any prior software skills or installations.

Minimum software requirements

Web-browser e.g. Mozilla Firefox, Windows Internet Explorer

Practice your legume estimation skills in 5 steps

- Open the file 'start' (it will appear in your web-browser)
- Choose between 'arable forage' and 'permanent grassland' and the training will start
- Study the first picture on your screen and read the information on yield below
- Estimate the legume percentage by pressing one of the buttons showing percentages
- If your estimation was correct, the exact percentage will be shown and you can press "next picture"; if not please estimate again.

Your estimation skills will improve with practice, so train regularly and monitor your rate of success. **Enjoy the training!**

Monitor your training!

- Estimate 100 pictures and note the no. of errors.
- Repeat this three times and compare the results to check your progress.
- Train until you have less than 20 errors – if you like!

Application of your estimation skills

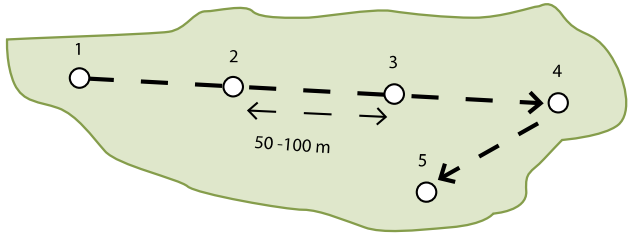
After the training, your estimation skills will be good enough to estimate the legume percentage in the field. To get a very rough estimation, you can estimate from the tractor or harvester at the time of harvesting. If time allows, a more precise estimation, at least on a few fields, is recommended. This can be done by a quick transect walk through the field.

How to estimate in the field (after the training)

How to carry out a transect walk?

- Use a record book for documenting all data during the field walk
- Walk diagonally through the field (transect)
- Take one sample every 50-100 m (avoid field margins)
- 5 samples for fields with little variation in legume percentage
- 10 samples for fields with high variation in legume percentage
- Estimate one square meter per sample (use a frame or sticks to mark the borders)
- Write the percentage for each sample in the record book and calculate the average
- Estimation should be repeated throughout each season since the percentage may vary between fields and cuts and from year to year

Estimation of the legume percentage in the field (more precise estimation)



Average legume percentage in the field

Sample	%
1	40
2	25
3	20
4	45
5	60
Average	**38**

Estimation of the legume percentage from the tractor (rough estimation)

Test your estimation skills by yourself

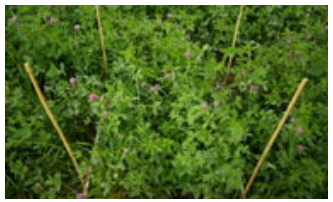
Equipment: 0.5 m² frame made of sticks and a kitchen scale

- Note your estimation on paper and cut the samples (0.5 m²)
- Sort the shoots into legumes and non-legumes
- Weigh the legume shoots and all shoots; and calculate:
  Legume percentage (%) = legume shoots (g) * 100 / all shoots (g)

This can be a group exercise with farmers facilitated by the advisor

Samples of arable forage

(Photos: ZALF)

Classification		
1-20 %	 11% Legumes / 4.2 t/ha DM / 51 cm	 4% Legumes / 4.4 t/ha DM / 47 cm
21-40 %	 37% Legumes / 2.6 t/ha DM / 37 cm	 22% Legumes / 3.8 t/ha DM / 53 cm
41-60 %	 59% Legumes / 3.1 t/ha DM / 51 cm	 48% Legumes / 3.7 t/ha DM / 42 cm
61-80 %	 78% Legumes / 2.7 t/ha DM / 42.6 cm	 73% Legumes / 3 t/ha DM / 46.4 cm
> 81 %	 94% Legumes / 2.1 t/ha DM / 24 cm	 80% Legumes / 2 t/ha DM / 39 cm

Samples of permanent grassland

(Photos: ZALF and Engel, Aulendorf)

		Classification
 4 % Legumes / 4.2 t/ha DM / 30 cm	 5 % Legumes / 2.8 t/ha DM / 45 cm	< 6 %
 11 % Legumes / 2.2 t/ha DM / 37 cm	 18 % Legumes / 3 t/ha DM / 27 cm	6-20 %
 25 % Legumes / 1.7 t/ha DM / 33 cm	 35 % Legumes / 2.9 t/ha DM / 29 cm	21-40 %
 45% Legumes / 3.6 t/ha DM / 60 cm	 51 % Legumes / 2.1 t/ha DM / 25 cm	> 40%

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The Leibniz Centre for Agricultural Landscape Research (ZALF) in Germany explores ecosystems in agricultural landscapes and develops ecologically and economically tenable land use systems while taking into account societal demands. The Institute of Land Use Systems focuses on the assessment and further development of sustainable farming systems, including organic farming.
www.zalf.de

Södertörn University in Sweden is lead partner of the EU project BERAS Implementation. The University conducts education and research to develop and disseminate knowledge on how human activities affect the natural world, as well as how to create the right conditions for environmental, social and economic sustainable development.

The Biodynamic Research Institute in Sweden works with long term on-farm studies to develop ecological and biodynamic agriculture for Nordic conditions with a focus on soil fertility, the environment and food quality.

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Photographers

PURPOSE

The environment of the Baltic Sea is endangered. Input of plant nutrients from highly intensive and specialized agriculture are a main source. BERAS Implementation can solve this problem through a systemic shift to Ecological Recycling Agriculture in association with the whole food chain from farmer to consumer.

WHO CAN USE THE GUIDELINES?

The guidelines will help farmers and advisers to practice and develop Ecological Recycling Agriculture. This type of agriculture will improve the environmental conditions of the Baltic Sea. They can be equally used for educational purposes, by decision makers and by politicians.

CONTENTS

The guidelines consist of four books that cover the following topics:

The Farming Guidelines give basic practical recommendations for implementing ERA and present proven agronomic measures and optimization strategies for effective nutrient recycling within the farm and between different farm types during and after conversion. Included are Software Tools that help to assess and improve sustainable crop rotation planning and nitrogen fluxes on a farm level.

The Economic Guidelines give advice and support to farmers how to plan the conversion process and highlight how the changes to ERA farming will affect farm economy.

In the Marketing Guidelines farmers can find support and ideas on how to more effectively promote and sell organic and ERA products.

The Farm Examples provide a personal presentation of different farms around the Baltic Sea, mainly farms in conversion to ERA, their challenges and future plans.

The books are available at www.beras.eu in digital form.

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