Bern University
of Applied Sciences

STEP-BY-STEP TO FILL THE GAPS ALONG THE PATH TO SUSTAINABILITY

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Agriculture at a crossroads

- 2.65 billion tons of grain were harvested worldwide in 2018, more than ever before
- over 800 million people are starving

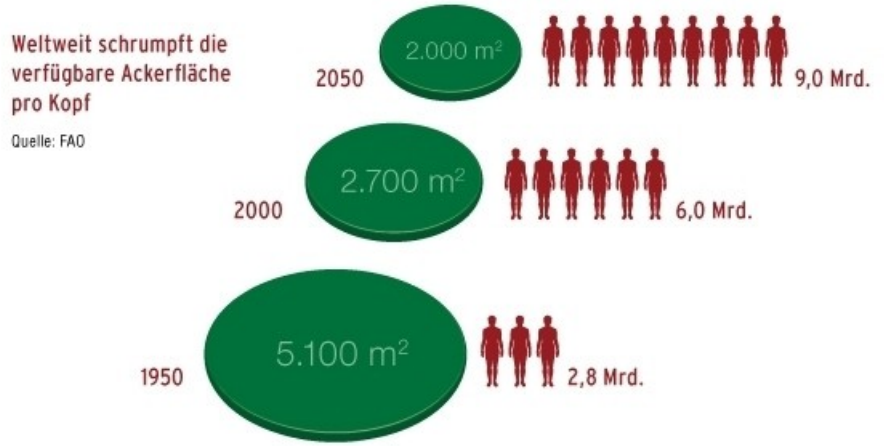
Source: steuer-gegenarmut.com

Source: reve24.de

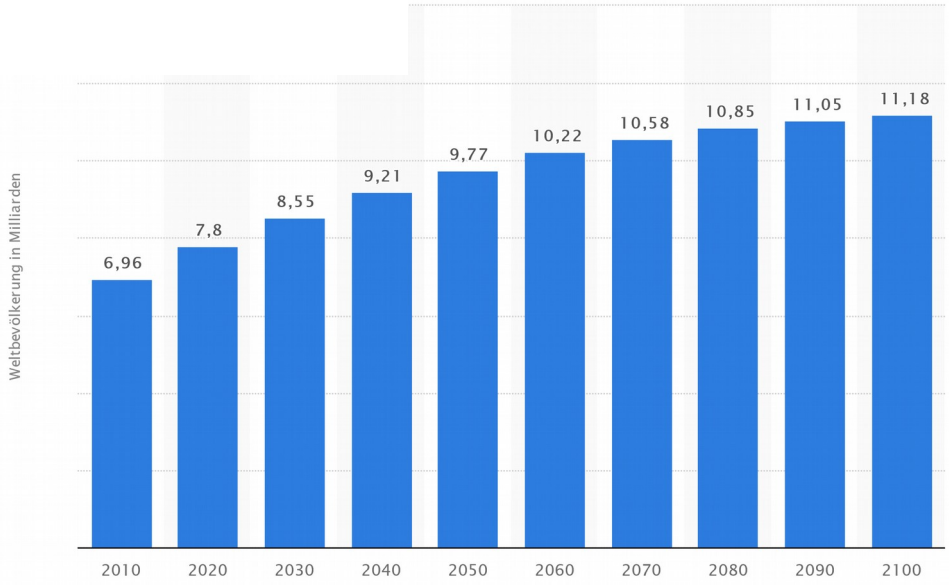
- On the other hand, around 1.9 billion people are overweight
- Only 40 per cent of the produced food is used as food, the rest is processed into animal feed, fuel and industrial raw materials (Weltagrarbericht 2019)

The world population is growing .....

..... and the available arable land shrinks!



Source: www.bdp-online.de



Source: https://de.statista.com

Challenges in agriculture and food industry

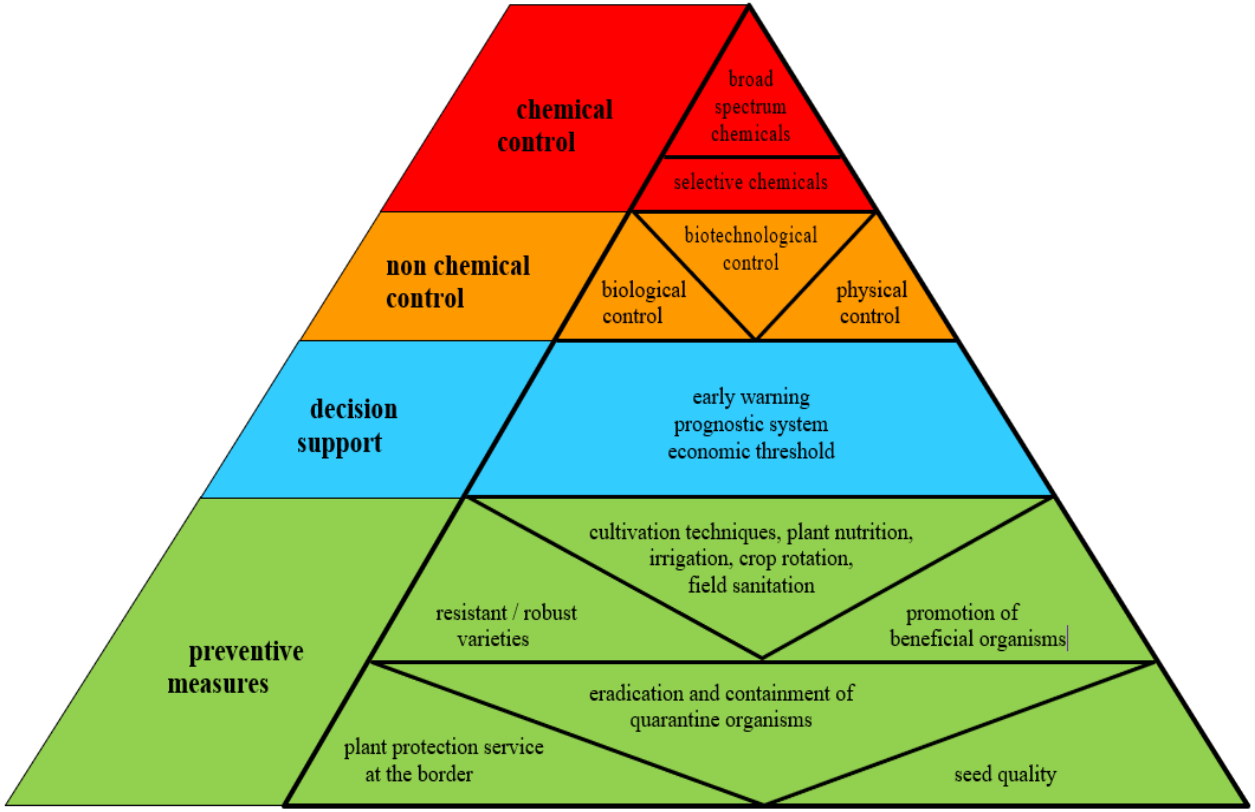
- Agricultural production will have to increase by around 50 per cent over 2013 levels to meet this demand (FAO 2017)
- Pressure on the soil is increasing
  - the crop rotation areas are decreasing and the pressure on the remaining areas is increasing
- Global trend towards specialisation
- Farming systems are simplified to the extent of becoming monocultures
- Food loss and food waste

  - **Today, natural resources are not used sustainably by agriculture**
- Water becomes a matter of survival

In future: More food needs to be produced from a smaller land area in a sustainable way!

Possible sustainable alternatives

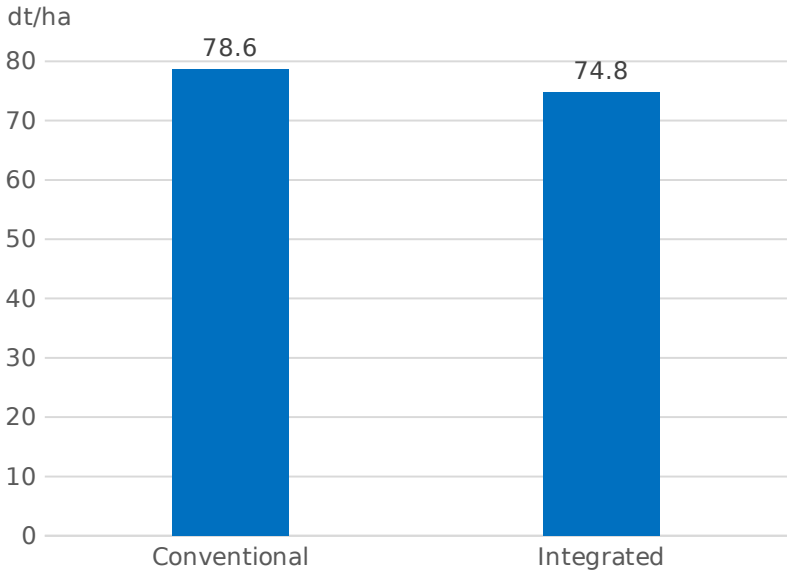
Consistent integrated farming

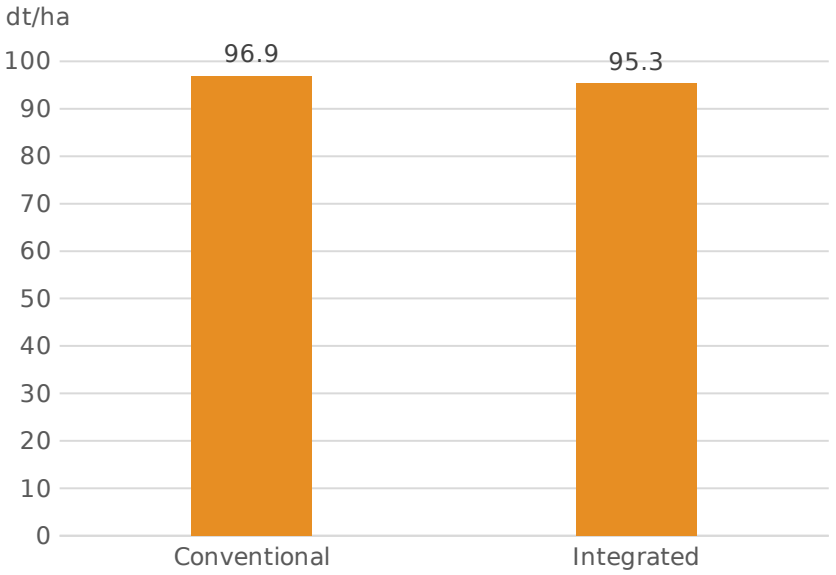


Source: Federal Office for Agriculture, Switzerland

Possible sustainable alternatives

Consistent integrated farming – 2 examples





Winter wheat 2018 – trials on 13 farms
Conventional: 2-3 fungicides
Integrated: 0-1 fungicide

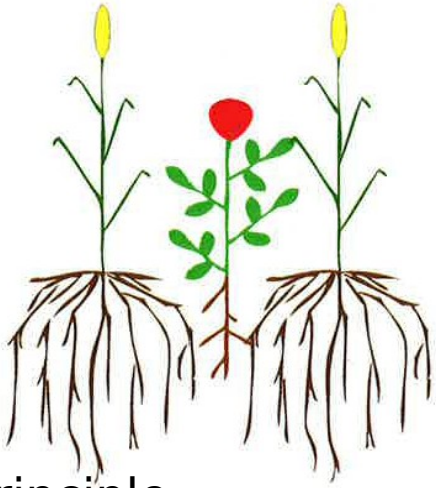
Winter barley 2019 – block trials with 4 replications on 2 locations
Conventional: 2 fungicides
Integrated: 1 fungicide

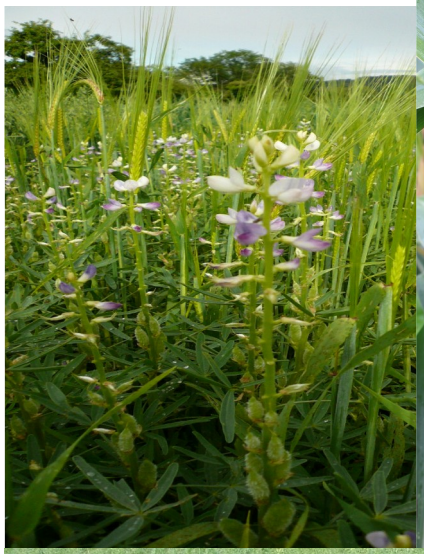
Due to the lower input costs, the integrated system is economically equal or even better

Possible sustainable alternatives

Intercropping

Examples
Peas – barley
Peas – camelina
Lupins – cereals
Corn - runner beans





Principle:
Supplementary use of water, nutrients (roots), and convertible energy (above ground)

- **LER (land equivalent ratio) > 1**

Possible sustainable alternatives

Intercropping – Cereal/lupin mixtures

Relative yields and LER					
Procedure	**Yield (dt/ha)**		**Relative yield**		
	Lupin	**Partner**	**Lupin**	**Partner**	**LER**
Boruta	18.92		1		1
Boruta/SO 395-12	9.08	26.89	0.48	0.63	1.11
Boruta/SO Buggy	10.00	17.98	0.53	0.45	0.98
Boruta/ST Trado	16.96	5.10	0.90	0.24	1.13
Boruta/WT Arti 8	18.17	6.04	0.96	0.29	1.25
Boruta/Red fescue	20.89	0.00	1.10		1.10
SO 395-12		42.86		1	1
SO Buggy		39.84		1	1
ST Trado		21.53		1	1
WT Arti 8		21.07		1	1

Relative yields and analysis of the land equivalent raio (LER) of the different mixed crops with the blue lupin, 2016 Rümikon CH

SO = summer oat, ST = summer triticale, WT = winter triticale (“change triticale”)

Possible sustainable alternatives

Intercropping – Relay intercropping

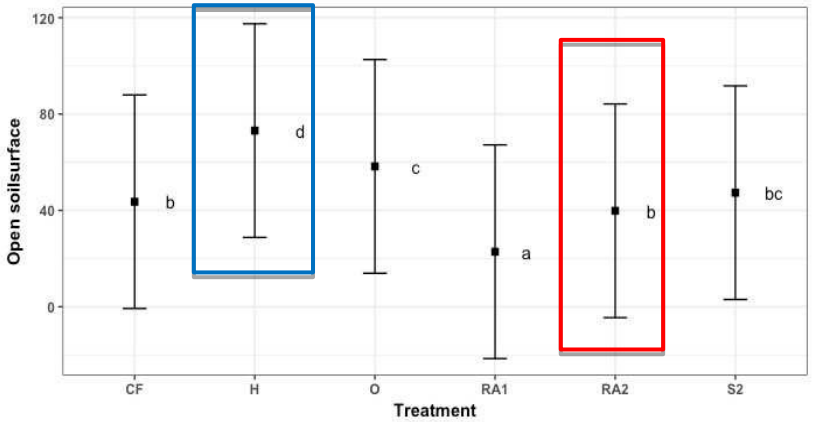
One special form of mixed planting is the procedure of *relay intercropping*, where crops are not only mixed in the field, but one is sown later than the other.

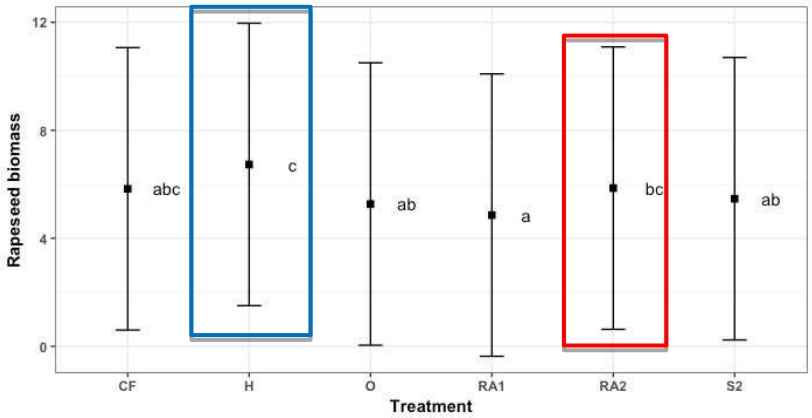
Possible sustainable alternatives

Undersowing – oilseed rape

Possible sustainable alternatives

Undersowing – oilseed rape

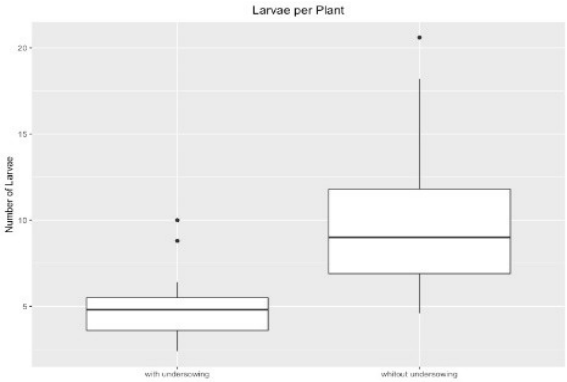




Bare soil surface in percent 30 days after sowing of the oilseed rape. (left) and oilseed rape biomass production in the spring (right). Control of herbicide (H) and zero (O) in comparison with several undersowing mixtures. Results from 4 experimental years. Superscripts mark statistically significant differences ($p < 0.05$)

Positive side effect

Number of cabbage-stem flea beetle larvae per rape plant in spring 2019 in the procedures with and without undersowing. With under-sowing, lower numbers of larvae are statistically significant (p 0.0003865).



Possible sustainable alternatives

Contract farming, solidarity agriculture

The consumer has moved far away from the production of food. He no longer understands what is needed to produce a qualitatively sufficient and healthy food as environmentally friendly as possible.

- **we have to bring the consumer closer to food production again**

One way to bring the consumer again closer to production is contract farming or solidarity agriculture.

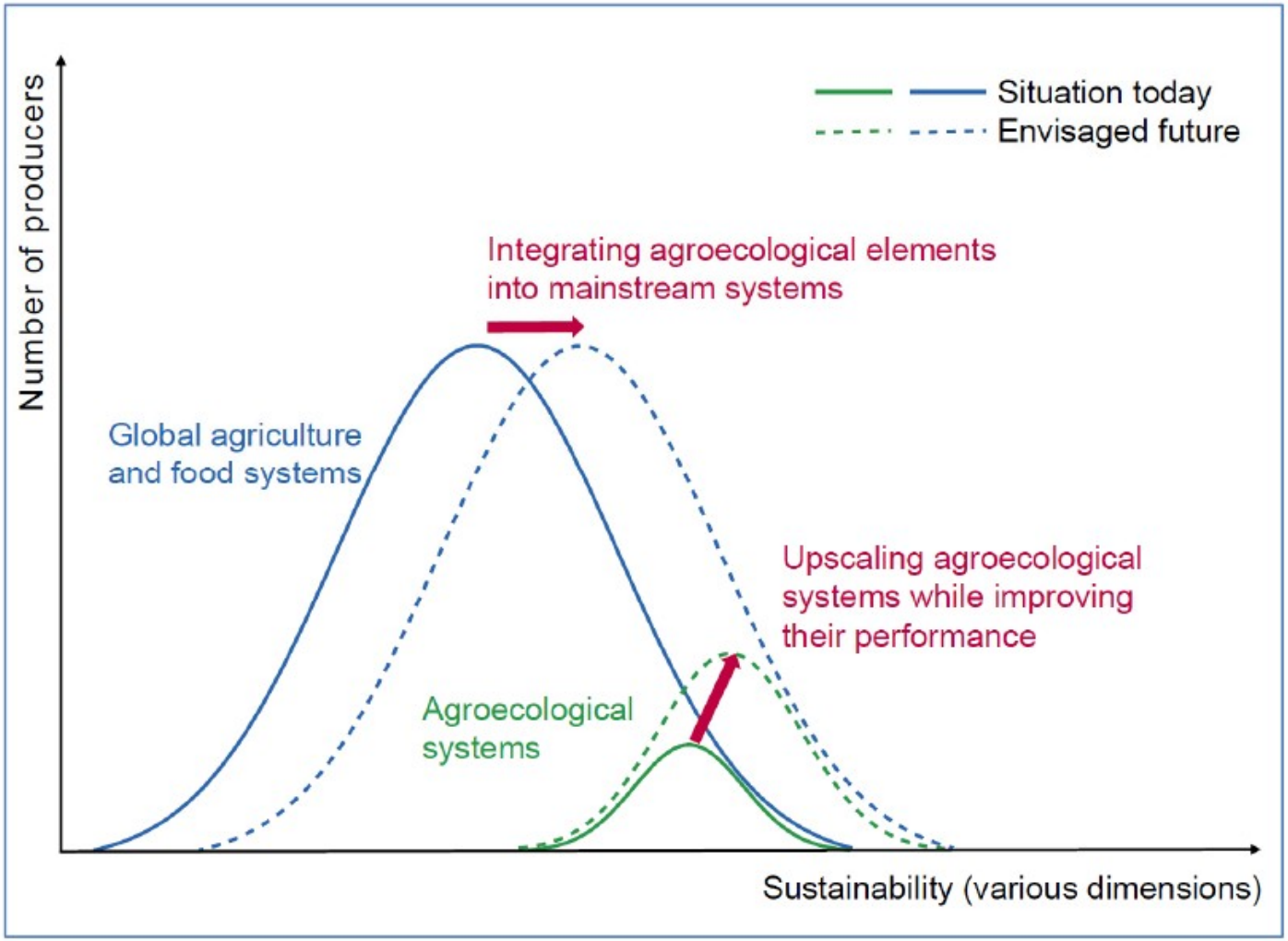
The consumer is responsible for the maintenance works (e.g. weeding) and the harvest. Conclusion: the consumer learns what is behind the production of food, learns to appreciate the food again, rethinks its quality standards and is willing to pay an adjusted fair price for the food.

Conclusion

- Agriculture and the food industry face challenges that must be confronted vigorously
- One approach could be the integration of agroecological elements in mainstream farming systems (e.g. integrated production, intercropping)
- Another key approach is the upscaling of agroecological farming systems such as strict organic farming and permaculture/agroforestry
- Rapid changes in agri-food systems require effective national and international governance ▭ governments would also have to play their part in promoting of sustainable approaches
- One more very important factor is ourselves – consumers
  - ▭ reduce food waste – “nose to tail”
  - ▭ higher proportion of plant-based foods
  - ▭ fair and appropriate price for our food
- The challenge for research is to develop farming systems suited to regional conditions that are more productive and at the same time resource-efficient.

Conclusion

STEP-BY-STEP!



Source: Swiss national FAO Committee CNS-FAO

Thank you
for your attention!