

Cover Crops: Their Role in Climate Change Mitigation and Practical Application

Zwischenfrüchte: Ihre Rolle beim Klimaschutz und ihre praktische Anwendung



Agenda

1. **Research Results on Cover Crops and Their Characteristics**
Werner Vogt-Kaute (Naturland e.V.)
2. **Enhancing Soil Health and Carbon Sequestration with Cover Crops: Principles and Practice**
Robert Leskovšek (KIS – Agricultural Institute of Slovenia)
3. **Use of Cover Crops in Practice – Experiences from Poland and Austria**
Monika Styczek, Poland
Alois Gimplinger, Austria

Improving C-balances on organic farms for the sequestration of atmospheric carbon

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Best practices for improving carbon balance:

- Cover crops
- Clover/alfalfa
- Grain legumes
- Compost (green and biowaste)
- Manure (biogas plant)
- Agroforestry



Project outcomes:

- On-farm trials on arable farms, horticulture, fruit, berries, vineyards
- Field days
- Online events
- Study trips
- C-calculation

Improving C-balances on organic farms for the sequestration of atmospheric carbon

Organic agriculture is especially suitable for a positive CO₂ balances because synthetic fertilizers with a very negative balance are not used.



Some methods are easy to apply for farmers (cover crops), others are intended for long term implementation (agroforestry).

One of our most important activities is the cultivation of cover crops like clover, clover gras, alfalfa.

During the cultivation, the period without disturbance e.g. tillage is longer and the rooting is very intensive.

Roots play a more and more important role in research concerning humus.

In Bavarian long term research results the production of clover and the reduction of intensive crops (maize, sugar beets, potatoes) were the main factors for higher contents of humus in organic farms compared to conventional farms. These were the only significant factors.



A rotation plan for an organic farm has to include planning cover crops.
Cover crops have an important role to reduce N losses.
Nitrogen is often a limiting factor for humus increase organic matter in soil.
Winter hard cover crops can remain on field for a longer time and therefore are more effective.

Our cover crops matrix shows some criteria of the most important cover crops on two pages.



Important cover crops and their main characteristics

	English	Scientific Name	Juvenile development	Biomass production	Nitrogen fixation	High C:N ratio	Feed utilisation	Winter hardiness	Drought tolerance	Late sowing tolerance	Undersown tolerance	Average sowing rate kg pure seed	Price in EUR /kg *	Additional Notes
Legumes	Berseem clover	<i>Trifolium alexandrinum</i>	Green	Green	Green	Yellow	Green	Green	Orange	Yellow	Green	30	4,10	Warmth and moisture for rapid juvenile development
	Bird's foot clover	<i>Ornithopus sativus</i>	Yellow	Green	Green	Yellow	Green	Green	Green	Green	Green	35	4,30	Suitable on sandy soils
	Black medic	<i>Medicago lupulina</i>	Yellow	Green	Green	Yellow	Green	Green	Green	Green	Green	15	10,30	
	Common vetch	<i>Vicia sativa</i>	Green	Green	Green	Orange	Green	Green	Green	Green	Orange	120	2,20	avoid seed dispersal
	Crimson clover	<i>Trifolium incarnatus</i>	Yellow	Green	Green	Yellow	Green	Green	Green	Green	Green	25	4,00	
	Faba bean	<i>Vicia faba</i>	Green	Green	Green	Yellow	Green	Yellow	Orange	Yellow	Orange	200	1,40	Supporting crop
	Forage pea	<i>Pisum sativum</i>	Green	Green	Green	Yellow	Green	Yellow	Yellow	Yellow	Orange	120	1,55	Optimum pH: 6.2-7, highly susceptible to lodging
	Grass pea	<i>Lathyrus sativus</i>	Green	Green	Green	Yellow	Green	Yellow	Green	Yellow	Orange	120	2,90	Strong root development
	Hairy vetch	<i>Vicia villosa</i>	Yellow	Green	Green	Orange	Green	Green	Green	Green	Orange	60	3,40	Avoid seed dispersal, seed dormancy, heat tolerant, slow establishment
	Hungarian vetch	<i>Vicia pannonica</i>	Yellow	Green	Green	Orange	Green	Green	Green	Green	Orange	60	2,70	pH values above 6 favourable, avoid seed dispersal
	Lentil	<i>Lens culinaris/Lens nigricans/Vicia ervilia</i>	Orange	Green	Green	Yellow	Green	Green	Green	Green	Yellow	75	4,90	Suitable for shallow and stony soils
	Lupins (yellow, blue, white)	<i>Lupinus luteus, angustifolius, albus</i>	Green	Green	Green	Yellow	Green	Green	Green	Green	Orange	120	1,70	Low pH values, phosphorus mobilisation, reduced soil erosion, favourable for soil fertility
	Persian clover	<i>Trifolium resupindum</i>	Green	Green	Green	Orange	Green	Green	Green	Yellow	Green	15	6,50	Not on acidic soils
	Purple vetch	<i>Vicia bengalesis</i>	Yellow	Green	Green	Orange	Green	Green	Green	Green	Orange	35	n.a.	Heat tolerant, reduced soil erosion, heavy and wet soil tolerant, avoid seed dispersal
	Squarrose clover	<i>Trifolium squarrosum</i>	Green	Green	Green	Yellow	Green	Green	Green	Yellow	Green	30	2,70	Resistant to low temperatures, allelopathic plant - may limit the growth of other plants
	Subterranean clover	<i>Trifolium subterraneum</i>	Yellow	Green	Green	Yellow	Green	Green	Green	Green	Green	15	6,90	
White clover	<i>Trifolium repens</i>	Yellow	Green	Green	Yellow	Green	Green	Green	Green	Green	12	11,70	Persistent after first year, can be invasive	
Poaceae	Black oat	<i>Avena strigosa</i>	Green	Green	Orange	Green	Green	Green	Green	Green	Yellow	110	2,60	All soil types, even with low pH values
	Proso millet/Foxtail millet	<i>Panicum milliaceum, Seteria italicum</i>	Orange	Green	Orange	Green	Green	Orange	Green	Yellow	Green	20	2,50	
	Sudan grass/Sorghum millet	<i>Sorghum sudanese Sorghum bicolor</i>	Yellow	Green	Orange	Green	Green	Orange	Green	Yellow	Green	25	3,50	Heat tolerant
	Winter rye	<i>Secale cereale</i>	Green	Green	Orange	Yellow	Green	Green	Green	Green	Orange	120	1,10	

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Asteraceae	Marigold	<i>Tagetes</i>	High	Medium	High	High	High	High	High	High	High	8	76,00	Combating <i>Pratylenchus</i> with good root penetration
	Niger	<i>Guizotia abyssinicum</i>	High	High	High	High	High	High	High	High	High	10	2,70	Seed should be free from clover dodder (<i>Cuscuta epithymum</i>), susceptible to <i>Rhizoctonia</i> and <i>Sclerotinia</i>
	Safflower	<i>Carthamus</i>	High	High	High	High	High	High	High	High	High	24	11,00	Salt tolerant, pH values above 6 favourable
	Sunflower	<i>Helianthus</i>	High	High	High	High	High	High	High	High	High	12	3,50	High water demand, <i>Sclerotinia</i> propagator, stems must be chopped
Brassicaceae	Brown mustard	<i>Sinapis juncea</i>	High	High	High	High	High	High	High	High	High	8	3,80	
	Camelina	<i>Camelina sativa</i>	High	High	High	High	High	High	High	High	High	10	2,90	Prefers medium-heavy soils
	Forage radish	<i>Raphanus sativus</i>	High	High	High	High	High	High	High	High	High	24	4,10	Nematode-resistant varieties available, avoid seed dispersal, reduces weed growth, quick nitrogen release
	Peppergras	<i>Lepidium sativum</i>	High	High	High	High	High	High	High	High	High	8	7,10	Not in crop rotation with sugar beet and rapeseed
	Spring forage rapeseed/spring turnip rape	<i>Brassica napus, Brassica napa</i>	High	High	High	High	High	High	High	High	High	15	2,80	
	White mustard	<i>Sinapis alba</i>	High	High	High	High	High	High	High	High	High	8	2,60	Nematode-resistant varieties available
	Winter forage rapeseed / winter turnip rape	<i>Brassica napus, Brassica napa</i>	High	High	High	High	High	High	High	High	High	12	2,60	
Other	Buckwheat	<i>Fagopyrum</i>	High	High	High	High	High	High	High	High	High	60	1,80	Phosphorus mobilisation, avoid seed dispersal, used as phytosanitary plant
	Hemp	<i>Canabis</i>	High	High	High	High	High	High	High	High	High	25	7,90	Be aware of THC levels
	Linseed	<i>Linum</i>	High	High	High	High	High	High	High	High	High	50	4,10	Cultivation intervals of at least 10 years
	Mellow	<i>Malva</i>	High	High	High	High	High	High	High	High	High	10	11,80	Avoid seed dispersal, seed dormancy
	Phacelia	<i>Phacelia tanacetifolia</i>	High	High	High	High	High	High	High	High	High	10	4,70	Not in crop rotation with potatoes, promotes corky ringspot

Very dark green	very high/good/accurate/favourable
Dark green	high
Light green	medium
Yellow	low
Orange	very low/poor/not applicable/expensive

* Prices are researched and verified for German market Oct 2025, referenced with market association of Naturland farms (Hohenkammern). Prices refer to organic seeds, if available. <https://marktgesellschaft.de>

Source: Choosing and managing cover crops in organic agricultural systems, <https://itab.bio/recherche?search=Cahier%20Couverts>

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Thank you!
Danke!