

Forage Radish Cover Crop: The Cream of Cover Crop for Sustainable Vegetable Production

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A cover crop is a type of crop that is grown primarily for the purpose of improving the quality and health of the soil rather than for harvesting and selling as a cash crop. Cover crops are typically planted in between periods when the main cash crop is not growing such as during the fallow season, fall/winter, or early spring. They are an integral part of sustainable and regenerative agricultural practices and offer numerous benefits to soil and overall farming systems. Cover crops are an essential tool in sustainable agriculture, promoting soil health, reducing erosion, enhancing bio-diversity, reducing pests and diseases, controlling weeds, increasing water and nutrient availability, improving crop yields and sequestering carbon dioxide from the atmosphere, aiding in climate change mitigation by storing carbon in the soil. Cover crops can be leguminous or non-leguminous. Leguminous species suitable for use as cover crops are purple vetch (*V. Benghalensis* L.), hairy vetch (*Vicia villosa* Roth), crimson clover (*Trifolium incarnatum* L.), crown vetch (*Coronilla varia* L.), sweet clover (*Melilotus* spp.), lupines (*Lupinus* spp.) and Austrian winter pea [*Pisum sativum* var. *arvense* (L.) Poiret].

Legume cover crops such as clovers, vetch, peas, and beans have the ability to fix nitrogen for future crops, typically between 50-150 pounds per acre, depending on the growing environment. Legumes can decrease the need for nitrogen fertilizer inputs, but they are not efficient at absorbing excess nitrogen remaining after growing cash crops. Legumes aid in erosion prevention, promote beneficial insects and pollinators, and contribute to soil organic matter accumulation, although to a lesser extent than grasses. Legumes vary in their productivity and ability to survive in different soil and climatic conditions.

Non-leguminous cereal cover crop species include rye (*Secale cereale* L.), oat (*Avena sativa* L.), annual ryegrass (*Lolium multiflorum* Lam.), barley

(*Hordium vulgare* L.), timothy (*Phleum pratense* L.) and wheat (*Triticum aestivum* L.). Apart from the above, several brassica species, like mustard [*Brassica juncea* (L.) Czerniak], turnip (*B. Rapa* L.), canola (*B. Napus* L.), and radish (*Raphanus sativus* L.) also grow as winter cover crop. The selection of cover crop species should be determined by their suitability to the specific climate, soil characteristics, and the particular cash crop being grown.

Characteristics of Forage or Tillage Radish

Forage radish, also known as Daikon or Tillage radish, is a specific variety of cover crop that belongs to the radish family (*Raphanus sativus* L. var. *Longipinnatus*). It is an annual cool-season cover crop. Unlike traditional radishes that are grown for human consumption, forage radishes are primarily grown as cover crops and are known for their robust taproot system, which makes them valuable for various soil improvement purposes. It is valued for its unique characteristics and its ability to improve soil health and structure. It is typically planted in late summer or early fall and allowed to grow through the fall and winter months in temperate climates. In colder regions, forage radishes may winterkill, leaving behind the decaying roots to provide organic matter in the spring. In warmer climates, they may need to be terminated mechanically or with herbicides before planting the main cash crop. Overall, forage radish cover crops are a valuable tool in sustainable and regenerative agriculture, particularly for addressing soil compaction and nutrient management issues. Their deep roots and ability to scavenge nutrients and improve soil structure make them a popular choice for farmers looking to enhance soil health and crop productivity. The primary cash crop being grown and the farmer's objectives determine which cover crop is best. Forage radish (*Raphanus sativus* var. *longipinnatus*), is gaining popularity as a cover crop

in sustainable vegetable production systems due to its numerous benefits for soil health and overall sustainability.

Some key characteristics and benefits of forage radish cover crops are as follows

Soil Health Benefits

1. **Soil Structure Improvement:** Forage radishes are known for their large and deep taproots, which can penetrate compacted or hardpan layers of soil. This tap root can extend several feet into the soil, effectively breaking up soil compaction and improving soil aeration and drainage. This enhances water infiltration, root penetration, and overall soil aeration. The deep taproots of forage radishes help to improve soil structure by creating channels (bio-drill) for air and water to penetrate deep into the soil. This can enhance the root growth of subsequent cash crops.



Fig. 1 Channels created by forage radish roots



Fig. 2 Deep taproots of forage radish

2. **Erosion Control:** The dense foliage of forage radish provides effective ground cover, reducing soil erosion caused by wind and water. This is especially beneficial during the winter months when fields would otherwise be bare. Their dense foliage and root systems help to stabilize the soil, preventing it from being washed away.

Fig. 3 Dense foliage and deep tap root of forage radish or tillage radish cover crop



3. **Organic Matter Addition:** Forage radish adds significant biomass to the soil when incorporated, increasing organic matter content. As forage radishes grow and later decompose, they add organic matter to the soil. This boosts soil fertility, and water-holding capacity, and promotes microbial activity.
4. **Nutrient Scavenging and Nutrient Cycling:** The deep roots of forage radish can access nutrients from deeper soil layers, making them available for subsequent crops when the radish residues decompose. This reduces the need for synthetic fertilizers and enhances nutrient cycling. Forage radishes take up nutrients from the soil, which can help reduce nutrient runoff and leaching, making them useful in nutrient management strategies. After the radishes die and decompose, these nutrients become available to other plants.

Weed Suppression

1. **Weed Suppression:** The dense foliage of forage radishes grows rapidly and shades the soil, outcompeting weeds for nutrients, light, and space. This natural weed-suppressing ability can reduce the need for herbicides and manual weed control.

Nutrient Management

1. **Nitrogen Scavenging:** Forage radish has the ability to scavenge residual nitrogen from the soil profile, reducing the risk of nitrogen leaching and making it available for subsequent crops.

Other Benefits:

1. **Biodiversity Promotion:** The improved soil health and increased organic matter resulting from forage radish cover crops can support a

diverse soil microbial community, contributing to overall ecosystem health and resilience

2. **Livestock Feed:** In addition to its benefits as a cover crop, forage radish can also be grazed by livestock, providing an additional economic benefit for farmers.

Pest and Disease Management

1. **Nematode Suppression:** Forage radish has been shown to suppress certain nematode populations, reducing pest pressure on subsequent vegetable crops.
2. **Disease Suppression:** Some studies suggest that forage radish may have allelopathic properties, releasing compounds that suppress soil-borne diseases and pathogens, potentially reducing the need for chemical interventions.
2. **Pest and Disease Management:** Some research suggests that forage radishes may help reduce populations of certain soil-borne pests and diseases.

Management Considerations

1. **Planting Time and Method:** Forage radish is typically planted in late summer or early fall

and can be seeded using conventional drills or broadcast methods when the soil is lying vacant. It can also be planted in the window between two successive vegetable crop plantings.

2. **Termination:** To maximize the benefits of forage radish as a cover crop, it should be terminated before it bolts and produces seed. This can be achieved by mowing, rolling, or incorporating the cover crop into the soil.
3. **Crop Rotation:** Forage radish should be incorporated into a diverse crop rotation system to optimize its benefits for soil health and pest management.

Conclusion

In conclusion, forage radish cover crops offer multiple benefits for sustainable vegetable production, including improving soil health, managing pests and diseases, suppressing weeds, and enhancing nutrient management. When integrated into a well-designed vegetable crop rotation system and managed properly, forage radish can play a crucial role in sustainable and environmentally friendly vegetable production systems.

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