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# LIVING ROOTS

Plant roots are important infrastructure for soil health. Roots provide physical benefits to soil by helping to reduce compaction and erosion, as well as serving as the main pathway by which nutrients, sugars, proteins and other exudates are exchanged between plants and the soil biome. Consequently, maximizing living roots—both in terms of diversity and length of time in the soil—is a key contributor to the physical, biological and chemical health of soils.

## WHERE TO START

### COVER CROPS

The most common approach to maximizing living roots is to plant a cover crop after a cash crop has been harvested (see [Soil Coverage Guide](#) for more information on cover crops). Planting a cover crop in Idaho can be challenging due to limitations in the availability of water late in the season and the number of growing degree days.

Considerations:

- Plant cover crops as soon after harvest as possible, even the same day of harvest if possible. Even one or two weeks of growing time can make a profound difference.
- Use multi-species mixes to increase the diversity of root types.
- Look for species or mixes that are drought tolerant when late season water availability is a concern.

### INTER-SEEDING

Inter-seeding is a technique of planting cover crops during the cash crop's growing season. Often used in corn systems, this technique involves seeding between rows before the crop canopy closes.

Considerations:

- Low-height species such as clover and vetch help avoid suppressing the cash crop while allowing for ample growth after harvest occurs.

- Matching cover crop species with herbicide programs can be a challenge.
- Seedings can be broadcasted, but specialized inter-seeding equipment can increase success through more consistent seed to soil contact.

## PLANTING GREEN

Planting green is a technique in which cash crops are seeded directly into living cover crops. This can occur where cover crops are allowed to overwinter or begin regrowth in the spring prior to planting.

Considerations:

- Consider cover crop species that can establish in the fall and/or emerge in the spring, such as cereal grains, sorghum-sudan, vetch and annual clovers. Grains need to be in the flower stage.
- Rolling or other mechanical methods may be necessary to ensure good seed to soil contact.
- Take into consideration C:N ratios of both cover crops and cash crops and adjust nitrogen applications accordingly. C:N ratios also affect the length of time that residue breaks down in the field.

Embracing a spirit of innovation is key to the success of these techniques. We encourage producers to start small and not be afraid to experiment to find the system that works best for their operation. Small or short-term reductions in yield can result in long-term reductions in fertilizer costs and increased soil health.



Figure 1. 2020 Inter-seeding corn/pea/timothy mix

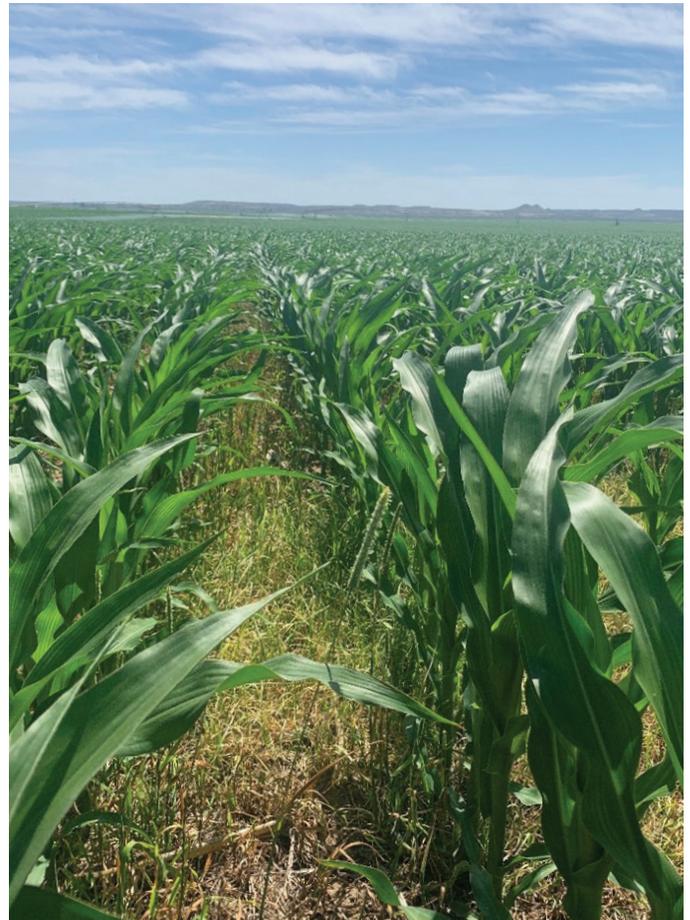


Figure 2. 2021 Inter-seeding grain corn/timothy

## IN THE FIELD

Chris Unruh farms in Grandview, Idaho, where he grows many different crops including timothy, corn, alfalfa, sunflower for seed and small grains. In 2020, Chris had a field of timothy that had exceeded its productive lifespan. Instead of plowing the old timothy, he no-tilled corn and peas directly after the first cutting, allowing the three species to grow together. After harvest, Chris worked with a local rancher who grazed cattle on the field through the fall and winter. The next growing season, Chris again allowed the timothy to re-emerge and again no-tilled grain corn into it. The corn yielded well at 290 bushels (about 20 bushels less than his conventional corn).

The diversity and extended period of living roots made a significant impact on Chris's soil. From 2021 to 2022, the soil respiration increased from 22.2 to 73.8 ppm CO<sub>2</sub>-C, indicating an increase in soil microbial biomass, which aids in multiple soil functions including nutrient cycling, soil aggregation and disease suppression. The soil organic carbon more than doubled from 169 to 344 ppm-c and the soil organic matter increased from 2.6% to 4.6%. Higher amounts of organic carbon mean there is more food or energy to drive the microbial system. In addition, the diversity of species allowed Chris to generate additional income from grazing, which in turn improved the soil's fertility. Seeing the success of inter-seeding crops, Chris planted another field of corn in 2022, this time on 44-inch rows with peas inter-seeded.



Figure 3. 2022 inter-seeding wide row corn

## ADDITIONAL RESOURCES

Kempf, J. (host). (2020, January 15). How Plants Absorb Living Microbes and Convert Soil Pathogens into Beneficials with James White (Episode No. 36). In Regenerative Agriculture Podcast. <https://regenerativeagriculturepodcast.com/how-plants-absorb-living-microbes-and-convert-soil-pathogens-into-beneficials-with-james-white>

Reed, H., Karsten, H., Tooker, J., Curran W., and Duiker, S. (2022). Planting Green 101: Penn State Research Summary. Pennsylvania State University Extension. <https://extension.psu.edu/planting-green-101-penn-state-research-summary>

University of Idaho Extension. (2018). Interseeding Cover Crop into Growing Corn Shows Promise for Grazing and Soil Cover – Impact Report. <https://www.uidaho.edu/-/media/UIDaho-Responsive/Files/Extension/admin/Impacts/2018/34-18-jhogge-interseeding-crop.pdf?la=en&hash=5296EECC7914A1998A3D0D3D23F065AFDCBE854B>

Hoorman, J. 2020. Crimping Cover Crops. Retrieved April 19, 2023, from Cover Crop Strategies web page: <https://www.covercropstrategies.com/articles/1296-roller-crimping-cover-crops> (originally published in Ohio's Country Journal web page: <https://ocj.com/2020/05/crimping-cover-crops/>).

For more information contact:

**Brad Johnson**  
Agriculture Strategy Manager  
[bradley.johnson@tnc.org](mailto:bradley.johnson@tnc.org)  
(208) 521-8058

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