



RegenPGC FAQs

Frequently Asked Questions - Last updated April 5, 2023

Please Note: RegenPGC (*Regenerating America's Working Landscapes to Enhance Natural Resources and Public Goods through Perennial Groundcover*) is supported by Agriculture and Food Research Initiative Competitive Grant No. 2021-68012-35923 from the USDA National Institute of Food and Agriculture. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture." For more information about RegenPGC, please visit our website at www.regenpgc.org.

1. Why would I use a perennial groundcover (PGC) system?

Because you want to improve soil conservation and water quality by implementing cover cropping on your land (or on more of your land) but lack the time/resources to do this via annual cover crops. Fundamentally, we believe that well-developed PGC can provide critical ecosystem services at a lower cost than annual cover cropping and, in some settings, even generating economic returns.

2. How is this different from an annual cover cropping system?

Once established, the perennial groundcover does not need to be replanted every year. In the upper Midwest, annual cover crops can be difficult to establish reliably because of the short planting window after grain harvest and weather challenges at that time of year. Perennial groundcovers may therefore offer the benefits of annual cover crops with less hassle.

3. Why do you think farmers would prefer this system over annual cover crops?

Two words: time and money. PGC systems are designed to save both and have the goal of increasing crop productivity while minimizing negative impacts on the environment.

4. How can PGC offer economic returns?

In systems where maize stover is harvested, either for animal feed or for use in biofuel markets, soils are vulnerable to erosion. Perennial groundcover (PGC) systems were first ideated to protect soils year-round in these systems. By allowing stover removal while protecting soil, PGC

can increase grain yields in a continuous maize production system. In the longer term, the improved nutrient and water cycling associated with better soil health could further increase yields. In areas with a stover market, the groundcover will allow for maximum harvest without appreciably increasing soil erosion. The RegenPGC research scope has expanded to include both grass and legume perennial groundcovers, and to investigate the benefits offered in a range of row crop systems.

5. Can I still use tillage if I have a PGC system? Zone tillage...?

The most successful implementation of PGC with corn and soybean thus far has been with strip tillage. With strip or zone tillage, only a fraction of the soil surface is disturbed. This makes it possible to till the soil between strips of perennial groundcover. This tilled zone is where the grain crop is planted and where other inputs can be applied and incorporated. A related question is whether perennial groundcovers can be used in a no-till system. Research suggests that it can work, but it is less reliable than a strip-till system.

6. Why not use a mixed group of native perennials?

The PGC system requires groundcover that is noncompetitive with the row crop being cultivated (maize, soybean, etc.). The ideal groundcover (for our Gen1 systems, which are focused on key upper-Midwest US crops) would be compatible with typical upper Midwest row crops, both spatially and temporally, meaning that it would use only a small volume of soil and grow most vigorously early and late in the growing season. Native grass species generally lack these traits. Their season of growth is similar to that of key row crops, and they have deep roots. They are also difficult to plant, slow to establish, and challenging to maintain. From an agronomic perspective, it is far better to manage a single groundcover species that has all the desired traits than to try and manage an assemblage of species.

7. When do you harvest the groundcover, and what is it used for?

The groundcover in a PGC system is not intended to be harvested. Its primary purpose is providing ecosystem services at zero yield loss (and perhaps with yield gain).

8. You lose the benefit of annual covers that can be harvested – isn't this wasteful?

First, we are not trying to displace annual cover cropping systems – farmers who do annual cover cropping can and should continue their annual cover cropping practices. That said, in the Midwest, more than 90% of the production landscape is not cover-cropped. We need approaches that are low-barrier-to-entry and will be taken up at scale. We think PGC could be

one such approach and believe that the ecosystem service benefits of a low-yielding perennial groundcover justify the further development of this system.

Second, many annual cover crops are not harvested for any marketable purpose, at least in the northern Corn Belt, where double cropping can be impractical due to the short length of the growing season. It is true that some annual cover crops are harvested for livestock forages, but the market is small for this purpose and typically involves an earlier row crop harvest for corn silage, versus a mature corn grain, to give the winter cover more time to grow. Additionally, farmers may be prohibited from harvesting cover crops for conservation plan compliance.

9. Farming is greatly influenced by Farm Bill policy. How does PGC fit with existing farm programs?

Our team recognizes the huge impact of federal farm programs on cropping systems management at the farm level. We are working collaboratively with the United States Department of Agriculture (USDA) to evaluate risk management products like crop insurance and programs that incentivize conservation adoption on working lands for PGC. The PGC system recognizes that achieving row crop yield potential affects a farmer's revenue today and their safety net in the future.

10. When do you graze the animals on these grasses?

The grass species used as groundcover in a PGC system are not prolific forage producers by design. Forage cultivars are too competitive to use in row-crop production unless a producer is willing to sacrifice some row-crop productivity in favor of the forage. Most promising groundcover species, however, would benefit producers that pasture cows on maize residues. The groundcover would provide a cleaner grazing environment, protect the soil from excessive trampling, and likely provide adequate protein to the grazing animal in the fall.

11. If I'm using a grass groundcover, will it compete with the maize and cause yield decreases, or at least require more inputs (e.g., N, P, K)?

The PGC system attempts to minimize competition between the groundcover and row-crop by compartmentalizing them in space. There is little competition for sunlight and soil moisture in a well-designed system. In fact, PGC systems tend to intercept and retain more rainfall than bare inter-rows in conventionally grown row crops. However, the groundcover does change nutrient cycling, especially in the top several inches of soil. PGC systems will immobilize mineral nitrogen by converting it into organic forms. This is valuable from a nutrient retention perspective, but it has been speculated some additional N fertilizer will initially be needed to make up the difference. Once the organic N pool stabilizes, however, no additional N fertilizer should be

needed. The work being done in this RegenPGC project will provide more insight into this question.

12. What if there is no stover market, or if the price for stover is low?

The current market for stover will not likely accommodate all that might be produced if maize growers widely adopted PGC systems in the upper midwestern US. An alternative market would need to develop, such as that projected by DOE (Department of Energy) for advanced biofuels. As more stover becomes sustainably available, its cost will decrease, and that should lead to greater market opportunities not only for biofuels but also for other biorenewable products, which would support a more robust and reliable market.

13. Can you just leave the stover on the field to build soil organic matter even more?

Yes, that is likely possible. Soil carbon (C) levels depend on both C loading and C oxidation rates. Tilling stover into the soil increases both so that a new steady state in soil C is achieved which is about half of that under prairie vegetation. [VN2] Initial studies with PGC systems indicate that soil sequestration of C will increase under PGC because carbon added from the groundcover root system is protected from oxidation due to the reduced tillage.

Related: Does a PGC system build soil organic matter?

Initial studies with PGC systems indicate that soil sequestration of C will increase under PGC compared to systems without a perennial groundcover because carbon added from the groundcover root system is protected from oxidation due to the reduced tillage in that zone.

14. What happens to nutrient requirements of a field overall when a PGC system is implemented?

This is an area that requires more research. In PGC systems with maize stover harvest, the current speculation is that the only fertilizer nutrient that will need to be applied in higher amounts is N, and this is only until the soil organic N pool becomes saturated. However, regardless of whether the field is using PGC if stover is harvested and removed from the field, at least some of the nutrients it contains will need to be replaced as fertilizer.

15. How much additional CO₂ is generated by doing all the extra field operations associated with this practice?

Ideally, once the groundcover is established, no additional field operations will be associated with PGC systems. A well-established groundcover could potentially persist indefinitely unless terminated for management reasons. The only possible additional operation required is the

suppression of the groundcover in the spring to prevent shade avoidance response in maize. The best approach for doing this in the short term is to apply a contact herbicide just before maize planting. However, this could be included with another spring herbicide application, thus avoiding an additional field operation. By increasing C sequestration in soil (see question #X), PGC systems may result in a net decrease in C emissions.

16. How much additional cost will the farmer bear doing all the extra field operations associated with this practice?

The PGC system is designed to be low-cost. The largest cost is associated with groundcover establishment, and that should be a one-time expenditure as opposed to the recurring costs borne by annual cover crop systems. Planting will require specialized equipment but could be accomplished by broadcast seeding, which requires low-cost equipment. The PGC establishment cost in the first year will be similar in magnitude to that of planting an annual cover crop, however, it will be a one-time expense rather than an annual one. As the technology matures, however, easier and more effective establishment methods will be developed, and a major effort in RegenPGC is to better understand and optimize the establishment process.

17. How long will a grass groundcover last?

The perennial groundcover species can be maintained more or less indefinitely. There will be some maintenance costs associated with reseeding in certain situations. In the case of grass, think of it as being like a lawn managed with minimal inputs. It may look rough from time to time but it usually will recover when growing conditions improve.

18. What about pests in a grass groundcover?

This is the greatest unknown with PGC systems. Changing the crop environment will undoubtedly affect pest ecology. Groundcovers tend to be weed suppressive and likely will benefit the control of many weeds. They may, however, serve as hosts for some harmful insects and diseases, and if so, new strategies for controlling these will need to be developed. There is potential for developing groundcover cultivars that are naturally pest resistant. However, this will take time. In the meantime, we need to be vigilant and use pest management tools already available. RegenPGC has active research efforts to better understand these issues.

19. Won't the groundcovers tie up moisture that the maize needs in a dry year?

This early concern turned out not to be a significant issue. The key to avoiding competition is to use a groundcover species that does not compete directly with maize for moisture. This can be accomplished by using a summer dormant or suppressed cultivar that is shallow rooted. With these groundcovers, studies have indicated that available soil moisture increases due to increasing intercepted rainfall and providing a barrier to evaporation from the soil surface, i.e., a mulching effect. Ongoing work in RegenPGC seeks to establish how widely applicable the findings are and to further clarify the underlying processes.

20. Won't the groundcovers depress soil temperatures and cause delayed germination in wet, cool years?

This is not as serious an issue as might be anticipated because the current recommendation is to use zone tillage for growing maize with a groundcover. The tilled zone between groundcover strips should warm at or near the same rate as clean-tilled soil. In the 2020 planting season, which was atypically cool and wet, soil temperatures were observed to be marginally higher in groundcover plots than in conventionally tilled plots. However, it is unknown why this occurred and if it would occur more generally. There are a lot of variables in play, and it is conceivable that in some years, PGC soils might warm more slowly because they retain more moisture.

21. How is this different from prairie strips?

Prairie strips are narrow vegetative filter strips placed down slope from a drainage area. They intercept and slow surface flow causing soil sediment to be deposited within the strip. They are remarkably effective in reducing sediment delivery to streams, and they are a reminder of the disproportionate benefits that can occur with some conservation practices. However, outside the strip itself, prairie strips do not reduce soil displacement or infield soil erosion. Perennial groundcover coupled with zone tillage on the contour significantly reduces both and may interfere less with field operations than prairie strips.

Related – we see the PGC approach as a potentially widely applicable conservation tool for large-scale commodity farming systems. As such, it is one of many practices (e.g., annual cover cropping, prairie strips, edge of field practices like saturated buffers) that farmers and landowners can use. It is not our intent (or job) to suggest that one of these is best - the inherent variability of the landscape and individual farmer / landowner needs and values means that one size does not fit all. Our goal is to create a scalable, low-barrier-to-entry practice that addresses the root-cause issue of bare soil on the production landscape. We are committed to doing so in a transparent way that shares both the benefits and challenges of PGC as we move

through the development processes. Individual farmers and landowners are the people who will decide whether PGC makes sense for them.

22. What is the biggest challenge with PGC systems right now?

Research has demonstrated that maize production under PGC can be as good or better than conventionally grown maize. Unfortunately, it can also be less in situations where competition with the groundcover is not managed well. Because, in its current state of development, it is quite brittle, we do not encourage producers to use it on large acreages (i.e., more than 5 acres). We would prefer they wait until the risk of failure can be reduced to that experienced using conventional production systems. Thus far, no commercially available maize hybrids have been developed for use in PGC systems. Research indicates and experience suggests that it is entirely possible to develop hybrids that are less sensitive to “perceived” competition from a groundcover.

23. This sounds great – I am a producer and have access to land where I’d like to try this. How can I learn about the details of implementing this practice?

If you are eager to try it, just remember that you are assembling a production system using off-the-shelf inputs developed for another system – like constructing a new tool from parts designed for another use. Please reach out to Anne Kinzel (akinzel@iastate.edu) who will direct you at resources we have to help producers get started trialing small-scale PGC systems.