Cover Crop Management Cost Estimator

Kipling S. Balkcom, Trent A. Morton, and H. Allen Torbert
USDA-ARS-National Soil Dynamics Laboratory, Auburn, AL, USA

Introduction

Cover crops are a key part of a conservation system that are typically combined with conservation tillage to enhance soil productivity (Balkcom et al., 2007, 2013). In the Southeast United States, the hot-humid climate, aggravated by previous conventional tillage operations, does not allow beneficial surface residues to persist for long periods, which contributes to degraded soil conditions across the region (Causarano et al., 2006; Franzluebbers, 2010; Novak et al., 2009). However, cover crops help offset these degraded soil conditions by providing extra surface residue that increases soil C inputs (Causarano et al., 2006). Additional cover crop residue also protects against soil erosion, improves water infiltration, provides short-term drought stress protection, and creates a surface mulch layer that promotes suppression of many small-seeded weeds (Faircloth et al., 2012; Price et al., 2006; Williams & Weil, 2004). These aspects all contribute to enhancing soil physical, chemical, and biological functions that can improve soil health and subsequent productivity for degraded soils found across the Southeast United States.

Despite potential benefits from cover crops, they require a monetary and time investment from growers. This aspect is a major concern for growers that are considering adopting cover crops because current profit margins are extremely small. As a result, growers are challenged with producing a level of biomass that will provide soil health benefits, while also minimizing cover crop expenses. Therefore, introducing new practices into farm operations, such as cover crops that increase expenses should be carefully evaluated to ensure growers can achieve a return on investment (ROI). As with any crop, proper management plays a vital role in the performance and subsequent profit associated with the crop. Performance, in the context of cover crops, is analogous to biomass produced and benefits derived from the cover crop.

Growers must recognize, regardless of which cover crop they choose to plant, there will be an establishment cost and a termination cost. Establishment costs include purchasing the seed and at least one trip across the field will be required to plant the cover crop. If the cover crop is planted in a broadcast application, another trip may be required to ensure adequate seed to soil contact and promote germination. Termination costs may include chemical, mechanical, or a combination of these aspects. Growers also have the option of applying N fertilizer to winter cereals that can enhance biomass production (Balkcom et al., 2018). Cover crop establishment and termination decisions can also be influenced by priorities favoring the cash crop or field conditions affected by weather that complicate the timing of these activities (Balkcom et al., 2015, 2023).

An important decision growers must consider during the cover crop establishment phase is when to plant. Research shows that cover crop biomass production is enhanced with early planting dates (Price et al., 2012; Webster et al., 2016). However, early planting dates can conflict with harvest of summer crops (Balkcom et al., 2023). Naturally, growers may emphasize cash crop harvest over cover crop planting in the fall. However, the management decision to delay cover crop planting can negatively impact cover crop performance. Balkcom et al. (2023) showed that planting date may be the most important management practice to enhance biomass performance and subsequent benefits. Although growers may recognize the value of planting

cover crops early, circumstances, such as weather may force growers to plant later than they prefer. Some growers increase cover crop seeding rates to compensate for later planting dates.

Increasing seeding rates escalates production costs that may not produce additional biomass compared to lower seeding rates. For example, Balkcom et al. (2023) found no difference for rye (*Secale cereale* L.) biomass production between seeding rates of 60 lb ac^{-1} and 90 lb ac^{-1}. On-going cover crop research across the United States is discovering that adequate seeding rates may be lower than previously thought; however, the lowest viable seeding rate for many cover crops requires additional research to identify across the multiple conditions possible. Any reductions identified to seeding rates that maintain adequate biomass production will directly benefit growers by lowering their cover crop production costs and subsequently increasing their ROI. Growers should remember that although they cannot control the cost of cover crop seeds, they can control how much seed they plant that can help them to control expenses.

Growers also have the option of applying N fertilizer to enhance biomass of cereal cover crops (Balkcom et al., 2018, 2019). Coarse-textured soil types found across much of the Southeast United States result in low residual N levels. However, cereals are excellent scavengers of N (Dabney et al., 2001), but excessive precipitation levels from tropical storms and hurricanes across the region on these soil types further limit access to "free" N that can promote cover crop growth. Despite N fertility limitations for coarse-textured soil types, applying N to a cover crop that will not be harvested for an economic return can be difficult for many growers to justify in addition to minimally required cover crop costs (i.e., establishment and termination). Growers should be aware that early planted cereal cover crops can benefit from applied N compared to late planted cereal cover crops (Balkcom et al., 2023). Late planted cereals grow slower; therefore, plant uptake of applied N is reduced, which increases N loss potential. This environmental constraint can explain why unfertilized, early planted cereal cover crops can produce equal biomass levels compared to fertilized cereal cover crops planted later, although both scenarios produced low biomass levels compared to a fertilized, early planted cereal cover crop (Balkcom et al., 2023).

Management is essential to enhance cover crop performance and provide subsequent benefits from cover crops, but minimizing costs are also critical to maximize ROI for growers planting a cover crop. Inconsistent cover crop performance from poor management could frustrate growers and limit successful cover crop adoption. Therefore, growers should consider the previously mentioned management factors in conjunction with the cover crop cost calculator to examine different cover crop cost scenarios to help them make informed decisions for their farm operations.

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