Extending The Grazing Season Through The Use Of Cover Crops

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Abstract

The use of cover crops in integrated crop-livestock systems is not a novel approach but has increased in popularity over the last few years due to the renewed interest in soil conservation, nutrient cycling, and water conservation. Moreover, cool-season annual forages have the ability to extend the grazing season, reduce the need for stored or bought supplemental feedstuffs, and as a result, lower winter-feeding costs. Small grain cover crops, legumes, forbes, and annual ryegrass (*Lolium multiflorum* Lam.) vary in their growth distribution and can be planted alone in monocultures or planted in mixtures to take advantage of the individual growth patterns. The Southeast alone accounts for 12% of the total farmland in the United States and has major cash crops of cotton, peanuts, soybeans and corn in addition to warm-season perennial pastures that can be overseeded with cover crops. Opportunity exists for beef and row crop producers to diversify their operations and take advantage of the growing season of cover crops.

Introduction

Row crops and warm-season perennial forages account for a significant amount of the arable acreage in the Southeastern U.S. This region consists of 200 million hectares of land and accounts for 12% of the total farmland in the United States (Franzluebbers, 2007). In the Southeast, pastures carry 16% of the entire U.S. cattle inventory and 3% of the entire sheep population, with other significant crops of cotton, peanuts, soybeans and corn. Although these crops are extensively used as cash crops or are grazed after harvest as crop residues, their growing season is short-lived, deeming fields to be unproductive for a significant portion of the year. Therefore, opportunity exists for integrated crop-livestock systems and the utilization of cool-season annual forages to maintain productive acreage, extend the grazing season, and decrease the need for stored forages and supplemental feeds.

Small Grain Forages as Cover Crops

Small grain forages of cereal rye (*Secale cereale* L.), triticale (*Triticosecale Wittm*.), oats (*Avena sativa* L.) and wheat (*Triticum aestivum* L.) provide excellent capabilities to extend the grazing season and are adapted to a wide range of climates and soil types. These species vary in their dry matter accumulation during the growing season and may be planted in monocultures, in mixtures with one another, or in combination with annual legumes, forbes, or annual ryegrass. Often times, cool-season annual forages are high in nutritive value and capable of producing gains in excess of 0.91 kg d^{-1} in growing beef cattle (Bagley et al., 1988).

These species vary in their timing of maturity and seasonal dry matter distributions. Compared to other small grains, cereal rye has been widely used as a cover crop due to its early growth pattern and ability to tolerate acidic soils. Meanwhile, triticale is faster to mature than wheat, but slower than rye. Triticale is a hybrid cross between wheat and rye and was bred to take advantage of the productivity, disease resistance, and grain quality of wheat but maintain the vigor and winter-hardiness of rye (Oelke et al., 1989; Dennett et al., 2013). Oats are also a popular cover crop and have been used for grain, forage, and as soil conservation technique in summer cropping systems. Winter oats are primarily used in the deep south where there is little fear of winter kill while spring oats are used in more temperate climates (Mackowiak et al., 2011). When grazing stocker steers on oats, cereal rye, wheat and ryegrass in both the spring and fall in Arkansas, Beck et al. (2005) found that gain per ha^{-1} was greatest for wheat and ryegrass, followed by cereal rye, and was least for oat pastures. Nonetheless, over a 3-year period, all

species produced fall average daily gains in excess of 1.07 kg d^{-1}, spring average daily gains in excess of 1.02 kg d^{-1}, and total gain per ha in excess of 587 kg ha^{-1}.

Annual Ryegrass

Annual ryegrass (*Lolium multiflorum* Lam.) is one of the most widely used winter-annual grass species, with reports of up to 1.1 million hectares planted annually and primarily in the Southeast (Evers, 1995). It is most commonly overseeded in warm-season perennial forage systems where dormancy occurs during the winter months. It's widespread popularity can be attributed to its ease of establishment, low maintenance, and ability to produce high quality tonnage in the spring months. Hoveland et al. (1978) reported a 12% increase in calf average daily gains and a 44% increase in calf gains per hectare when ryegrass was overseeded in bermudagrass [*Cynodon dactylon* (L.) Pers.] pastures. Additionally, stocking of bermudagrass pastures began almost 2 months earlier in the spring with the overseeding of ryegrass.

The late spring growth of annual ryegrass is complementary to the growth of other cool-season annual grasses and legumes and helps extend the grazing season well into late spring when seeded in mixtures (Beck et al., 2012). Bagley et al. (1988) found that when compared to ryegrass pastures fertilized with nitrogen fertilizer, cattle grazing ryegrass and arrowleaf clover (*Trifolium vesiculosum* Savi) mixed pastures had more grazing days, higher average daily gains, and greater final body weights. Similarly, Dubeux Jr et al. (2016) reported that when mixed with annual ryegrass, small grains of cereal rye, triticale, and oats dominated the sward during the December and January months but as the grazing season progressed toward the end, annual ryegrass became 75 to 96% of the total forage dry matter.

Forage Legumes

Legumes play a crucial role in grassland agriculture by supplying N to interseeded and subsequent crops, generally improving animal performance, providing habitat to wildlife (Moore et al., 2020), and as an integrated strategy for pest and weed management (McCartney and Fraser, 2010). Although there are many cool-season annual legume species, arrowleaf clover, ball clover (*Trifolium nigrescens* Viv.), berseem clover (*Trifolium alexandrinum* L.), crimson clover (*Trifolium incarnatum* L.), Austrian winter pea (*Pisum sativum* L. subsp. Arvense), and hairy vetch (*Vicia villosa* Roth) are the more common species found planted in pasture and crop fields in the Southeastern U.S. In bermudagrass systems, overseeded legumes can both extend forage distributions while also providing fertility for the next growing season. Freeman et al. (2014) reported forage from Austrian winter peas, crimson clover, arrowleaf clover, and hairy vetch to be available 6 to 10 weeks earlier than that of bermudagrass forage in spring. However, authors report that although these legume species yielded between 2500 and 4500 kg DM/ha they differed in both maturation and senesces. Others in the literature have also described these differences in timing of maturity. Hoveland et al. (1978) indicated that in overseeded Alabama bermudagrass pastures, crimson clover dominated the sward in March and April while arrowleaf was primarily productive during April to June. Collectively, the two clovers interseeded together extended the grazing season by nearly a month and increased calf gains per hectare by 40% compared to bermudagrass alone.

Other Forage Crops

There has been a recent renewed interest in the use of non-traditional forage species as societal demands for "regenerative agriculture" and the promotion of "soil health" grows. Forages in the family brassicas (*Brassica* spp.) are winter-annual or biennial species that are often planted in mixtures with small grain species. Forage brassicas include rape (*Brassica napus* L.), turnip (*Brassica rapa* L.), kale (*Brassica oleracea* L.), and radish (*Raphanus sativus* L.). Forage brassicas may be established from spring to fall throughout varying climates in the U.S. and are often incorporated into mixtures because of their rapid above and below ground biomass accumulation, nutrient density, and cold tolerance (Moore et al., 2020). In Pennsylvania, Dillard et al. (2020) reported August planted monocultures of canola, rape and turnip averaged 782.3 kg/ha of DM and resulted in an average of 55.9 kg/ha per day of DM

accumulation from September to November. When compared to the growth of ryegrass, all forage brassicas yielded 113 to 150% greater DM during the same timeframe. In irrigated pastures in New Mexico, Lauriault et al. (2009) reported total 120 day DM yields of kale to be lower than that of rape and turnip (2461, 3109 and 2983 kg/ha, respectively). However, authors reported that, on average, kale, rape and turnip amassed 87.3% of their total forage DM yield during their first 60 days of growth. Furthermore, regrowth harvested in 30-day intervals decreased by 86.3% in kale, 69.6% in rape, and 79.4% in turnip from harvest 2 on day 90 to harvest 3 on day 120.

Monoculture vs Mixtures

Multiple studies have observed that mixtures of small grains have a greater distribution of forage dry matter than monocultures and often results in increased animal performance (Myer et al., 2008; Sanderson et al., 2018). Beck et al. (2005) found contrasting results in mixtures of small grains but reported a mixture of cereal rye + ryegrass produced greater spring average daily gains and total gain per hectare in growing cattle compared to cereal rye alone, although ryegrass monocultures did not differ from the mixtures. In a similar study, Beck et al. (2007) extended the grazing days per hectare when ryegrass was seeded with small grains of oats, cereal rye, triticale, and wheat instead of seeded in a monoculture.

The addition of cool-season annual legumes to small grains can also extend the grazing season (Hoveland et al., 1978), increase forage quality (Han et al., 2012), and have the added benefit of reducing N fertilization needs by fixing atmospheric nitrogen (Evers, 2011). However, these benefits have not been consistently reported in the literature and appear to vary from year to year and by environmental conditions. General reports suggest that 20% of the forage mass must be legumes in order to see the benefits of increased forage quality and decreased N fertilizer requirements within grass-legume systems. Holderbaum et al. (1990) found dry matter yields to be higher in wheat + legume mixtures compared to legume monocultures, but these results were not consistent across years or locations. Meanwhile, Bauer and Roof (2004) compared cover crop biomass production and nitrogen accumulation of cereal rye, crimson clover, and a mixture of cereal rye + crimson clover in a cotton rotation. Authors found that the cereal rye + crimson clover mixture outperformed crimson clover alone in 2 out of 3 years, but nitrogen accumulation during this time did not differ. Many of these studies compare monocultures to two or three species mixtures, but opportunity exists to explore the effects of mixtures with an increased number of annual grass, forb and legume species.

Conclusions and/or Implications

Utilizing cover crops in an integrated crop-livestock system and overseeding cool-season annual forages into perennial warm-season grasses has the potential to diversify farming operations, extend the grazing season, reduce the need for stored forages, and promote soil conservation.

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