Economics and other factors affecting the adoption of Novel Endophyte Technology

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Abstract

Endophyte infected tall fescue impacts cattle and other livestock across vast regions of the world. Toxicosis from wild type endophyte is widespread in regions where toxic tall fescue is the base perennial forage. The Alliance for Grassland Renewal was founded to address this complex issue and to facilitate appropriate adoption of Novel Endophyte Tall Fescue, the only potentially 100% effective remedy for fescue toxicosis. A poor understanding of the Cost/Benefit ratio of renovating pasture is one of the main reason farmers give for not renovating tall fescue pastures. An Excel-based spreadsheet tool was developed by University of Missouri Extension to analyze costs and benefits of tall fescue pasture renovation. A team from the Alliance for Grassland Renewal worked with the tool and the developer to set default values for both costs and benefits. This tool will be made available in the future to extension agents and other advisors that are trained on the basics of Tall Fescue Toxicosis Management.

Introduction

Endophtye tall fescue causes a myriad of livestock production problems including reduced breeding rate, reduced intake, reduced growth rate, agalactia, and general health problems (Roberts and Andrae, 2021). Despite an abundance of research determining the mechanisms of fescue toxicosis and showing the benefits of removing ergot alkaloids from the production environment, adoption of non-toxic forages like novel endophyte tall fescue remains low. Seed cost for novel endophyte tall fescue is higher than the common infected Kentucky-31 tall fescue but most other costs for pasture renovation remain the same. The Alliance for Grassland Renewal provides tall fescue renovation workshops to teach farmers and their advisors the basics of converting their pastures from toxic tall fescue to novel endophyte tall fescue. Through workshop evaluations we found several important factors that limit adoption including; 1) the balance of cost and benefit is unclear, 2) farmers have limited financial resources, 3) the land is rented or unsuitable for renovation 4) farmers lack of knowledge, and 5) farm forage reserves are limiting (Poore et al., 2021). These factors are considered as we develop our educational strategy. This paper will focus on economic considerations concerning renovation of tall fescue pastures.

Methods

To address the economic question of cost/benefit of adopting the technology on beef cow-calf farms, an enterprise budget tool was developed by Missouri Extension and subsequently modified through interaction with the Alliance. The tool is built on an Excel platform, and includes all costs associated with typical conversion strategies. The tool also includes considerations for opportunity cost for lost forage production before renovation, and for increased forage yield that may result following renovation. Expected benefits are compared to costs to determine years to payback and internal rate of return.

The tool evaluates 3 systems of renovation including; 1) Spray-Summer Smother-Spray-Plant, 2) Spray-Winter Smother-Spray, and 3) Spray-Wait-Spray (Roberts and Andrae, 2020). The tool is broken into four sections including; preparation for renovation (smother crop phase), novel endophyte tall fescue planting, cost/benefit of idling land during the renovation process, and cow-calf producers' benefit of conversion to Novel Endophyte Tall Fescue. All fertilizer, seed and other costs are current Missouri prices (Summer 2022), while custom planting, spraying and fertilizer application are from the 2022 Iowa State Custom rate tables.

Default values used for improved performance due to renovation were determined from a variety of research results and discussion among members of the Alliance for Grassland Renewal. It was assumed that calf crop would increase 15%, weaning weight would increase 30 kg, and extra cost due to toxicosis per cow would be $10.

Results and Discussion

Renovation of perennial pastures is an expensive process depending on what inputs are needed to correct soil fertility, and what is planted. Fertility inputs are not always needed, but it is critical to use broad spectrum herbicides (glyphosate), high quality seed for both smother crops and the final crop, and to use good planting and spraying technique in nearly all situations. Systems developed for toxic fescue pasture renovation include steps to control seed production the year before renovation (mowing fescue seedheads), and to clear seedlings that may arise from previous seed crops. While these steps are important in any renovation situation, it is especially critical when replacing toxic fescue that toxic seedlings are not able to survive.

The three approaches discussed here include the standard “Spray-Summer Smother-Spray-Plant” where a summer annual such as sorghum-sudan or pearl millet are used. More northern regions may elect a “Spray-Winter Smother-Spray Plant” system that leaves land fallow after the winter annual is terminated allowing for early planting of the tall fescue. Finally, the “Spray-Wait-Spray-Plant” system does not use the smother crop, but rather uses a waiting period between two consecutive applications of glyphosate. Given the assumptions of costs used, the total cost of renovation per acre is $337.96, $493.13 and $372.36/acre for the Spray-Summer Smother-Spray-Plant, Spray-Winter Smother-Spray-Plant, and Spray-Wait-Spray-Plant (Table 1). Initial preparation for the Spray-Wait-Spray-Plant system is much lower than the other two systems, but the total net cost is similar to Spray-Summer Smother-Spray-Plant due to the value of the high yielding summer annual which returns substantial grazing days to the system. The use of the Spray-Wait-Spray system might prove to be less challenging to implement due to the fewer total steps in renovation. Some producers also like the shorter total time for the SWSP renovation system.

Using a default stocking rate of 3 acres/cow and the improvements in performance given above, years to payback is shorter for the SSSSP and SWSP. It appears that the SSSSP and the SWSP systems are more economical than the SWSSP, but situations will vary, and there may be some situations where SWSSP would be the best system, such as the northern reaches of the tall fescue belt.

The spreadsheet tool allows the user to change costs and benefits to reflect their own conditions and situations. To determine sensitivity to various cost factors we varied them and recorded years to payback as a response. Important factors identified include stocking rate, improvement in breeding rate, improvement in calf death loss, reduction of extra production costs, and increased pasture productivity due to renovation.

Stocking rate is critical in that the cost of renovation per acre is multiplied by the stocking rate to determine total cost per cow. Years to payback for a stocking rate of 2, 3, 4 or 5 acres per cow was 3.6, 5.3, 7.1 or 8.9. This indicates that more intensively managed farms with high forage yield and high forage utilization would benefit more from renovation than more extensive farms.

Improvement in calf crop is a key economic driver. Increased calf crop may result from an improved cow breeding rate, or a reduction in calf death loss. For the default we have assumed an increase of 10% in breeding rate, and a decrease of calf death loss of 5%. With breeding rate increase set at 0, 10, 20, or 30%, years to pay back was 9.2, 5.3, 3.8 or 2.9 years. If breeding rate is already very high it will be hard to increase it, and thus it will take a long time for renovation to pay back. To the contrary, in situations where breeding rates are low, improvements may be dramatic reducing the time to payback. Reduced calf death loss has been harder to show with research, but it is common on toxic tall fescue dominated farms to lose calves due to agalactia in cows, weak calves at birth, and increased levels of dystocia. When calf death loss improvement was 0, 5, 10, or 15%, years to pay back was 6.7, 5.3, 4.4, and 3.8, respectively.

When pastures are renovated it is critical to take into account opportunity costs of displaced forage production, and also to account for potential improvements in yield following renovation. The opportunity cost section of the tool helps producers realized that they must either rent extra pasture, purchase hay or reduce cow numbers when they renovate pastures. The tool allows the opportunity cost of lost summer pasture to be valued differently than lost fall pasture. If pastures need renovation for reasons other than simply that they are toxic tall fescue, then it is possible that cow grazing days post-renovation will increase. We increased the cow grazing days in the year following renovation by 0, 50, 100 or 150 cow grazing days/acre, and years to pay back was 5.3, 4.8, 4.3, and 3.7, respectively.

Research has shown that many benefits of renovation with novel endophyte tall fescue can be realized with renovation of only a portion of the acreage. Caldwell, et al. (2013) showed that when they renovated 25% of the acreage to novel endophyte tall fescue and used it strategically for spring-calving cows, breeding rate was fully recovered. There was no improvement in weaning weight, presumably because calves grazed toxic forage for much of the time. If acres renovated is only 25% of the total acreage and calf crop increases 15%, then payback time for the SSSSP system is only 2.1 years. While there is continuing benefit to renovating additional pasture it is reassuring to many farmers to know that the first acres they renovate will be the most economical

One cost that deters many farmers from planting novel endophyte tall fescue is seed cost. Currently Kentucky-31 tall fescue costs $2.40/lb whereas most Novel Endophyte tall fescue varieties cost $4-5/lb. When seed cost is varied in the spreadsheet tool at 2, 4, 5, or 6 $/lb, years to payback was 5.2, 5.4, 5.6 and 5.9 respectively, showing that the economic outcome is not very dependent on seed cost.

Other authors have evaluated time to breakeven for tall fescue renovation. Gunter and Beck, 2004 showed that if cattle were discounted for being “tall fescue cattle” before renovation (and not after), then payback would occur in 3 years, rather than 7 years if cattle were not discounted. Beck at al, (2008) suggested a 4-year period before returns from pasture renovation would cover renovation costs. However, a major limitation in the literature is a full scale study that evaluates all costs and animal performance during renovation, and pasture productivity and animal performance following renovation.

Table 1. Per acre cost of land preparation, Novel Endophyte Tall Fescue planting and opportunity cost for conversion of toxic tall fescue to Novel Endophyte Tall Fescue.

	SSSSP[1]	SWSSP[1]	SWSP[1]
Preparation for fescue renovation, $/ac	145.32	191.79	26.72
Planting novel endophyte tall fescue, $/ac	162.74	162.74	162.74
Total variable costs, $/ac	308.06	354.53	189.46
Cost of idling land, $/ac	29.90	138.60	182.90
Total cost, $/ac	337.96	493.13	372.36
Years to payback	5.3	7.7	5.8
Internal rate of return over 20 years, %	18	11	16

[1]SSSSP = Spray-Summer Smother-Spray-Plant, SWSSP = Spray-Winter Smother-Spray-Plant, SWSP = Spray-Wait-Spray-Plant

Conclusions

It is clear that renovation of perennial pastures is an expensive process. Regardless of what is planted, it will take several years for improved revenue to payback renovation costs. Pasture renovation is a difficult practice for farmers to implement because of the many critical steps, and high level of up-front cash costs. It is unclear to many producers if their system will benefit enough to cover their costs and managerial effort. Factors of great importance in the cost/benefit relationship include the stocking rate, improvement in breeding rate, reduction in calf death loss, and improvement in pasture productivity post-renovation. These factors will vary farm to farm, so a tool to provide a customized analysis is needed. This spreadsheet tool has been helpful in evaluating economic cost/benefit from a tall fescue renovation and it has been useful in communicating with farmers contemplating renovation. The tool will be made available in the future to trained advisors working with farmers to make decisions about tall fescue pasture renovation.

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