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CHAPTER 12

ECONOMICS OF RYEGRASS PRODUCTION AND UTILIZATION

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Introduction

Other topics presented at this symposium concentrate on the "how to" of annual ryegrass production and utilization. They provide information on preparations for planting, various harvesting methods, storage and utilization by a variety of livestock classes. Details are provided about varieties, fertilization, pest management and nutritive values. However, application of economic principles used to evaluate the cost effectiveness and profitability of using ryegrass in pasture systems for commercial farm and ranch operations is the focus of this chapter.

Where to begin evaluating the efficiency of production systems and identifying the most profitable utilization alternatives offers considerable challenges. Producers face many production decisions, from the very basic type, such as determining the most profitable amounts, kinds, and application frequencies of inputs (e.g. seed, lime and fertilizer), to those dealing with farming systems, such as selecting appropriate enterprises and the extent to which each becomes part of a whole farm plan. Decisions about the quantity of inputs to be applied for annual ryegrass production depend greatly on planting and harvesting methods, class of livestock utilizing the ryegrass, as well as the value of products being produced. It also depends on whether annual ryegrass is being used in conjunction with other forages or is being planted by itself.

Substituting inputs, one for another, is a second major type decision with which producers must deal. It makes good business sense to substitute inputs as long as total production costs decrease with the level of production at least remaining constant. This principle is applied to decisions such as selecting efficient fertilizer levels, deciding between lime products, or designing feeding programs to meet the nutrient requirements of different classes of livestock..

Farm operation decisions involve comparing the costs and benefits of current practices with other available production alternatives. Changes should be implemented if they appear profitable after weighing costs and revenues of current operations against net changes in costs and revenues as a result of instituting new practices or enterprises. Changes may be as dramatic as adopting new computerized fertilizing technologies or as commonplace as subdividing pastures to develop an intensive grazing systems.

Current Information

Annual ryegrass and forage systems including annual ryegrass are costly resources which should be used efficiently. Recent estimates indicate total production costs range from over $95 per acre for overseeded ryegrass pastures to almost $150 per acre for small grain-ryegrass mixtures on disked sod or prepared seedbed for grazing, Table 1. Cost of production estimates likely will be much higher for the 1995-96 season if fertilizer prices remain at current levels. Fertilizer, the largest single budget item, represents over half of all production costs. Other major costs include seed, machinery and equipment or custom services for land preparation, planting and harvesting, and interest on operating capital.

Table 1. Estimated total costs per acre of selected pastures for grazing, 1994-95 (S.A. Reeves and G.M. Clary, 1994).

Pasture system	Cost per acre
Small grain/ryegrass, disked sod or prepared seedbed	$147.37
Clover, overseeded	$65.15
Fescue/clover	$95.18
Clover/ryegrass, overseeded	$95.81
Ryegrass, broadcast and overseeded	$108.41

Individual producers react to costs in a variety of ways. Many face costs similar to those shown in Table 1 because they follow specialists' recommendations for seeding and fertilizing. However, others find ways to cut costs while still profitably using ryegrass in pasture systems. For example, combining fertilizer and seed and broadcasting them together eliminates at least one trip over a field with a tractor and implement. Using less fertilizer than recommended, or using animal wastes for fertilizer, also lowers costs. However, attempts to lower costs have implications that must not be overlooked. For example, broadcasting seed with fertilizer usually means pastures are available for grazing later than if seed are drilled into a disked sod or prepared seedbed. Also, cutting back too much on the amount of fertilizer applied will significantly lower forage yields. Reduced forage production dictates lower stocking rates.

One of the foremost challenges for producers is to determine the optimal (most profitable) level of input use to produce ryegrass or ryegrass-based forage systems. A basic economic principle of farm management applicable to this situation states that additional units of inputs should be employed to the point where each additional dollar spent generates at least a dollar in revenue or value of product. In terms of ryegrass production, this implies that additional inputs such as higher seed and fertilizer rates should be applied as long as each dollar spent on the input produces at least a dollar's worth of ryegrass. Of course, this notion introduces additional issues, such as selecting appropriate methods to value the additional forage produced and assigning additional forage production to additional inputs when they are used in combination.

An example of analyzing a ryegrass production-level problem is shown in Clary, Haby, Leonard and Hillard (1990). Limestone was applied at various rates to increase pH of a soil with an initial level of 4.5. Economic returns from liming ryegrass under these experimental conditions were significant. An economic value for additional ryegrass produced as a result of liming was estimated with the aid of a computerized animal nutrition and gain model. Assumptions for economic evaluations were that ryegrass was grazed by 450 lb stockers and that lime was priced at $24 per acre, including spreading.

Results indicated that there were economic benefits to applying more than 1.5 tons of lime per acre on this pH 4.5 soil as the value of additional ryegrass produced remained above the cost per unit of limestone. Results indicated that the final 1,000 lbs of lime applied cost $12, while accounting for an additional $77 worth of ryegrass. It was concluded that the profit maximizing level of lime under these conditions was between 2.0 and 2.5 tons/ac. It was expected that at this point additional liming would not result in significantly increased yields. Liming is not necessary on soils with a pH 5.7 or higher.

Table 2. Calculating marginal ratios based on total production for use in determining profitable applications of nitrogen fertilizer on crimson clover-ryegrass and ryegrass only pastures[1] (G.W. Evers and V.A. Haby, 1995).

	Total production			
Treatment number	Application[2] (actual lbs N)	Total N (lbs/ac)	Yield (lbs/ac)	Marginal ratio[3]
Crimson clover-ryegrass treatments				
1	0-0-0-0	0	2730	
2	0-0-60-60	120	3569	1.69
3	30-0-60-60	150	3284	0.90
4	60-0-60-60	180	3773	1.40
5	90-0-60-60	210	4073	1.55
6	0-60-60-0	120	3491	1.54
Ryegrass only treatment				
7	0-0-0-0	0	469	0.00
8	60-0-60-60	180	3142	0.55

[1]Data reflect utilization of applied nitrogen fertilizer to crimson clover-ryegrass and ryegrass only pastures, two year average.

[2]Total lbs of actual N applied at planting in October, November, January and March, respectively.

[3]Marginal ratio is defined as the marginal return ($) from additional forage production per dollar of fertilizer expense as compared to treatment 1. The value of additional forage is estimated by assuming it is consumed by stocker steers with a 10:1 feed/lb of gain conversion rate and a market price of $.80/lb. Nitrogen cost is assumed to be $.33/lb.

Comparing the overall benefits and costs of applying nitrogen to ryegrass and clover-ryegrass combinations provides another illustration of profitable input use (Table 2). Higher returns from additional forage production should be expected to offset fertilizer expenses. Initially, producers might think it is sufficient to compare the value of increased forage production with their total fertilizer bill. However, the similarities of marginal ratios (defined here as the marginal return from additional forage production per dollar spent on nitrogen fertilizer with a baseline scenario shown as treatment 1) calculated for overall production year data indicates that sufficient detail is not provided for cost saving decision making. Physical relationships related to timing and total amounts of fertilizer used are complex and have significant economic implications. Calculations include a valuation of forage estimated as if it is grazed by stocker cattle with a conversion rate of 10:1 and market price of $80 per cwt.

Segmenting the ryegrass-clover growing season allows for calculating benefit-cost ratios at key production decision points which helps producers more closely determine profit maximizing levels and timing of fertilizer applications (Table 3). Treatment 1 is a control which utilizes no nitrogen fertilizer and represents the lowest cost of production. This strategy is followed by producers who are minimizing costs and are hoping to capture as much economic benefit from combining clovers with ryegrass (as illustrated by comparing yields of treatments one with production and costs incurred by ryegrass only treatments). Producers following treatment one are satisfied with least cost forage production with the bulk of production being in Spring. However, most producers' want more early forage production as well as more total production and they would like to accomplish this in the most cost effective manner.

Marginal ratios in Table 3 indicate that treatments two and three provide the highest return per dollar spent for fertilizer than other clover-ryegrass treatments during the production period through early March. These returns reflect traditional production responses whereby grasses usually respond more dramatically to the first units of N applied than further additional units. Up through early March, all treatments represent very profitable use of fertilizer. However, it is important to note that there are no major differences in the total quantity of forage produced in treatments two through six, regardless of total N used.

Table 3. Calculating marginal ratios for use in determining profitable applications of nitrogen fertilizer on crimson clover-ryegrass and ryegrass only pastures[1] (G.W. Evers and V.A. Haby, 1995).

		Production by early March			Early March to early May production		
Treatment number	Application[2] actual lbs N	Total N lbs/ac	Yield lbs/ac	Marginal ratio[3]	March N lbs/ac	Yield lbs/ac	Marginal ratio[3]
Crimson clover-ryegrass treatments							
1	0-0-0	0	408		0	2322	
2	0-0-60	60	1007	2.42	60	2562	0.97
3	30-0-60	90	1064	1.77	60	2220	0.00
4	60-0-60	120	1126	1.45	60	2647	1.31
5	90-0-60	150	1263	1.38	60	2810	1.97
6	0-60-60	120	1110	1.42	60	2381	0.24
Ryegrass only treatments							
7	0-0-0	0	79	0.00	0	390	0.00
8	60-0-60	120	888	1.80	60	2254	0.00

[1]Data reflect utilization of applied nitrogen fertilizer to crimson clover-ryegrass and ryegrass only pastures, two year average.
[2]Total lbs of actual N applied at planting in October, November and January, respectively.
[3]Marginal ratio is defined as the marginal return ($) from additional forage production per dollar of fertilizer expense as compared to treatment 1. The value of additional forage is estimated by assuming it is consumed by stocker steers with a 10:1 feed/lb of gain conversion rate and a market price of $.80/lb. Nitrogen cost is assumed to be $.33/lb. Ratio is shown as 0.00 if yield with fertilizer application is less than the no fertilizer treatment.

Results for the early March to early May production period indicate that the additional 60 lbs of N applied in treatments two, three and six represents unprofitable input use under the assumptions used (Table 3). Wherever the overall marginal ratio is less than one , the additional cost of N fertilizer is greater than the additional return from increased forage production. Adding the additional 60 lbs/ac of N in treatments four and five is profitable as marginal ratios are greater than one. However, producers must decide whether the additional forage produced by additional fertilizer will be fully utilized. If pastures are stocked to properly utilize forage production prior to early March, additional animal units are required to consume rapidly growing forage during the Spring flush.

Two production alternatives (treatments 7 and 8) in which only ryegrass is planted, demonstrate that early ryegrass production over a two year period may be increased an average of about 800 lbs per acre as a result of applying 120 lbs/ac of nitrogen (Table 3). Results indicate that an additional 60 lbs/ac of N in early March provides significantly more ryegrass. Economic data (marginal ratios) imply that fertilizer applied to ryegrass is profitable, if that is the only alternative. Results also indicate that the most efficient time to apply

N to a ryegrass only pasture is in early March. However, a comparison of treatments one and seven suggests that producers could grow nearly the same total forage with minor differences in seasonal growth patterns by substituting clover in the seed mix for 180 lbs/ac N. This substitution would save $43.40/ac, the difference between clover seed (innoculated) cost of $16/ac and N cost of $59.40/ac.

Difficulties in decision making arise not only because responses are varied and appear inconsistent, but because final decisions also depend on the intended use of pastures. For example, production decisions will differ by the class of livestock that will be grazed. Decisions must consider when grazing needs to begin, the volume of forage needed and the alternative costs of reaching grazing objectives.

Which variety to plant is an often asked question. Improved varieties such as Marshall, TAM90, Jackson and Surry will normally yield annually at least 1,000 lbs/ac more forage than Gulf when planted on a prepared seedbed with good fertilization. The additional value of production, using the above assumptions, could approach $80/ac which more than offsets additional seed costs of $1.00 to $1.25/ac. An additional benefit of improved varieties is reduced production risk from winter kill.

Table 4 illustrates input substitution as it presents the cost of several alternatives for providing required nutrition to a cow for 150 days during a winter feeding period. Average daily cost of alternative feeding strategies including limit and continuous grazed small grain-ryegrass pasture, continuous grazed clover-ryegrass pasture, and a hay-supplement ration, are compared. All strategies are designed to provide recommended nutrition to a Spring calving cow. Limit grazed small grain-ryegrass pasture is the cheapest alternative as it more fully utilizes pasture acreage by means of higher stocking rates. However, several costs, including additional labor and fencing, are not included in the analysis. Differences in production risk associated with the various alternatives are discussed but not measured.

Table 4. Summary of estimated cash costs of wintering a cow 150 days during winter (Reeves and Clary, 1994

Pasture system	Total cost per acre	Cost per cow per day
Small grain/ryegrass; limit graze	$128.49	$0.86
Small grain/ryegrass; continuous graze	$203.53	$1.36
Clover/ryegrass; continuous graze	$209.44	$1.40
Hay and supplements only	$197.40	$1.32

Examples presented thus far raise an important question that must be addressed in the course of evaluating economic characteristics of ryegrass systems. What is the most appropriate way of determining the economic value of ryegrass? The simplest response is to estimate its market value in its highest and best use, whether it is actually sold as forage or used as feed in a livestock enterprise. For annual ryegrass, this might mean determining its value as grazing, silage or hay.

Ryegrass value as silage or hay might best be determined by what producers are willing to pay for it as a feedstuff. Alternatively, its value as silage or hay could be based on comparisons with other roughages and concentrates in terms of protein, TDN and other nutrients. For example, ryegrass hay might be valued at $75 per ton if coastal bermudagrass hay is selling for $60 per ton. This value would have to be justified by ryegrass' generally higher protein and TDN content on a dry matter basis.

Estimating a value for ryegrass in a grazing situation requires becoming familiar with nutritional requirements of various types of livestock. Value will depend on the animal or livestock class used as their conversion rates and market values may vary. For example, ryegrass used to feed a 500 lb steer calf might be worth $.10 per lb if it takes ten lbs of grass per lb of gain (conversion rate of 10:1) and 500 lb calves are selling for $1.00 per lb liveweight. Alternatively, the same ryegrass might be valued at $.20 per lb if grazed by exotic deer converting 10:1 and selling for $2.00 per lb liveweight.

It is more difficult to estimate the value of ryegrass utilized in cow-calf enterprises. Productive efficiencies gained from incorporating ryegrass and ryegrass-clover pastures into forage systems for cows has been discussed widely. It is difficult to estimate the economic value of improved cow condition, breeding and calf crop percentage, and weight of weaned calf per exposed cow which offsets production costs.

How much to produce, or how many acres to devote to winter pastures, is another common dilemma faced by producers. Ryegrass acreage may be limited by availability of appropriate land or access to additional operating capital. Regardless of these limitations, producers should have a definite plan for cost effective utilization of all acreage devoted to ryegrass prior to beginning the planting process. All ryegrass production should be used by the species of livestock or sold through market channels that are expected to bring the highest returns per acre.

Summary and Conclusions

Producers working towards increased efficiency and profits in their farm and ranch operations will continue to find ways to cut unit costs of production. Annual ryegrass, either by itself or in combination with other forages, is a tool to accomplish just that. However, it must be utilized carefully and to its full potential, just like other resources in which producers invest significant amounts of capital. Meeting the nutrient requirements of a given class of livestock with ryegrass should be compared to other alternatives such as the cost of hay, protein supplements and grain.

Detailed estimates of production costs are necessary to insure they will be offset by benefits derived from forages. These costs will vary greatly depending on production practices, fertility requirements and amount of forage needed to accomplish producers' original objectives for planting. Utilization strategies should take into account relatively high per acre production costs by insuring maximum economic benefit derived from forage resources. This might translate into the development of intensive, rotational or limit grazing systems, or into the use of storage facilities or products designed to protect high quality forages from inclement weather.

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