Forage Response and Economic Benefits to Weed Management in Grasslands

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Abstract

A common question among managers of grazing operations is "At what level of weed pressure does it become economical to apply herbicides on pastures?" Unfortunately, there isn't just one answer to this question as production goals and practices differ between operations and even within an operation over time. Regardless, the real question being ask is if weed control will increase profit per acre.

There are three basic avenues that may be taken to improve profit per acre through weed control. The first is to increase the carrying capacity of the grazing operation by controlling weeds and replacing them with desirable forage species that will support the required increase in animal units. The second is to use weed control to improve forage availability to the existing herd to support higher average daily gains (ADG) or improve body condition (BCS) of animals. The third is to simply improve animal health through control of toxic plants that may suppress animal performance or increase mortality. Here we will only focus on weed control for increased carrying capacity and improved animal performance.

Making Estimates on Production and Expenses

When trying to determine the economic weed threshold in pastures several estimates or assumptions must be made. One of the most important is that weeds are displacing desirable forages and once controlled they will be replaced by these desirable forages. Normally we assume that for every pound of weed pressure controlled we gain a pound of forage (Flynn 2020). However, we must keep in mind that this may vary among weed and forage species.

Expected feed conversion of pasture forage species is also an important variable that must be considered. This number depends on forage quality, abundance, and management, but is estimated that it takes 7-15 lbs DM to increase live weight by 1 lb (NASEM 2016). Grazing operations also differ in their level of forage utilization which is key in determining how efficiently the increase in forage production will be used. For instance, continuous grazing systems may only utilize 20-30 percent of available forage, whereas rotational grazing systems may exceed 50% utilization. Thus, rotational grazing systems can't tolerate as much weed pressure as continuous systems as it will have a greater effect on carrying capacity.

The number years between applications may vary between producers and products used, so this time frame must be considered to determine how cost will be spread out over months or years. For example, the use of non-residual herbicides such as 2,4-D only kills emerged weeds and will likely require more frequent applications than a residual pasture herbicide which may control certain weeds for several months. Efficacy of weed control over this period is also important as we don't always expect 100% control, especially when we use non residual herbicides. Herbicide costs will vary as well depending on the weed spectrum. Herbicide costs may range from $8/acre for general broadleaf weed control to as much as $50/acre for dense brush.

Other important variables are profit per lb of beef sold, the level of forage DM production, and the level of forage utilization.
Below are several examples that show the estimated economic weed threshold level for pastures under various management conditions and production levels.

Example 1:

Expected Profit:	$0.25 /lbs/beef sold
Feed conversion:	10:1
Herbicide cost:	$22.00
Years between herbicide application:	3 years

Profit/lbs =	$0.25	Forage Utilization						
Land Productivity	Potential Yield (DM lbs/acre/year)	30%	40%	50%	60%	70%	80%	90%
		Ecomonimc Weed Threshold Level						
Low Productivity	3000	41%	31%	24%	20%	17%	15%	14%
Moderate Productivity	6000	20%	15%	12%	10%	9%	8%	7%
High Productivity	9000	14%	10%	8%	7%	6%	5%	5%
Break even weed pressure (DM lbs/acre)		1222	917	733	611	524	458	407

Example 2:

Profit:	$0.50 /lbs/beef sold
Feed conversion:	10:1
Herbicide cost:	$22.00
Years between herbicide application:	3 years

Profit/lbs =	$0.50	Forage Utilization						
Land Productivity	Potential Yield (DM lbs/acre/year)	30%	40%	50%	60%	70%	80%	90%
		Ecomonimc Weed Threshold Level						
Low Productivity	3000	20%	15%	12%	10%	9%	8%	7%
Moderate Productivity	6000	10%	8%	6%	5%	4%	4%	3%
High Productivity	9000	7%	5%	4%	3%	3%	3%	2%
Break even weed pressure (DM lbs/acre)		611	458	367	306	262	229	204

Example 3:

Profit:	$1.00 /lbs/beef sold
Feed conversion:	10:1
Herbicide cost:	$22.00
Years between herbicide application:	3 years

Profit/lbs =	$1.00	Forage Utilization						
Land Productivity	Potential Yield (DM lbs/acre/year)	30%	40%	50%	60%	70%	80%	90%
		Ecomonimc Weed Threshold Level						
Low Productivity	3000	10%	8%	6%	5%	4%	4%	3%
Moderate Productivity	6000	5%	4%	3%	3%	2%	2%	2%
High Productivity	9000	3%	3%	2%	2%	1%	1%	1%
Break even weed pressure (DM lbs/acre)		306	229	183	153	131	115	102

National Academies of Sciences, Engineering, and Medicine (NASEM). 2016. *Nutrient Requirements of Beef Cattle: Eighth Revised Edition*. Washington, DC: The National Academies Press.

Flynn, E.S. 2020. Disrupting Pasture Management: The Profit-Per-Acre Approach. Corteva Agriscience, Indianapolis, IN.